FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN WITH DOWN SYNDROME: A PRECEDENT STUDY FOR CHRISTIAN SCHOOLS

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A Thesis

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by

Emily Anne Ibrahim

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APPROVAL SHEET

FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN
WITH DOWN SYNDROME: A PRECEDENT STUDY
FOR CHRISTIAN SCHOOLS

Emily Anne Ibrahim

Read and Approved by:

_____
Anthony W. Foster (Chair)

_____
John David Trentham

Date_____

For the glory of God

And the flourishing of those he so uniquely formed

with an extra 21st chromosome

In memory of my Daddy

Russell Clay Mathis

February 19, 1955 – January 20, 2022

I kept going because I knew you were cheering me on.

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LIST OF ABBREVIATIONS

CA	chronological age
DS	Down syndrome
DSL	Down Syndrome of Louisville
DLD	Developmental Language Disorders
EOWPVT-B	*Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition*
EVCBT	expressive vocabulary content-based test
EVT-2	*Expressive Vocabulary Test, Second Edition*
FL	foreign language
KBIT-2	*Kaufman Brief Intelligence Test, Second Edition*
L1	first language
L2	second language
MA	mental age
NVC	nonverbal cognition
PPVT-4	*Peabody Picture Vocabulary Test, Fourth Edition*
ROWPVT-B	*Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition*
RVCBT	receptive vocabulary content-based test
TD	typically developing
VSTM	verbal short-term memory

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PREFACE

Seven and a half years ago I had never had any meaningful interaction with a child with Down syndrome; now I can't imagine my life without them. Seven and a half years ago, I would have never imagined that I would want to pursue doctoral work, but that was because I didn't have a reason to do so. Seven and a half years ago my life unexpectedly changed when the principal at my new job asked me if I would be willing to teach Spanish to the children with Down syndrome at our little elementary school. As I began to teach those precious children and watch them begin to learn a foreign language, I knew that the world needed to know what I knew: children with Down syndrome can learn a foreign language.

The road to complete this project has been tumultuous and difficult, with many challenges both personally and professionally. I am grateful first and foremost to my God and my Lord, who has sustained me by his grace through many trials. I declare with the psalmist that by my God I have run against many troops, and by my God I have scaled many walls which I thought were insurmountable (Ps 18:29). I would have never begun this research nor carried it to completion without the unwavering support and encouragement of my husband Ayman. You encouraged me in my darkest hours and cheered me at every success. I would have quit a million times over, and likely never would have started, if it weren't for you. You believed in me more than I believed in myself. Thank you.

Before I began this project there were a couple of people who were instrumental in helping to shape me as a teacher, without whose influence I never would have been the type of teacher to successfully teach a foreign language to children with

Down syndrome, or any child for that matter. My mother, Rosemary Castillo Mathis, modeled for me how to teach a second language to children as she taught English as a Second Language during my growing up years. Thank you, Mommy, for coming home and telling me stories of your work and letting me tag along to watch you in action. After I began teaching, Carol Gaab was instrumental in forming my philosophy of language teaching and graciously me took me under her wing, for what reason I will never know. After I met her at a conference in Ohio my first year teaching Spanish, my teaching was never the same.

Several scholars have helped me at various stages of this project, and I am thankful that they would take notice of me and guide me in my research. John Grinstead of Ohio State University and Bill VanPatten (diva of SLA) were very helpful to me in the initial stages of my project. Thanks to you both for guiding me and offering of your expertise. Moreover, my project would not have succeeded were it not for the guidance and wisdom of Elizabeth Kay-Raining Bird. She graciously met with me via Zoom and corresponded with me from the beginning of my project until the very end, helping me think through issues of methodology, literature, and the challenges of my research, and gave the most detailed feedback on my thesis from an outside reader in the history of SBTS. Dr. Kay-Raining Bird, your wisdom, guidance, and feedback were invaluable to this project, and I am grateful that you would invest yourself in me and my research.

I am thankful to have been able to learn at The Southern Baptist Theological Seminary, and for the support that I found there. Dr. Anthony Foster, my doctoral supervisor, was a faithful mentor and help, always ready with a quick, kind, and thorough response. I am grateful to him and to Dr. John David Trentham for their support and flexibility when trials came my way. I am also grateful for the support I found in my cohort mates, especially Becca and Evan Pietsch and Siran Wang. You enriched my learning and helped carry me along the way.

Finally, I am grateful to Down Syndrome of Louisville for welcoming me into

their summer camp to conduct my research. Thank you especially to Dr. Jenny Kimes and Susan Teaford for your help and support in this regard. Additionally, my research would not have been possible were it not for the wonderful teachers at the summer camp who served as my “assistants.” They faithfully and cheerfully observed and took notes to help gather data for my case studies and supported the learning of the children at the same time. Nefris, Kelsey, Erin, Samantha, Alex, Lauren, Madeline, Jasmine, Claire, and Hunter, I learned so much from all of you.

Teaching the children at Down Syndrome of Louisville for the completion of this research was one of the greatest honors and joys of my life. I will never forget those six weeks of teaching which began in a whirlwind and ended with tears of sadness because I didn’t want my time with the children to end. When I began this project, I knew that they would learn Spanish, yet their learning far exceeded my expectations, and witnessing their growth was magical. But even more than watching them learn Spanish, I loved spending time with them and getting to know them. I am grateful to these precious children for the effort they put forth in class every day when surrounded by an unfamiliar language and am grateful to their parents for entrusting to me their dear children, if only for a short time. My life is forever enriched because of them.

Emily Anne Ibrahim

Louisville, Kentucky

December 2022

CHAPTER 1

RESEARCH CONCERN

"Our students with Down syndrome are included in the classroom and attend all the special area subjects with their classes. However, they have never attended Spanish class before. Would you be willing to have them come to Spanish class?" the principal at my new job asked me. I readily agreed. "We don't really expect them to learn Spanish, per se. We just want them to have a break and do something different with their brains," the program coordinator for students with Down syndrome told me. As the Spanish teacher, I was not sure what to expect from my students with Down syndrome, but I was hopeful that they would learn. Others, however, were not so optimistic. Over a casual conversation at the faculty lunch table, one of the assistants of our students with Down syndrome commented, "I'm not sure why our students are attending Spanish class. They have a hard-enough time with English as it is. It's pretty stupid that we would expect them to learn another language." Despite my colleague's objections, our students began attending Spanish class, though separate from their peers. The students with Down syndrome initially attended Spanish as a group and separate from their peers as the administration was not sure if they would be able to keep up with their typically developing peers in a foreign language class. However, after a year of instruction, I knew they were ready to join their peers, evidenced by the aptitude they displayed to participate in class and acquire the language. The second year, our students with Down syndrome were included in Spanish class with their peers, and by the end of the school year all of them were demonstrating signs of language acquisition, and many of them were on par with their peers.

This story exemplifies the challenges students with Down syndrome (DS) face

to be fully included with their peers. Though many may be included in the general classroom, they are often excluded from the foreign language (FL) classroom.[1] Their own teachers may be skeptical toward their ability to learn another language, or even object to the notion that it is wise to expose them to another language. While their classmates reap the benefits of learning another language, they are far too often denied the opportunity of inclusion in the FL classroom.

Introduction to the Research Problem

The official push for inclusion of students with disabilities into the mainstream classroom in the United States began in 1975 with the passing of the Education for Handicapped Children Act (EHA).[2] Among other mandates, the act specified that, "to the maximum extent appropriate, children with disabilities . . . [be] educated with children who are not disabled," and that they be removed from the "regular educational environment . . . only when the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily."[3] The change in the educational scene in the United States was not

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[1] Studies conducted by an international group of researchers in various locations throughout Europe, Canada, and the United States (New Mexico) demonstrate that students with developmental disabilities, including children with Down syndrome, have limited access to programs which support bilingualism or second language learning in the school setting. Stefka H. Marinova-Todd et al., "Professional Practices and Opinions about Services Available to Bilingual Children with Developmental Disabilities: An International Study," *Journal of Communication Disorders* 63 (2016): 58; Julia Scherba de Valenzuela et al., "Access to Opportunities for Bilingualism for Individuals with Developmental Disabilities: Key Informant Interviews," *Journal of Communication Disorders* 63 (2016): 32–46.

[2] In 1990 the EHA was revised and renamed the Individuals with Disabilities Education Act (IDEA). *Individuals with Disabilities Education Act*, Public Law 101–476, *U.S. Statutes at Large* 104 (1990): 1103–51. After further revisions, the act was again revised and renamed the Individuals with Disabilities Education Improvement Act (IDEIA) in 2004. *Individuals with Disabilities Education Improvement Act*, Public Law 108–446, *U.S. Statutes at Large* 118 (2004): 2647–808. The EHA called for the integration (mainstreaming) of children with disabilities, while the term and concept "inclusion" did not begin to be widely used until the adoption of IDEA in 1990. Turki Alquraini and Diane Gut, "Critical Components of Successful Inclusion of Students with Severe Disabilities: Literature Review," *International Journal of Special Education* 27, no. 1 (2012): 44–45.

[3] *Education for All Handicapped Children Act*, Public Law 94–142, *U.S. Statutes at Large* 89

immediate, but rather students with disabilities were gradually integrated into the mainstream classroom.[4] By 2018 "more than 64% of children with disabilities" in the United States "(were) in general education classrooms 80% or more of their school day."[5] The increase in students with disabilities learning alongside their peers in the mainstream classroom is likely due to further mandates and governmental stipulations as well as an increase of identification of students with mild disabilities.[6] However, the percentage of students with intellectual disabilities included in the general education classroom is considerably lower than that of students with learning disabilities or other disabilities.[7]

Christian schools have an even greater impetus for educating and including children with disabilities, far more compelling than that of any governmental mandate: the inherent value and dignity of every person created in the image and likeness of God. Among other things, the doctrine of *imago Dei* signifies each person's "uniqueness" and "dignity before God," and thus should compel Christian schools to make education

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(1975): sec. 1412(5)(B), 780.

[4] James McLeskey et al., "Are We Moving toward Educating Students with Disabilities in Less Restrictive Settings?," *Journal of Special Education* 20, no. 10 (July 2010): 1–2.

[5] U.S. Department of Education, "History of the IDEA," accessed November 28, 2020, https://sites.ed.gov/idea/about-idea/#IDEA-History.

[6] McLeskey et al., "Educating Students with Disabilities in Less Restrictive Settings?," 6–7. McLeskey identifies the federal IDEA of 1997 and 2004, the No Child Left Behind Act of 2002, and further stipulations by the Office of Special Education Programs in 2004 as "(catalysts) for many states and local school districts to educate increasing numbers of students with disabilities in (general education) classroom" (7).

[7] McLeskey et al., "Educating Students with Disabilities in Less Restrictive Settings?," 7; Dianne L. Ferguson, "International Trends in Inclusive Education: The Continuing Challenge to Teach Each One and Everyone," *European Journal of Special Needs Education* 23, no. 2 (2008): 111. In 2017, while 63.5 percent of all students with disabilities spent 80 percent or more of their day in the general classroom, only seventeen percent of students with intellectual disabilities did so. U.S. Department of Education, Office of Special Education and Rehabilitative Services, Office of Special Education Programs, *41st Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 2019* (Washington, DC, 2020), 55. Individuals with Down syndrome have significant cognitive (intellectual) disabilities, as well as "specific deficits in speech, language production, and auditory short-term memory." Robin S. Chapman and Linda J. Hesketh, "Behavioral Phenotype of Individuals with Down Syndrome," *Mental Retardation & Developmental Disabilities Research Reviews* 6, no. 2 (2000): 84.

available to all people, for each person, no matter their status or abilities, is worthy of an education.[8] Despite this great impetus, the state of inclusive education or even segregated education of children with disabilities in Christian schools seems to lag far behind that of public education. Since Christian schools are not required by law to provide services for children with disabilities, little data is available on what percentage of Christian schools educate students with special needs, or what percentage of the student population of said schools have learning or intellectual disabilities.[9]

However, a couple of key studies shed some light on the state of education of students with special needs in Christian schools in the past couple of decades.[10] Research conducted by the United States Conference of Catholic Bishops in 2002 found that 7 percent of children attending Catholic schools have disabilities, as compared to more than 11 percent in public schools.[11] Among evangelical schools, a survey conducted by the Association of Christian Schools International found that approximately 35 percent of schools provide some sort of special education service, with 7 percent of students enrolled in said special education programs.[12] Of those schools which reported providing

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[8] Peter J. Gentry and Stephen J. Wellum, *Kingdom through Covenant: A Biblical-Theological Understanding of the Covenants*, 2nd ed. (Wheaton, IL: Crossway, 2018), 669.

[9] Tammy Bachrach, "Venturing outside the Bounds of IDEIA in Search of Inclusive Christian Education: An Autoethnographic Account," *Journal of Research on Christian Education* 30, no. 1 (2021): 5. For an explanation of the relationship between IDEA, Christian schools, and special education services provided by public schools see Julie M. Lane and Quentin P. Kinnison, *Welcoming Children with Special Needs: Empowering Christian Special Education through Purpose, Policies, and Procedures*, ed. David R Jones (Bloomington, IN: West Bow Press, 2021), 36–48.

[10] I use the term Christian here broadly, and it encompasses any school that would claim the identification "Christian," whether Catholic or Protestant/Evangelical.

[11] United States Conference of Catholic Bishops, *Catholic School Children with Disabilities* (Washington, DC: United States Conference of Catholic Bishops, 2002), cited in Bachrach, "Venturing outside the Bounds of IDEIA," 5, and Leonard DeFiore, "The State of Special Education in Catholic Schools," *Journal of Catholic Education* 9, no. 4 (2006): 459.

[12] In some areas the numbers may be higher. For example, in his survey of faith-based schools in 10 rural counties of a midwestern state, Eigenbrood found that eighty-three percent of the schools surveyed provided resource room services, though the majority of the students using the services "had not

special education services, thirty-one percent reported providing inclusive classrooms, yet 40 percent of schools reported having students whose special education needs are not met by the services provided.[13] Furthermore, special education services in Christian schools are generally restricted to students with mild learning disabilities such as dyslexia, ADHD, or Asperger's syndrome.[14] Students with multiple or moderate to severe disabilities such as intellectual disabilities or behavioral difficulties, like children with DS, are often excluded from Christian schools.[15]

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been officially identified as eligible for special education services." Additionally, Eigenbrood reports that "faith-based schools . . . made less use of special education services than public schools." Rick Eigenbrood, "A Survey Comparing Special Education Services for Students with Disabilities in Rural Faith-Based and Public School Settings," *Remedial and Special Education* 26, no. 1 (2005): 20. Similarly, in their survey of 240 Christian schools in the United States, Lane and Jones found that ninety-three percent "knowingly accept students with disabilities." Julie M. Lane and David R. Jones, "Special Education Professional Development in Christian Schools," *Journal of the Christian Institute on Disability* 3, no. 2 (2014): 50. However, this does not mean that they are currently serving students with disabilities nor that they provide adequate services for those students.

[13] Charlotte A. Marshall, "By the Numbers: How Christian Schools Serve Students with Special Needs," Association of Christian Schools International, March 3, 2020, https://blog.acsi.org/how-christian-schools-serve-students-with-special-needs.

[14] Jennifer Camota Contreras, "Including Exceptional Children in a Christian Learning Community: New Narratives in Special Education" (EdD diss., The University of San Francisco, 2013), 45–46, 56; Martin Scanlan and Karen Tichy, "How Do Private Sector Schools Serve the Public Good by Fostering Inclusive Service Delivery Models?," *Theory into Practice* 53, no. 2 (2014): 152; Joan Kent Bacon and Kelsey Elizabeth Erickson, "Special Education in Lutheran Schools," *Journal of Religion, Disability & Health* 14, no. 4 (2010): 361; Lane and Jones, "Special Education Professional Development," 55. Eignebrood's survery, which revealed a high percentage of faith-based schools providing special education services, demonstrated that these schools provided support for students with mild disabilities, most of whom did not have an IEP and had not been officially diagnosed with a disability. Eigenbrood, "A Survey Comparing Special Education Services," 20–21. Lane and Jones note that "the discrepancy between the number of students with Asperger's syndrome served and the number of students with autism served may indicate misunderstanding of how these two disability types are related." Lane and Jones, "Special Education Professional Development," 55. Even so, it may also reflect the trend that Christian schools are less likely to admit a child with a more severe form of autism.

[15] DeFiore, "The State of Special Education," 459; Meghan M. Burke and Megan M. Griffin, "Students with Developmental Disabilities in Catholic Schools: Examples in Primary and Secondary Settings," *Journal of Catholic Education* 19, no. 3 (2016): 214. I should note that I do personally know of two Christian schools (one Catholic and one evangelical) in my own city (Louisville, Kentucky) which specifically serve children with DS in an integrated context. However, this does not seem to be a common trend among Christian schools. In her research on special education in Christian schools, Contreras provides examples of a variety of education models for children with special education needs in Christian schools, including children with severe disabilities, though the most common seems to be those schools

Internationally, inclusion has become a hot topic over the past few decades. Beginning with the Salamanca Statement in 1994, international organizations, national governments, local governments, and school districts have advocated for the inclusion of children with special needs or disabilities in the mainstream classroom.[16] Thanks in part to these efforts, the inclusion of students with DS in the mainstream classroom around the world has increased considerably since the release of the Salamanca Statement.[17] Benefits of inclusion for children with DS are many, including academic, social, and communicative.[18]

While inclusion of children with DS has advanced in the general classroom, the same cannot be said for the FL classroom; opportunities for children with DS to learn a second language are nearly non-existent in the school setting. Though in theory children with DS have equal access to opportunities to attain or maintain bilingualism, this is often

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which provide services for children with mild learning disabilities. Contreras, "Including Exceptional Children."

[16] Thomas Hehir et al., *A Summary of the Evidence on Inclusive Education* (Cambridge, MA: Abt Associates, 2016), 4–6; UNESCO, *The Salamanca Statement and Framework for Action on Special Needs Education* (adopted by the World Conference on Special Needs Education: Access and Quality, Salamanca, Spain, June 1994). The Salamanca Statement was the first international statement of its kind to essentially make it "quasi-obligatory for national delegations to implement the objectives" of inclusive education. Florian Kiuppis and Rune Sarromaa Hausstätter, "Inclusive Education for All, and Especially for Some? On Different Interpretations of Who and What the 'Salamanca Process' Concerns," in *Inclusive Education Twenty Years after Salamanca*, ed. Florian Kiuppis and Rune Sarromaa Hausstätter, Disability Studies in Education 19 (New York: Peter Lang, 2015), 1.

[17] While no current data is available, the following reports attest to the increase: Liv Inger Engevik, K-A. B. Næss, and L. Berntsen, "Quality of Inclusion and Related Predictors: Teachers' Reports of Educational Provisions Offered to Students with Down Syndrome," *Scandinavian Journal of Educational Research* 62, no. 1 (2018): 34–51, demonstrates that inclusion of children with DS into the mainstream classroom in Norway is higher than originally thought, though there remains much room for improvement. See also Sam Fox, Peter Ferrell, and Pauline Davis, "Factors Associated with the Effective Inclusion of Primary-Aged Pupils with Down's Syndrome," *British Journal of Special Education* 31, no. 4 (2004): 184; Robert M. Hodapp, "Families of Persons with Down Syndrome: New Perspectives, Findings, and Research and Service Needs," *Mental Retardation & Developmental Disabilities Research Reviews* 13, no. 3 (August 2007): 280.

[18] Hehir et al., *A Summary of the Evidence*, 2; Alquraini and Gut, "Critical Components of Successful Inclusion," 46.

not the case in practice.[19] Despite teachers' and administrators' somewhat positive attitude toward the ability of students with mild developmental disabilities to learn a second language, students with developmental disabilities are not included in the second language classroom at the same rate as their typically developing (TD) peers. Even when schools have an inclusive philosophy or express the desire to include students with developmental disabilities, children with developmental disabilities do not have equal access to learning or maintaining a second language.[20] Reasons for exclusion for second language learning include the nature of one's disability, priority given to special needs, IEPs, scheduling conflict, service availability, and parental decisions.[21] When a conflict exists between participating in special education services or participating in the second language learning context, priority is often given to special education services. Overall, priority seems to be given to special needs, often driven by the belief either by parents or professionals that severe learning, language, or intellectual disabilities may impede students from learning a second language, or that attempting to do so would add an unnecessary burden on the child.[22] The fact that some parents of children with developmental disabilities are counseled not to allow their child to participate in programs that facilitate learning a second language seems to reflect the misconception that individuals with DS or other disabilities are unable to learn a second language, or at least that it is harmful to their development.[23]

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[19] Diane Pesco et al., "A Multi-site Review of Policies Affecting Opportunities for Children with Developmental Disabilities to become Bilingual," *Journal of Communication Disorders* 63 (2016): 15–31; de Valenzuela et al., "Access to Opportunities," 32–46.

[20] De Valenzuela et al., "Access to Opportunities," 37.

[21] De Valenzuela et al., "Access to Opportunities," 32–46.

[22] De Valenzuela et al., "Access to Opportunities," 38–40.

[23] Fred Genesee, "French Immersion and At-Risk Students: A Review of Research Evidence," *Canadian Modern Language Review* 63, no. 5 (2007): 656. See also Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *American Journal of*

However, research over the past two and a half decades has made clear that individuals with DS are capable of becoming bilingual.[24] In addition, neither bilingualism nor exposure to a second language have been found to be harmful to children with DS.[25] Bilingualism has been shown to offer many benefits to the general population, such as enhanced attention and cognitive control, working memory, and executive function.[26] Even limited contact with a second language may prove to offer metalinguistic benefits to children learning to read.[27] Moreover, there is evidence that bilingualism is beneficial for children with DS. For example, bilingual children with DS were shown to have a larger

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Speech-Language Pathology (2005): 197. Kay-Raining Bird and colleagues state that "there seems to be a continued need to disseminate current evidence broadly so that professionals and parents are able to make informed decisions and recommendations and children with DD are included in important life contexts." Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *Journal of Communication Disorders*, Article in Press (2016): 11. See also Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 21; Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 226–27.

[24] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 53–54.

[25] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down Syndrome," *Journal of Intellectual Disability Research* 55, no. 3 (2011): 351–56; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 187–99; Patricia L. Cleave et al., "Syntactic Bootstrapping in Children with Down Syndrome: The Impact of Bilingualism," *Journal of Communication Disorders* 49 (2014): 51.

[26] Ellen Bialystok, "Consequences of Bilingualism for Cognitive Development," in *Handbook of Bilingualism: Psycholinguistic Approaches*, ed. Judith F. Kroll and Annette M. B. De Groot (Oxford: Oxford University Press, 2005), 417–32; Olusola O. Adesope et al., "A Systematic Review and Meta-Analysis of the Cognitive Correlates of Bilingualism," *Review of Educational Research* 80, no. 2 (2010): 207–45.

[27] Gregory W. Yelland, Jacinta Pollard, and Anthony Mercuri, "The Metalinguistic Benefits of Limited Contact with a Second Language," *Applied Psycholinguistics* 14, no. 4 (1993): 423–44; Ruth Campbell and Efisia Sais, "Accelerated Metalinguistic (Phonological) Awareness in Bilingual Children," *British Journal of Developmental Psychology* 13, no. 1 (1995): 61–68; Maggie Bruck and Fred Genesee, "Phonological Awareness in Young Second Language Learners," *Journal of Child Language* 22, no. 2 (1995): 307–24.

overall vocabulary than monolingual children with DS.[28] Additionally, learning a second language may also confer social benefits to children with DS as it may increase their abilities to communicate with others in their community and may open future opportunities for employment and recreation, thus "(increasing) social inclusion and (decreasing) social isolation."[29] Despite the evidence, students with DS are regularly denied the opportunity to participate in the FL classroom and reap the benefits of both inclusion and bilingualism.

Need for the Study

While bilingualism in individuals with DS is still an understudied topic, second language acquisition in the context of the FL classroom, with children having minimal exposure to the language, is virtually non-existent. Pioneer researcher in bilingualism in children with DS, Elizabeth Kay-Raining Bird, asks, "Can individuals with Down syndrome become second language learners? The answer is probably. There are currently no studies of bilingualism in children with DS that have focused specifically upon second language learners. This is an important gap in the literature."[30] This research seeks to be a

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[28] Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1 (2008): 16.

[29] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 57–58. This would be especially true for children growing up in a bilingual home or community but may prove true for children with DS in the FL context as well, especially given the increased globalization and mixture of cultures. Sarah Martin and colleagues report the case of Jake, a boy with DS who participated in French Immersion and as a result began to use his French to communicate with others in his community. Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 19–20. See also Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30.

[30] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 93. While one study has since been conducted on second language learning in the immersion context, I am not aware of any significant scholarly research which has been conducted on the topic of second language learning in the foreign language classroom among children with DS since the publication of the quoted article. It should be noted that in 2017 an EdD dissertation was published on the topic of receptive vocabulary acquisition in the FL

first step in filling that gap.

Though some work has been done in the area of second language acquisition in the context of the FL classroom for children with Developmental Language Disorders (DLD) and learning disabilities more generally, this work is still extremely sparse, and the need remains for further research.[31] Furthermore, even that research which focuses on second language acquisition in the FL classroom in students with DLD examines acquisition in form-based teaching, in which grammar is explicitly explained and practiced.[32] Research is needed to assess language acquisition with different types of instruction, such as that which is communicative and meaning-based, not form-based.[33]

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context, but was very limited in scope, focusing on the effects of music in learning targeted vocabulary, and was a case study of one child. Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto Rico, 2012). For the case study on second language learning by a child with DS in the immersion context see Martin et al., "Bilingual Outcomes," 1–29. While Edgin and colleagues conducted a study on the neuropsychological effects of second language exposure upon children with DS, they did not collect data regarding linguistic competence in each language. Edgin et al., "Neuropsychological Effects," 355. Additionally, the exposure to the second language was primarily through parents or caregivers in the home, not in the FL or instructional context (352).

[31] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *Journal of Communication Disorders* 88 (2020): 14; Mary Caitlin S. Wight, "Students with Learning Disabilities in the Foreign Language Learning Environment and the Practice of Exemption," *Foreign Language Annals* 48, no. 1 (2015): 50; Peggy McCardle and Erika Hoff, "An Agenda for Research on Childhood Bilingualism," in *Childhood Bilingualism: Research on Infancy through School Age*, ed. Peggy McCardle and Erika Hoff, Child Language and Child Development 7 (Bristol, UK: Multilingual Matters, 2006), 158–61. The literature of second language acquisition in the context of the FL classroom among various special needs populations will be reviewed in chapter two.

[32] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 5; Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13. It is not clear what type of teaching was utilized in the Zoutenbier and Zwitserlood study, but the assessment for language acquisition was largely dependent upon reading, possibly creating a disadvantage for the students with DLD to demonstrate their acquisition.

[33] Form-based teaching "(explicitly) . . . (focuses) on the formal properties (of language) with either little or no attention to meaning." Bill VanPatten and Alessandro G. Benati, *Key Terms in Second Language Acquisition*, 2nd ed. (London: Bloomsbury, 2015), 117. As opposed to form-based teaching, communicative language teaching has as its goal "communicative competence and . . . seeks to make meaningful communication and language use a focus of all classroom activities." Jack C. Richards and

Finally, the need exists not only to explore the acquisition of a second language by students with DS, but to provide for teachers an example of how to effectively include children with DS in the FL classroom.[34] True inclusion begins with teachers, and unless FL teachers have a viable example of inclusion and understanding of the capabilities of students with DS to acquire a second language, many may not be willing or able to effectively include students with DS in their classroom.[35] By documenting the acquisition of a second language by children with DS, this study seeks to "[enlarge] the capacity" of FL teachers to "imagine what [may] be achieved" by students with DS in relation to second language acquisition and thus increase their "sense of accountability for bringing it about."[36] By providing am example of how to include children with DS in the FL classroom, this study also seeks empower the FL teacher's imagination to bring about this achievement of second language acquisition in children with DS.[37]

Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 99.

[34] Longard and Deacon note that in order for students with DS to be successful in L2 learning, teachers must "have access to appropriate resources to support children with special needs, and to date there are few available." Longard and Deacon, "Bilingualism in Children with Down Syndrome," 30. See also Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11.

[35] Arnett and Mady document the attitudes of novice FL teachers regarding inclusion of students with learning disabilities. Katy Arnett and Callie Mady, "Exemption and Exclusion from French Second Language Programs in Canada: Consideration of Novice Teachers' Rationales," *Exceptionality Education International* 28, no. 1 (2018): 86–99. Though teachers' attitudes vary, they are largely positive toward the idea of including students with learning disabilities. However, all four teachers felt that some students may not be suitable for FL learning, and Arnett and Mady note that "French is typically the only subject in which students are removed from a learning environment because of challenges" (96). When challenges arise in other subjects, needed support is typically provided. Two teachers admitted that teaching methods may largely affect the success of students with learning disabilities (95).

[36] Mel Ainslow, "Struggling for Equity in Education: The Legacy of Salamanca," in Kiuppis and Hausstätter, *Inclusive Education Twenty Years after Salamanca*, 43.

[37] Paradis also emphasizes the need to get the word out to FL teachers that children with developmental disabilities are indeed able to learn an L2, yet also stresses the need for further research in this area. Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *Journal of Communication Disorders* 63 (2016): 80.

The Benefit of the Study

1. This study may benefit teachers in the FL classroom who would like to integrate students with disabilities such as those with DS into their classroom but do not know if or how it is possible.

2. This study may benefit parents who may want to allow their child with DS to participate in the FL classroom but do not know if their child could be successfully included or successfully learn the language.

3. This study may benefit school administrators who are seeking a more fully inclusive approach.

4. This study may benefit individuals with DS cognitively and socially through exposure to a second language.

5. This study may benefit individuals with other learning or intellectual disabilities who are often excluded from the FL classroom for many of the same reasons as those individuals with DS.

Research Problem

Some parents may desire for their child with DS to learn a second language, but they are not sure if it is possible.[38] Can students with DS acquire a second language in the context of the FL classroom? If so, will they be able to keep up with their peers? Many language teachers are eager to include students with disabilities in their classroom but are unsure how to do so. What type of curriculum is effective for students with DS to learn a second language? How should the teacher modify or adjust the curriculum for students with DS? What type of support do students with DS in the FL classroom need? What is the proper role of the assistant? This study will provide for FL teachers an example of teaching individuals with DS in the FL classroom and will describe the initial stages of language acquisition of a second language of individuals with DS.

Purpose Statement

The purpose of this study was to describe the participation of elementary-aged children with Down syndrome in a six-week foreign language class and to measure the

[38] See for example, the opinions expressed by parents of children with special educational needs in Kay-Raining Bird et al., "Access and Outcomes," 21–22.

receptive and expressive lexical acquisition of Spanish as a foreign language in students with Down syndrome.

Research Questions

The research questions explored two major categories: participation of students with Down syndrome in the foreign language classroom and the initial stages of second language acquisition in children with Down syndrome.

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?
    e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?
2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?
3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?
4. Which of the following variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome? The variables of interest are chronological age, nonverbal cognition, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education.
5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Research Population and Sample

The research population for this study was monolingual children with DS. All

students in this study were monolingual English-speaking children who had completed kindergarten–sixth grade. The research sample of children with DS was recruited primarily through Down Syndrome of Louisville, and was not drawn from one school, but from all over the greater Louisville metro area. All research sample children were participants in a six-week summer academic enrichment camp at Down Syndrome of Louisville. Participants in the research sample did not have any significant prior exposure to the Spanish language nor were they enrolled in any other type of Spanish language learning class for the duration of the study.[39] Additionally, children with and without DS participated in a pilot test group, and monolingual children with DS formed an L1 control group.

Research Delimitations

This study assessed the receptive and expressive lexical acquisition of children with DS resulting from participation in a six-week FL class. The focus of this study was lexical acquisition, as measurement of vocabulary is a meaningful assessment of language acquisition.[40] Moreover, even more so than in typically developing individuals, vocabulary development may be an important precursor for syntactic development in

[39] One child had previously participated in a Spanish class but did not appear to have retained any vocabulary from that class.

[40] Batia Laufer and Zahava Goldstein note that "tests of vocabulary size have been shown to predict success in reading, writing, and general language proficiency as well as academic achievement." Batia Laufer and Zahava Goldstein, "Testing Vocabulary Knowledge: Size, Strength, and Computer Adaptiveness," *Language Learning* 54, no. 3 (2004): 401–402. See also Beatriz González-Fernández and Norbert Schmitt, "Vocabulary Acquisition," in *The Routledge Handbook of Instructed Second Language Acquisition*, ed. Shawn Loewen and Masatoshi Sato, Routledge Handbooks in Applied Linguistics (New York: Routledge, 2017), 280. J. Charles Alderson contends that vocabulary is a useful measure of language proficiency, especially a knowledge of low-frequency words. J. Charles Alderson, "Judging the Frequency of English Words," *Applied Linguistics* 28, no. 3 (2007): 384. For the necessity of vocabulary for reading in L2 see Batia Laufer, "The Lexical Plight in Second Language Reading: Words You Don't Know, Words You Think You Know, and Words You Can't Guess," in *Second Language Vocabulary Acquisition: A Rationale for Pedagogy*, ed. James Coady and Thomas Huckin (Cambridge: Cambridge University Press, 1997), 20–34. For vocabulary and academic achievement see Muriel Saville-Troike, "What Really Matters in Second Language Learning for Academic Achievement?," *TESOL Quarterly* 18, no. 2 (1984): 199–219.

individuals with intellectual disability such as DS, thus measuring vocabulary development is a reasonable first step to measuring initial language acquisition.[41] Given the limited exposure that students were to have to the second language during the study, it was speculated that vocabulary production would likely be minimal, and certainly less than vocabulary comprehension.[42] Though some may have deemed that it was thus not worth measuring expressive vocabulary, since this study was the first of its kind and children with DS currently have limited access to participation in the FL classroom, it was decided to be advantageous to use this opportunity to measure participants' expressive, as well as receptive, vocabulary acquisition.[43] Assessing both the receptive and expressive lexical acquisition of participants presents a fuller picture of their acquisition and fluency (or lack thereof). This study did not assess reading abilities or writing abilities in Spanish. In addition, this study did not assess grammatical acquisition.[44] Since exposure to the L2 was severely limited and individuals with DS are

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[41] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 111; Margje van der Schuit et al., "How Cognitive Factors Affect Language Development in Children with Intellectual Disabilities," *Research in Developmental Disabilities* 32, no. 5 (2011): 1884–94. That is, it seems that in order for second language syntax to develop, second language vocabulary development must first occur. Thus, it is reasonable in measuring incipient stages of second language acquisition to measure only vocabulary.

[42] Before the start of the study, it was suspected that the participants with DS may not be able to produce any significantly measurable amount of language after such limited contact with the language. Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 532. See also Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 6.

[43] Per a Zoom conversation with Elizabeth Kay-Raining Bird, leading scholar in bilingualism in individuals with DS, on February 1, 2021. Additionally, Sini Smolander and colleagues note that previous studies investing L2 acquisition in children with DLD have largely neglected to investigate vocabulary acquisition, and "have rarely included both receptive and expressive modes." Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *International Journal of Language & Communication Disorders* 56, no. 1 (2021): 76. Thus, despite the limitations, the need exists to study both receptive and expressive vocabulary acquisition.

[44] By *grammatical* I am referring to the "syntactic and morphological properties of a language." Heike Behrens, "Grammatical Categories," in *The Cambridge Handbook of Child Language*,

shown to have marked deficits in grammatical receptivity and expression, as well as difficulties in literacy skills, a longer intervention would be more effective to study grammar acquisition as well as reading and writing abilities.[45]

Terminology[46]

Bilingual. Generally speaking, a bilingual person is one who can "produce, comprehend, read or write more than one language."[47] In the context of the research referenced in this study, unless otherwise specified, a *bilingual person* is one who is regularly exposed to two or more languages and generally uses those languages in their daily life.[48] This distinguishes them from those *second language learners* such as *foreign*

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ed. Edith L. Bavin (Cambridge: Cambridge University Press, 2009), 200.

[45] In her review of the research, Alexandra Perovic concludes that the impaired linguistic abilities of individuals with DS "usually mean impaired grammar." Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1619. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 11, 13; M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *Journal of Intellectual Disability Research* 63, no. 12 (2019): 1438. For literacy skills see Kari-Anne B. Næss et al., "Reading Skills in Children with Down Syndrome: A Meta-Analytic Review," *Research in Developmental Disabilities* 33, no. 2 (2012): 737–47; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 8–9; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *Journal of Intellectual Disability Research* 50, no. 7 (2006): 477–91; Donna Boudreau, "Literacy Skills in Children and Adolescents with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 497–525; Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *American Journal of Speech-Language Pathology* 9, no. 4 (2000): 319–30.

[46] In a field where terms are often used in various ways, an extra effort is made to clarify the meanings of these terms to "provide the clearest information possible" and to allow for replicability of the research. McCardle and Hoff, "An Agenda for Research," 160. See also Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 21.

[47] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 49.

[48] François Grosjean, "A Psycholinguistic Approach to Code-Switching: The Recognition of Guest Words by Bilinguals," in *One Speaker, Two Languages: Cross-Disciplinary Perspectives on Code-Switching*, ed. Lesley Milroy and Pieter Muysken (Cambridge: Cambridge University Press, 1995), 259;

language learners who are learning a language in a context in which that language is not needed or used in daily life.[49]

Comprehensible input. Any language which a learner hears or sees (in spoken, written, or signed form), which is understandable to the learner.[50]

Developmental Language Disorder. An impairment of language ability which does not affect or necessitate the presence of impairment of hearing, nonverbal intelligence, neurological function and other domains of health or physical features such as oral motor structure and function which may affect the ability to speak properly.[51] Developmental Language Disorder (DLD) is "severe enough to interfere with daily life,

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Rebecca Ward adheres to this same understanding of *bilingual* in her research on bilingualism in preschoolers with Down Syndrome. Ward, "Profiling the Language Abilities," 20.

[49] It is important to note that bilingualism exists on a continuum, and it may be said that as soon as an individual begins acquiring an L2, they are on the continuum of bilingualism. Richard Diebold refers to this as "incipient bilingualism." A. Richard Deibold, "Incipient Bilingualism," *Language* 37, no. 1 (1961): 99. For further detail on the concept of bilingualism as a continuum see William F. Mackey, "The Description of Bilingualism," in *The Bilingualism Reader*, ed. Li Wei (London: Routledge, 2000), 26–27. Blake Turnbull argues that FL learners should be considered emergent bilinguals. He thus defines an emergent bilingual as "any person who is actively in the process of acquiring knowledge of a second language and developing bilingual languaging skills for use in a given situation relevant to their individual needs to learn the TL." Blake Turnbull, "Reframing Foreign Language Learning as Bilingual Education: Epistemological Changes Towards the Emergent Bilingual," *International Journal of Bilingual Education and Bilingualism* (September 2016): 3.

[50] Bill VanPatten, Megan Smith, and Alessandro G. Benati, *Key Questions in Second Language Acquisition: An Introduction* (Cambridge: Cambridge University Press, 2019), 45, 197; Richards and Schmidt, *Longman Dictionary of Language Teaching*, 108. The term comprehensible input was popularized by Stephen Krashen, beginning with his seminal work *Principles and Practice in Second Language Acquisition*, though many other scholars recognized the concept before him. See Stephen Krashen, "Who Invented Comprehensible Input?," *International Journal of Language Teaching* 12, no. 2 (2017): 32–33. Krashen now refers to the necessity of comprehensible input for language acquisition as the Comprehension Hypothesis but originally referred to it as the Input Hypothesis. Stephen Krashen, "The Comprehension Hypothesis Extended," in *Input Matters in SLA*, ed. Thorsten Piske and Martha Young-Scholten, Second Language Acquisition (Bristol, UK: Multilingual Matters, 2009), 81; Stephen D. Krashen, *Principles and Practice in Second Language Acquisition*, internet ed., Stephen Krashen, 2009, 20–30. *Principles and Practice in Second Language Acquisition* was originally published in 1982.

[51] Laurence B. Leonard, "Specific Language Impairment Across Languages," *Child Development Perspectives* 8, no. 1 (March 2014): 1; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with DD," 2; Zoutenbier and Zwitserlood, "Exploring the Relationship," 1.

(has) a poor prognosis and (is) not associated with a clear biomedical aetiology."[52] In this study the term may be used synonymously with Specific Language Impairment (SLI).[53]

Down syndrome. A syndrome caused by additional chromosome 21 (in whole or in part) which can take one of three forms: (1) Trisomy 21—an extra whole chromosome 21 is present in every cell of the body. Trisomy 21 is the most common form of Down syndrome, present in 95 percent of all cases of DS; (2) Translocation—an extra part of chromosome 21 is present and attaches itself to another chromosome; (3) Mosaicism—an extra whole chromosome 21 is present in some cells of the body. Mosaicism is the least common form of DS, making up only one percent of individuals with DS.[54] DS is associated with various health challenges, cognitive delays, and language impairments, some of which will be discussed in chapter two.

Inclusion/inclusive classroom. In the context of the foreign language classroom, *inclusion* entails presuming the competence of each student to acquire the language. The presence and participation of each student is valued, and the class is

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[52] Dorothy V. M. Bishop et al., "Phase 2 of CATALISE: A Multinational and Multidisciplinary Delphi Consensus Study of Problems with Language Development: Terminology," *Journal of Child Psychology and Psychiatry* 58, no. 10 (2017): 1078. The phrase "poor prognosis" means that the problems are "long-standing and unresponsive to general educational practices." Karla K. McGregor et al., "Developmental Language Disorder: Applications for Advocacy, Research, and Clinical Service," *Perspectives of the ASHA Special Interest Groups* 5, no. 1 (2020): 39.

[53] Developmental Language Disorder is now the accepted terminology. Bishop et al., "Phase 2 of CATALISE," 1068–80. However, due to the prevalence of Specific Language Impairment in the precedent literature, it may be necessary at times to use the terminology of SLI. For an in-depth analysis of the discussion which led to the change in terminology see Dorothy V. M. Bishop, "Why Is It So Hard to Reach Agreement on Terminology? The Case of Developmental Language Disorder (DLD)," *International Journal of Language & Communication disorders* 52, no. 6 (2017): 671–80. Using the current definition of DLD, children with Down syndrome would not be diagnosed as having a DLD, but rather a "language disorder associated with Down syndrome," since the cause of language problems in DS "is likely different from the cause of DLD." McGregor et al., "Developmental Language Disorder," 39. SLI differs from DLD in that "the term DLD can apply to the language problems of individuals who have co-occurring conditions that impair cognitive, sensorimotor, or behavioral functioning but whose causal relation to language disorder is unknown." McGregor et al., "Developmental Language Disorder," 39. However, the term DLD does not necessitate the presence of a co-occurring condition.

[54] Mark Selikowitz, *Down Syndrome: The Facts*, 3rd ed. (Oxford: Oxford University Press, 2008), 36–42.

designed so that every child can participate in and benefit from classroom activities and experience reciprocal social relationships.[55]

Input. Any language which a learner hears or sees (in spoken, written, or signed form), especially in a communicative context in which the learner is actively seeking to understand the message (as opposed to for the purpose of explicit instruction).[56]

Integration/Integrated classroom. In an *integrated* foreign language classroom, students with disabilities are present in the classroom with their peers. They are not segregated from their peers by being sent to another place or denied the opportunity to attend the foreign language class. Mere integration, however, does not guarantee that students are truly a part of the classroom and learning. Effective integration results in *inclusion*.[57]

Foreign language. Any language that is neither the native language of an individual nor the language widely spoken in the society in which that individual lives. In the context of this study, a *foreign language* is one which is not the native language of the country in which an individual resides, nor is it the language of instruction in the school.[58] Additionally, the term *foreign language* is used to distinguish foreign language learning to that of *second language learning* by those who are learning as a second

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[55] TASH, "Inclusive Education," accessed January 26, 2021, https://tash.org/advocacy-issues/inclusive-education/; Committee on the Rights of Persons with Disabilities, "General Comment No. 4 on Article 24: Right to Inclusive Education" (adopted at the Convention on the Rights of Persons with Disabilities, 2016) Article 11.

[56] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 44–45; Richards and Schmidt, *Longman Dictionary of Language Teaching*, 286.

[57] Committee on the Rights of Persons with Disabilities, "General Comment No. 4," Article 11.

[58] Richards and Schmidt, *Longman Dictionary of Language Teaching*, 224; Annette M. B. de Groot and Janet G. van Hell, "Learning Foreign Language Vocabulary," in Kroll and de Groot, *Handbook of Bilingualism: Psycholinguistic Approaches*, 25n1.

language the dominant language of the society in which they live.[59] Finally, the context of the foreign language classroom differs from that of immersion or dual language programs due to the limited contact hours with the second language typical in the foreign language classroom, and that in immersion or dual language programs the second language is the language of instruction for at least part of the school day.[60]

Language acquisition. Refers to the subconscious process of the language entering the mind/brain which occurs as a result of receiving comprehensible input in the language. During language acquisition, learners do not consciously focus on the rules of

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[59] It should be noted that for native speakers of a language who live where said language is not the dominate language of society, the language is not foreign. Often times, those languages which are called foreign coexist alongside the dominant language, albeit in minority. Ryuko Kubota and Theresa Austin, "Critical Approaches to World Language Education in the United States: An Introduction," *Critical Inquiry in Language Studies* 4, no. 2–3 (2007): 74. Though for this reason I would prefer to use the term *world language* or *modern language*, for the sake of clarity and consistency with past and current research, I will employ the term *foreign language*. I should note that though my approach to the term *foreign language* is somewhat critical, this study is not founded upon a critical approach to research on second language acquisition or language teaching. For further discussion on a critical approach to SLA research and language education see Kubora and Austin, "Critical Approaches to World Language Education," 74–78. For further discussion on the problematic use of the word foreign in second language education, see Diane Larsen-Freeman and Donald Freeman, "Language Moves: The Place of 'Foreign' Languages in Classroom Teaching and Learning," *Review of Research in Education* 32 (2008): 147.

[60] An additional caveat which may distinguish the foreign language classroom context from that of an immersion or dual language program is that for some students, the second language being learned is not a foreign language but rather the dominant language of the community where they live. For example, for a native Spanish speaker in the United States enrolled in an English-Spanish dual language program, their second language (English) is the dominant language. Conversely, for a native English speaker in a Spanish immersion program their second language (Spanish) is not the majority language and therefore may be considered a foreign language. See Fred Genesee and Kathryn Lindholm-Leary, "Two Case Studies of Content-Based Language Education," *Journal of Immersion and Content-Based language Education* 1, no. 1 (2013): 3–33, and Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 21, for further description of foreign/second language immersion and dual language education. However, the immersion and dual language learning contexts differs vastly from the typical foreign language classroom due to the hours and frequency of exposure, and that the second language is also a language of instruction. For example, "in French immersion (IMM) programs in Canada, at least 50% of academic instruction is delivered through French during one or more grades in elementary and/or secondary school for majority language English-speaking students." Genesee and Lindholm-Leary, "Two Case Studies," 7. This may be contrasted with a typical FL classroom setting in which students only spend on average between two to three hours a week in the FL classroom. Laura Collins and Carmen Muñoz, "The Foreign Language Classroom: Current Perspectives and Future Considerations," *The Modern Language Journal* 100, no. S1 (2016): 138.

grammar and sounds of the language, but rather on communication – understanding or expressing a message. As opposed to language learning, there is "no conscious awareness of the formal properties of language involved" in the process of *language acquisition*.[61]

Language learning. Refers to the explicit, conscious process of learning a language. Learners are focused on the rules of grammar, memorization of vocabulary, and sounds of the language. *Language learning r*esults in explicit knowledge which cannot be transformed into implicit knowledge and only serves a limited purpose for use in real-time communication.[62]

Productive lexical ability. Generally, *productive lexical ability* refers to the ability of an individual to actively produce vocabulary in spoken, written, or signed form.[63] This study will only assess vocabulary produced in spoken form. It may also be referred to as *expressive lexical ability*.[64] Lexical/lexicon and vocabulary will be used

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[61] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 150. See also Stephen Krashen, *Second Language Acquisition and Second Language Learning*, internet ed., Stephen Krashen, 2002, http://www.sdkrashen.com/content/books/sl_acquisition_and_learning.pdf, 1–2; Krashen, *Principles and Practice*, 10–11. I acknowledge that some may use language *acquisition* and language *learning* synonymously to simply refer to "the learning and development of a person's language." Richards and Schmidt, *Longman Dictionary*, 312. However, I find it helpful to distinguish between the two as the distinction holds pedagogical implications. Generally speaking, language *acquisition* is facilitated by implicit teaching methods, while language *learning* is facilitated by explicit methods of teaching. See Bill VanPatten, "Why Explicit Knowledge Cannot become Implicit Knowledge," *Foreign Language Annals* 49, no. 4 (2016): 650–57, regarding the distinction between the roles of implicit and explicit teaching. I also understand that the distinction between learning and acquisition and the roles implicit and explicit instruction play in second language acquisition/learning are not clear cut and are still up for debate. For a helpful summary of this issue see Nick C. Ellis, "Implicit and Explicit SLA and Their Interface," in *Implicit and Explicit Language Learning: Conditions, Processes, and Knowledge in SLA and Bilingualism*, ed. Cristina Sanz and Ronald P. Leow, Georgetown University Round Table on Languages and Linguistics Series (Washington, DC: Georgetown University Press, 2010), 35–47.

[62] VanPatten, Smith, and Benati, *Key Questions in Second Language Acquisition*, 150; Krashen, *Second Language Acquisition and Learning*, 1–2; Krashen, *Principles and Practice*, 10–11.

[63] Richards and Schmidt, *Longman Dictionary*, 462; González-Fernández and Schmitt, "Vocabulary Acquisition," 284.

[64] For example, see Todd A. Gibson et al., "The Receptive-Expressive Gap in the Vocabulary of Young Second-Language Learners: Robustness and Possible Mechanisms," *Bilingualism (Cambridge, England)* 15, no. 1 (2012): 102–16.

interchangeably throughout this study.[65]

Receptive lexical ability. For the purposes of this research, *receptive lexical ability* refers to the ability of an individual to understand spoken or signed vocabulary.[66]

Second language. Any language that one is learning (or acquiring) after having acquired a native language.[67]

Second language learner. A person who is learning (or acquiring) a language which is not their native language. This language could be the dominant language of the society in which the individual lives, or a language which may be considered a foreign language.[68] The participants in the study are *second language learners* but not *bilingual* since they are not regularly exposed to their second language, nor do they use their second language in their daily life.

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[65] Andreas Rohde, "Receptive L2 Lexical Knowledge in Bilingual Preschool Children," in *Bilingual Preschools*, ed. Kristin Kersten et al., Volume I: Learning and Development (Trier, Germany: Wissenschaftlicher Verlag Trier, 2010), 45n2. See also David Singleton, *Exploring the Second Language Mental Lexicon* (Cambridge: Cambridge University Press, 1999), 162.

[66] Richards and Schmidt, *Longman Dictionary*, 462; González-Fernández and Schmitt, "Vocabulary Acquisition," 284. The ability to understand the written word is also a part of lexical receptivity but was not measured in this study.

[67] Richards and Schmidt, *Longman Dictionary*, 514. However, in the case of young children, the first language may still be in development when the second language is introduced. Such children may be referred to as simultaneous or sequential bilinguals, depending upon when the second language is introduced. Though there is not a precise consensus, introduction of the second language at three-years old often serves as the distinguishing factor between simultaneous and sequential bilingualism. Smolander et al., "L2 Vocabulary Acquisition," 74; Anne Dorothee Roesch and Vasiliki Chondrogianni, "'Which Mouse Kissed the Frog?' Effects of Age of Onset, Length of Exposure, and Knowledge of Case Marking on the Comprehension of Wh-Questions in German-Speaking Simultaneous and Early Sequential Bilingual Children," *Journal of Child Language* 43, no. 3 (2016): 636; Roxanna Ruiz-Felter et al., "Influence of Current Input–Output and Age of First Exposure on Phonological Acquisition in Early Bilingual Spanish–English-Speaking Kindergarteners," *International Journal of Language & Communication Disorders* 51, no. 4 (2016): 373. However, this is different than when the child is introduced from two languages at birth, in which case both languages would be considered a first language. This is referred to as bilingual first language acquisition, though these children may also be referred to as simultaneous bilinguals. Fred Genesse, "Bilingual First Language Acquisition in Perspective," in McCardle and Hoff, *Childhood Bilingualism*, 46; Roesch and Chondrogianni, "'Which Mouse Kissed the Frog?,'" 636.

[68] Richards and Schmidt, *Longman Dictionary*, 514; de Groot and van Hell, "Learning Foreign Language Vocabulary," 25n1.

Methodology

An exploratory mixed methods multiple case study design was used. A mixed methods multiple case study design was employed to develop an enhanced understanding of initial second language acquisition in children with DS through the collection of both quantitative and qualitative data and the analysis of multiple cases.[69] The first phase consisted of two primary components: implementation of the experiment, that is, teaching Spanish to children with DS, and multiple case studies of children with DS who are participating in the Spanish FL classroom. The method of case studies is applicable, since there is very little research conducted on the nature of second language acquisition in individuals with DS.[70] The study began with three categories of assessments of the research sample: an assessment of nonverbal intelligence, an assessment of verbal short-term memory (VSTM), and English vocabulary assessments.[71] These assessments served to develop a profile for each participant and as predictor measures for how participants may differ in their acquisition of Spanish.[72]

The qualitative portion of the study lasted for six weeks, during which time all participants attended Spanish class every day, Monday through Friday, for forty-five minutes.[73] The classes took place at Down Syndrome of Louisville in conjunction with an academic enrichment summer camp for children with DS, and I taught the classes. Of

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[69] John W. Creswell and Vicki L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. (Los Angeles: SAGE, 2018), 116.

[70] Paul D. Leedy and Jean Ellis Ormrod, *Practical Research: Planning and Design*, 11th ed. (New York: Pearson, 2016), 254; Sue Buckley recommends case studies as a starting point for researching L2 acquisition in children with DS. Sue Buckley, "Can Children with Down Syndrome Learn More than One Language?," *Down Syndrome News and Update* 2, no. 3 (2002): 100.

[71] No Spanish pre-tests were administered.

[72] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 10.

[73] The six weeks was divided into two three-week sessions, with a week without classes in-between.

those children that participated in the study only one or two per class were part of the multiple case study, for a total of four case studies.[74] For the students who participated in the case studies, I observed the students' participation in the Spanish classroom. Classes were video recorded so that I could accurately record their habits of participation and evidence of acquisition of the Spanish language as demonstrated in the classroom.

Upon completion of the Spanish intervention, the quantitative portion of the study assessed the receptive and expressive lexical development in Spanish of the intervention participants. I developed my own instrumentation based on instrumentation used in other studies to assess lexical acquisition of Spanish in order to tailor the questions to the input the students received in the class. I developed one instrument to assess receptive lexical acquisition, and one instrument to assess expressive lexical acquisition. The development of my own instrumentation is in line with a three-phase exploratory mixed methods design "in which the researcher first begins by exploring with qualitative data and analysis, then builds a feature to be tested . . . and tests this feature in a quantitative third phase."[75] In the third phase I assessed the receptive and expressive

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[74] The number of participants with DS in the study far exceed the recommended number of participants for a multiple case study, and thus I could only choose one or two from each class. While everyone's data was included in the quantitative assessment of language acquisition, it was not feasible to conduct an in-depth case study of every participant in the study. The maximum number of case studies that I would accept was five, due to the feasibility of collecting and synthesizing data. An initial invitation to participate in a case study was extended to every participant. Only a couple of parents responded to the initial invitation. Follow up invitations were extended to children who I felt represented a variety of cognitive and linguistic abilities and were participating in various classes. John Creswell and Cheryl Poth offer four to five cases as the norm for multiple case studies. John W. Creswell and Cheryl N. Poth, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (Los Angeles: SAGE, 2016), 161.

[75] John W. Creswell and J. David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches,* 5th ed. (Los Angeles: SAGE, 2017), 224. Unlike the traditional three-phase exploratory mixed methods design, in which separate research participants are used in phase one than in phase three, the same subjects were used for the quantitative phase of the study as for the qualitative phase of the study. This is due to the nature of the research. Those students who participated in the class, based off of which the instrumentation was formed, must be the same ones who receive the assessment. Thus, the reasons for using different populations in the quantitative and qualitative phases of the study offered in the literature are not applicable in this study. See Creswell and Creswell, *Research Design*, 225; Creswell and Plano Clark, *Designing and Conducting Mixed Methods,* 192–93.

lexical Spanish acquisition of the intervention participants. For each domain (receptive and expressive Spanish vocabulary) I administered a standardized test and my own instrumentation which I developed in the second stage. Since the development of my own instrumentation "(captured) the material that the children were directly exposed to" in class, it "may reveal better performance and give a wider range of performance" than what could be captured through the standardized assessments.[76] Results from these assessments were analyzed to compare the receptive and expressive lexical development in Spanish of the children with DS as well as to determine which variables correlated with L2 acquisition in children with DS. Additionally, participants were administered English receptive and expressive vocabulary assessments post-intervention. The English vocabulary pre- and post-test scores of the intervention participants were compared to determine the impact of participation in a six-week FL classroom on L1 development. The qualitative and quantitative data was then combined to provide an overall language acquisition profile of each child who participated in the multiple case study.

Limits of Generalization

Several limits exist to the generalization of the findings in this study. First, those participants with DS in this study may not be fully representative of all individuals with DS. The cognitive and language abilities of individuals with DS vary greatly, and it is possible that the lowest or highest scale of language and cognitive abilities present in some individuals with DS was not fairly represented in the study. Secondly, the context of the class in which the students learned Spanish was not the school setting. Elementary FL programs vary vastly in the amount and frequency of exposure to the second language, as

[76] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

well as curriculum content and methodology.[77] Variance in any one of these factors will inevitably result in varying second language acquisition outcomes. While the frequency of exposure for this class was higher than what is typical for an elementary FL class, the duration of exposure was much less.[78] Additionally, unlike a typical school setting, many participants with DS in the study did not know each other apart from their participation in the summer camp in which the classes took place. This may have raised their affective filter and lowered their receptibility to acquisition.[79] Therefore, the acquisition achieved by the students in the study may not be equal to what they might attain were the class in their own school with their classmates.

Finally, this study assessed the acquisition of Spanish vocabulary by native English speakers, and it should not be presumed that the same results would be obtained given different languages.[80] Spanish and English share the same alphabet and many cognates, and the similarities may benefit acquisition.[81] As cognates may facilitate vocabulary learning, the same level of acquisition may not be achieved, given the same amount of input, when acquiring a language with fewer cognates.[82]

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[77] Curtain, Donato, and Gilbert, "Elementary School Foreign Language Programs," 19–20, 25–31.

[78] These factors and their possible effect on acquisition will be discussed in further detail in chapters two and five.

[79] Krashen's Affective Filter hypothesis posits that when the affective filter is high, language acquisition decreases. See Krashen, *Principles and Practice*, 30–33.

[80] Smolander and colleagues recognize that results of vocabulary acquisition may vary depending on the similarity and differences of the L1 and L2. Smolander et al., "L2 Vocabulary Acquisition," 76.

[81] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 55.

[82] Martin Willis and Yoshie Ohashi, "A Model of L2 Vocabulary Learning and Retention," *The Language Learning Journal* 40, no. 1 (2012): 127, 131, 133. Eva Lindgren and Carmen Muñoz found that cognate linguistic difference in a key predictor of receptive language acquisition. Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1

Research Assumptions

1. The medical diagnosis of Down syndrome provided by the families of the participants are accurate and reliable.

2. The assessment used to measure nonverbal intelligence (KBIT-2) is a valid measure of nonverbal intelligence.

3. The assessment used to measure English receptive vocabulary (PPVT-4) is a valid instrument and an accurate measurement of receptive vocabulary in English.

4. The assessment that used to measure expressive vocabulary in English (EVT-2) is a valid instrument and measurement of expressive vocabulary.

5. The assessment used to assess Spanish receptive vocabulary (ROWPVT-B) is a valid instrument and an accurate measurement of receptive vocabulary in Spanish.

6. The assessment that used to assess expressive vocabulary in Spanish (EOWPVT-B) is a valid instrument and measurement of expressive vocabulary.

7. The nonword repetition task used is a valid instrument and accurate measurement of verbal short-term memory.

Conclusion

This study addresses a significant gap in the literature. Virtually no research to date has addressed the topic of second language acquisition by children with DS in the FL context nor their participation in the FL classroom. Utilizing an exploratory mixed methods multiple case study design, this study sought to describe the beginning stages of second language acquisition in children with DS, and provide for FL teachers an example of inclusion and pedagogy for students with DS in the FL classroom.[83] A deeper

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(2013): 105–29. However, Smolander and colleagues argue that the usefulness of cognates in acquiring vocabulary is limited. Smolander et al., "L2 Vocabulary Acquisition," 74. Caroline Floccia et al. found that phonological similarity is helpful for vocabulary production, while typological and morphological closeness contribute to vocabulary comprehension. Caroline Floccia et al., "Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance: III: Analyses and Results for Study 1: Estimating the Effect of Linguistic Distance on Vocabulary Development," *Monographs of the Society for Research in Child Development* 83, no. 1 (2018): 60.

[83] Though no TD students participated in the intervention, and thus it cannot be claimed that this study is an example of inclusion in the fullest sense, it does set a precedent for how children with DS of varying cognitive and linguistic capabilities can effectively be included and participate in the FL classroom.

understanding of the physical, cognitive, behavioral, and language development of individuals with DS, as well as the current research on bilingualism and FL learning in individuals with DS and similar populations, and general factors of second language acquisition will help set the stage for this study. These fundamental topics are the focus of chapter two.

CHAPTER 2

PRECEDENT LITERATURE

The purpose of this study is to examine the beginning stages of second language acquisition of children with Down syndrome (DS) in the foreign language (FL) classroom. Additionally, this study seeks to describe the participation of children with DS in the FL classroom and thus provide for FL teachers an example of inclusion for students with DS in the FL classroom. To do so necessitates not only an understanding of the language abilities of children with DS, but their physical, cognitive, and behavioral development as well. After reviewing these aspects of development in individuals with DS, this review will explore the research on bilingualism in children with DS. Finally, it will explore FL learning in populations similar to that of the DS population and factors of second language (L2) acquisition.

Down Syndrome

DS is the most prevalent cognitive and chromosomal disorder, accounting for approximately 15 out of 10,000 live births in the United States.[1] As a congenital syndrome, DS is present from birth and characterized by "a cluster of features which occur together."[2] This cluster of features, while commonly referring to physical features, also includes clinical, cellular, and physiological components, medically referred to as a

[1] Cara T. Mai et al., "National Population-Based Estimates for Major Birth Defects, 2010–2014," *Birth Defects Research* 111, no. 18 (2019): 6.

[2] Mark Selikowitz, *Down Syndrome: The Facts*, 3rd ed. (Oxford: Oxford University Press, 2008), 26; L. Devlin and P. J. Morrison, "Accuracy of the Clinical Diagnosis of Down Syndrome," *The Ulster Medical Journal* 73, no. 1 (2004): 10.

"phenotype."[3] As many as 120 different features have been associated with DS, yet only a handful may be present in any one child.[4] Though the syndrome is present from birth, it is not always diagnosed immediately after birth, due in part to the variance of manifestation of the phenotypic features typically associated with DS.[5]

DS is caused by an abnormality in the 21st chromosome, manifested in three different ways: trisomy 21, translocation, and mosaicism. Trisomy 21 is characterized by an extra whole chromosome 21 in every cell of the body, and is the most common form of DS, accounting for approximately 90–95 percent of all cases.[6] Translocation occurs in approximately 2–4 percent of DS cases and is a result of an extra portion of chromosome 21, as opposed to a whole chromosome.[7] Individuals with translocation do not differ in

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[3] Julie R. Korenberg et al., "Down Syndrome Phenotypes: The Consequences of Chromosomal Imbalance," *Proceedings of the National Academy of Sciences* 91, no. 11 (1994): 4997.

[4] Selikowitz, *Down Syndrome*, 28; Julie R. Korenberg et al., "Down Syndrome Phenotypes," 4998; Stylianos E. Antonarakis and Charles J. Epstein, "The Challenge of Down Syndrome," *Trends in Molecular Medicine* 12, no. 10 (2006): 475; Kenneth Lyons Jones, Marilyn Crandall Jones, and Miguel del Campo Casanelles, *Smith's Recognizable Patterns of Human Malformation*, 7th ed. (Philadelphia: Elsevier Saunders, 2013), 3.

[5] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 5–11; Selikowitz, *Down Syndrome*, 28; Mikyong Shin, Csaba Siffel, and Adolfo Correa, "Survival of Children with Mosaic Down Syndrome," *American Journal of Medical Genetics Part A* 152A (2010): 800; Paulie Papavassiliou et al., "Mosaicism for Trisomy 21: A Review," *American Journal of Medical Genetics Part A* 167, no. 1 (2015): 27. Some of the most common and identifiable physical features of DS include 1) simian (a singular transverse crease in the palm of the hand, as opposed to the usual two); 2) sandal gap (a wider than usual gap between the first and second toe); 3) epicanthic folds (a skin fold of the upper eyelid which covers the inner corner of the eye); 4) hypotonia (weak muscle tone); 5) upslanting palpebral features (eyes that appear to slant upward); 6) protruding tongue; 7) low set or small ears 8) short neck, loose neck skin, or increased neck skin thickness; 9) a flat facial profile, and 10) mouth corners turned downward. Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 7, 10–11; K. Fried, "A Score Based on Eight Signs in the Diagnosis of Down Syndrome in the Newborn," *Journal of Mental Deficiency Research* 24, no. 3 (1980): 181–85; Bruce R. Korf, David L. Rimoin, and Reed E. Pyeritz, "Nature and Frequency of Genetic Disease," in *Emery and Rimoin's Essential Medical Genetics*, ed. David L. Rimoin, Reed E. Pyeritz, and Bruce R. Korf (Oxford: Academic Press, 2013), 3,8; Jones, Jones, and del Campo Casanelles, *Smith's Recognizable Patterns*, 7–8; Selikowitz, *Down Syndrome*, 28–31.

[6] Selikowitz, *Down Syndrome*, 37; Papavassiliou et al., "Mosaicism for Trisomy 21," 26; Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10; Shin, Siffel, and Correa, "Survival of Children," 800.

[7] Selikowitz, *Down Syndrome*, 39; Devlin and Morrison, "Accuracy of the Clinical Diagnosis,"

the degree of severity of intellectual impairment nor the manifestation of clinical features as compared to individuals with trisomy 21.[8] Mosaicism, characterized by an extra whole chromosome 21 in multiple cells of the body, occurs in approximately 2–4 percent of DS cases.[9] In general, individuals with mosaic DS do not present as many clinical features of DS as do those with trisomy 21 or translocation, resulting in a lower detection rate.[10] Additionally, it seems that individuals with mosaic DS may have higher cognitive abilities and better social conditions than those individuals with trisomy 21, though still lagging behind TD peers.[11]

Physical Development

The physical development of individuals with DS is characterized by marked individual differences, and diverges from that of the general population in various ways.[12] In addition to the phenotypic physical features which outwardly distinguish individuals with DS from the TD population, the skeletal and muscular systems differ from those of

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10; Papavassiliou et al., "Mosaicism for Trisomy 21," 26; Shin, Siffel, and Correa, "Survival of Children," 800.

[8] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 5; Eran Bornstein et al., "Complete Trisomy 21 vs Translocation Down Syndrome: A Comparison of Modes of Ascertainment," *American Journal of Obstetrics and Gynecology* 203, no. 4 (2010): 391.e1–e5; Selikowitz, *Down Syndrome*, 40.

[9] Selikowitz, *Down Syndrome*, 42; Shin, Siffel, and Correa, "Survival of Children," 800; Papavassiliou et al., "Mosaicism for Trisomy 21," 26–28; Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10.

[10] Devlin and Morrison, "Accuracy of the Clinical Diagnosis," 10; Shin, Siffel, and Correa, "Survival of Children," 800; Papavassiliou et al., "Mosaicism for Trisomy 21," 27.

[11] Papavassiliou et al., "Mosaicism for Trisomy 21," 32; Jin Liang Zhu and colleagues found that adults with mosaic DS in Denmark had higher levels of education and higher rates of employment, income, marital status, and birth than those with other types of DS. Jin Liang Zhu et al., "Social Conditions for People with Down Syndrome: A Register-Based Cohort Study in Denmark," *American Journal of Medical Genetics Part A* 164, no. 1 (2014): 1–13.

[12] Annette Karmiloff-Smith et al., "The Importance of Understanding Individual Differences in Down Syndrome [version 1; referees: 2 approved]." *F1000Research* 5 (2016):1–10.

the TD population.[13] Individuals with DS face a variety of impairments in their physical development and health which may affect their cognitive and/or language development. Some of the most common physical impairments in the DS population include delayed motor development, hearing loss, heart defects, vision impairment, weak muscle tone, oral-motor structure and function, and sleep disturbances**.**

Motor development. Individuals with DS lag behind their peers in motor development, and the variability of motor development within the DS population is much wider than that of the TD population.[14] While children with DS generally follow the same sequence of motor development milestones, reaching those milestones may take twice as long for children with DS than their TD peers.[15] Additionally, delays in motor development can be exacerbated by surgery for medical conditions, common among children with DS.[16] The rate of motor development slows as the complexity of skills increases, declining noticeably by three years of age, so that by the time children with DS are school-aged, some may not have fully reached all motor development milestones needed for functional skills and typical interaction and participation in school.[17] In addition to negatively affecting functional skills, evidence seems to suggest that delayed

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[13] Carol Stoel-Gammon, "Down Syndrome Phonology: Developmental Patterns and Intervention Strategies," *Down Syndrome Research and Practice* 7, no. 3 (2001): 94.

[14] P. Winders, K. Wolter-Warmerdam, and F. Hickey, "A Schedule of Gross Motor Development for Children with Down Syndrome," *Journal of Intellectual Disability Research* 63, no. 4 (2019): 351.

[15] Hyo In Kim et al., "Motor and Cognitive Developmental Profiles in Children with Down Syndrome," *Annals of Rehabilitation Medicine* 41, no. 1 (2017): 99; Robert J. Palisano et al., "Gross Motor Function of Children with Down Syndrome: Creation of Motor Growth Curves," *Archives of Physical Medicine and Rehabilitation* 82, no. 4 (2001): 495.

[16] Kim et al., "Motor and Cognitive Developmental Profiles," 101.

[17] Palisano et al., "Gross Motor Function," 497–99; Roksana Malak et al., "Delays in Motor Development in Children with Down Syndrome," *Medical Science Monitor* (2015): 1908; Michiel J. M. Volman et al., "Functional Status in 5 to 7-Year-Old Children with Down Syndrome in Relation to Motor Ability and Performance Mental Ability," *Disability and Rehabilitation* 29, no. 1 (2007): 29.

motor acquisition has a negative effect on cognitive abilities. While one study found no significant correlation between reaching motor development milestones and cognitive function, a larger body of literature demonstrates a significant relationship between motor achievement and cognitive function, as well as language skills.[18]

Hearing loss. Individuals with DS are at increased risk of experiencing hearing loss throughout their life, whether transient or permanent.[19] As many as one-fourth of infants with DS may be born with congenital hearing loss, and as many as over two-thirds of children with DS experience some type of hearing loss.[20] While individuals

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[18] For no correlation see Kim et al., "Motor and Cognitive Developmental Profiles," 102. For evidence of a correlation between motor development and cognitive function see Roksana Malak et al., "Motor Skills, Cognitive Development and Balance Functions of Children with Down Syndrome," *Annals of Agricultural and Environmental Medicine* 20, no. 4 (2013): 805; Yuko Yamauchi et al., "Motor and Cognitive Development of Children with Down Syndrome: The Effect of Acquisition of Walking Skills on their Cognitive and Language Abilities," *Brain and Development* 41 (2019): 324; Jan Pieter Marchal et al., "Growing up with Down Syndrome: Development from 6 Months to 10.7 Years," *Research in Developmental Disabilities* 59 (2016): 447. For evidence of correlation between motor development and language skills see Yamauchi et al., "Motor and Cognitive Development," 324.

[19] Emily Nightengale et al., "Understanding Hearing and Hearing Loss in Children with Down Syndrome," *American Journal of Audiology* 26, no. 3 (2017): 301, 305–306. Not only are individuals with DS more likely to experience hearing loss than the general population but have higher rates of hearing loss when compared to other cognitively impaired populations as well. Michael M. Marcell et al., "Hearing Abilities of Down Syndrome and Other Mentally Handicapped Adolescents" (paper presented at the Annual Conference of the American Psychological Association, Boston, MA, August 1990), 7; Michael Marcell, "Relationships Between Hearing and Auditory Cognition in Down's Syndrome Youth," *Downs Syndrome Research and Practice* 3 (1995): 75–91, accessed August 27, 2021, https://library.down-syndrome.org/en-gb/research-practice/03/3/relationships-hearing-auditory-cognition-down-syndrome-youth.

[20] Adrienne Tedeschi and colleagues found that fifteen percent of infants were born with hearing loss, whereas Albert Park and colleagues found the percentage of infants who did not pass their newborn hearing screening to be as high as twnty-six percent. Adrienne S. Tedeschi et al., "The Prevalence of Congenital Hearing Loss in Neonates with Down Syndrome," *The Journal of Pediatrics* 166, no. 1 (2015): 168–71; Albert H. Park et al., "Identification of Hearing Loss in Pediatric Patients with Down Syndrome," *Otolaryngology--Head and Neck Surgery* 146, no. 1 (2012): 136. For information on prevalence of hearing loss in childhood see Nancy J. Roizen, "Down Syndrome (Trisomy 21)," in *Children with Disabilities*, 7th ed, ed. Mark L. Batshaw, Nancy J. Roizen, and Gaetano R. Lotrecchiano (Baltimore: Paul H. Brookes, 2013), 309. Two-thirds of the patients with DS tested by Balkany and colleagues were found to have significant hearing loss, and sixty-six percent of those tested by Roizen and colleagues. Thomas J. Balkany et al., "Hearing Loss in Down's Syndrome: A Treatable Handicap More Common than Generally Recognized," *Clinical Pediatrics* 18, no. 2 (1979): 116–18; Nancy J. Roizen et al., "Hearing Loss in Children with Down Syndrome," *The Journal of Pediatrics* 123, no. 1 (1993): S11.

with DS can experience sensorineural hearing loss ("involving the cochlea or auditory nerve"), a more common cause for hearing loss in children with DS is conductive ("middle ear conduction of sound") hearing loss, especially as a result of otitis media.[21] Otitis media with effusion (OME; fluid in the middle ear), seems to peak in children with DS at age one, with a prevalence between at 67 to 93 percent, and again at age six with a 60 percent prevalence, declining after eight years of age, though such problems can persist into adulthood.[22]

In the general population, hearing loss is the most commonly reported symptom of OME, and such adverse impacts are greater in the DS population. Though such hearing loss generally resolves spontaneously within three to twelve months among TD children, acute otitis media can lead to permanent hearing loss.[23] Not all cases of

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However, the prevalence is not always so high. Nightengale and colleagues found a prevalence of thirty-six percent, and De Schrijver, forty-seven percent. Nightengale et al., "Understanding Hearing," 304; L. De Schrijver et al., "Prevalence and Etiology of Sensorineural Hearing Loss in Children with Down Syndrome: A Cross-Sectional Study," *International Journal of Pediatric Otorhinolaryngology* 116 (2019): 168–72.

[21] Roizen, "Down Syndrome," 309. For the prevalence distribution of sensorineural hearing loss and conductive hearing loss as a result of otitis media in infants see Park et al., "Identification of Hearing Loss," 138. For further evidence of sensorineural hearing loss see De Schrijver et al., "Prevalence and Etiology," 168–72.

[22] M. Maris et al., "A Cross-Sectional Analysis of Otitis Media with Effusion in Children with Down Syndrome," *European Journal of Pediatrics* 173, no. 10 (2014): 1322–23; Though Emily Barr and colleagues found a strikingly high prevalence of otitis media with effusion among one-year old's, not all were symptomatic, and only a minority of the children diagnosed required intervention. Emily Barr et al., "The Prevalence of Ear, Nose and Throat Disorders in Preschool Children with Down's Syndrome in Glasgow," *Scottish Medical Journal* 56, no. 2 (2011): 101. However, Marit Erna Austeng and colleagues found that in eight year-old children with DS, otitis media was significantly associated with hearing loss. Marit Erna Austeng et al., "Otitis Media with Effusion in Children with Down Syndrome," *International Journal of Pediatric Otorhinolaryngology* 77, no. 8 (2013): 1330. For the definition of otitis media with effusion and other related terms see Richard M. Rosenfeld et al., "Clinical Practice Guideline: Otitis Media with Effusion (Update)," *Otolaryngology–Head and Neck Surgery* 154, no. 1S (2016): S3. For evidence of persistence into adulthood see Nightengale et al., "Understanding Hearing," 306.

[23] Ali Qureishi et al., "Update on Otitis Media–Prevention and Treatment," *Infection and Drug Resistance* 7 (2014): 16–17; Austeng et al., "Otitis Media with Effusion," 1329–32; Rosenfeld et al., "Clinical Practice Guideline," S5; Heather Fortnum et al., "Assessment of the Feasibility and Clinical Value of Further Research to Evaluate the Management Options for Children with Down Syndrome and Otitis Media with Effusion: A Feasibility Study," *Health Technology Assessment* 18, no. 60 (2014): 1. Children with DS are also at an increased risk for acute otitis medias. Rosenfeld et al., "Clinical Practice

OME are symptomatic or cause hearing loss, yet the presence of OME during crucial formative years may have adverse effects on both cognitive and linguistic development, though the strength of such adverse effects is debatable.[24] Such adverse effects may be exacerbated in the DS population, for which cognitive and linguistic deficits are already characteristic.[25] The presence of OME in early childhood may negatively affect overall intellectual ability, school achievement, speech, and language.[26] More specifically, in TD infants, the presence of otitis media has been shown to negatively affect receptive and expressive language development, and infants with otitis media associated hearing loss have a ten times greater risk of developing a speech disorder than those without.[27] In the DS population, hearing loss has been found to contribute to decreased performance in auditory-cognitive tasks ("such as sentence imitation, language comprehension, backward masking of spoken words, word identification, auditory-verbal short-term memory,

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Guideline," S15.

[24] Joanne Roberts et al., "Otitis Media, Hearing Loss, and Language Learning: Controversies and Current Research," *Journal of Developmental & Behavioral Pediatrics* 25, no. 2 (2004): 112–17.

[25] Fortnum et al., "Assessment of the Feasibility," 17; Robert J. Ruben, "Host Susceptibility to Sequelae," in *Evidence-Based Otitis Media*, 2nd ed., ed. Richard M. Rosenfeld and Charles D. Bluestone (Hamilton, Canada: BC Decker, 2003), 506; Joanne E. Roberts et al., "Meta-Analysis of Speech and Language Sequelae," in Rosenfeld and Bluestone, *Evidence-Based Otitis Media*, 395–97; Glynis Laws and Amanda Hall, "Early Hearing Loss and Language Abilities in Children with Down Syndrome," *International Journal of Language and Communication Disorders* 49, no. 3 (2014): 334, 339; Ben Sacks and Amanda Wood, "Hearing Disorders in Children with Down Syndrome," *Down Syndrome News and Update* 3, no. 2 (2003): 41; Lawrence D. Shriberg et al., "Otitis Media, Fluctuant Hearing Loss, and Speech-Language Outcomes: A Preliminary Structural Equation Model," *Journal of Speech, Language, and Hearing Research* 43, no. 1 (2000): 106.

[26] Roberts et al., "Otitis Media, Hearing Loss, and Language Learning," 112–16; For example, Teele and colleagues found that time spent with OME in the first year of life was significantly inversely correlated with cognitive abilities at ages three and seven, with those children with the least amount of time spent with OME scoring higher than those with more time spent with OME. This general pattern held true for measurements of school achievement, speech, and language, though not all reached significance. David W. Teele et al., "Otitis Media in Infancy and Intellectual Ability, School Achievement, Speech, and Language at Age 7 Years," *Journal of Infectious Diseases* 162, no. 3 (1990): 68–90.

[27] Joanne E. Roberts et al., "Meta-analysis of Speech," 388, 397; Ina F. Wallace et al., "Otitis Media and Language Development at 1 Year of Age," *Journal of Speech and Hearing Disorders* 53, no. 3 (1988): 249; Shriberg et al., "Otitis Media," 112.

receptive vocabulary, and oral vocabulary"),[28] to negatively impact general language scores, speech accuracy and intelligibility, lexical development, word processing speed, and comprehension of syntax, grammatical morphemes, and vocabulary.[29]

Heart defects. Congenital heart disease (CHD) is one of the most common anomalies present in the DS population, with approximately 50 percent of infants suffering from congenital heart defects.[30] Though some research shows that CHD does

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[28] The auditory-cognitive tasks administered by Marcell were "language and memory tasks that required the initial processing of acoustic-verbal information, the forming of mental representations, and the performing of actions (e.g., speaking, pointing) based on the representations." Marcell, "Relationships Between Hearing." Marcell suggests that the lower performance by individuals with DS on such measurements when compared to CA-matched youth with other causes of intellectual impairment may be "due to an interaction of lower auditory acuity and slower processing speed."

[29] Laws and Hall, "Early Hearing Loss," 333–42; Giuliana Miolo, Robin S. Chapman, and Heidi A. Sindberg, "Sentence Comprehension in Adolescents with Down Syndrome and Typically Developing Children," *Journal of Speech, Language, and Hearing Research* 48 (2005): 172–88; Robin S. Chapman et al., "Predicting Language Production in Children and Adolescents with Down Syndrome: The Role of Comprehension," *Journal of Speech, Language, and Hearing Research* 43, no. 2 (2000): 340–50; Robin S. Chapman, Scott E. Schwartz, and Elizabeth Kay-Raining Bird, "Language Skills of Children and Adolescents with Down Syndrome: I. Comprehension," *Journal of Speech, Language, and Hearing Research* 34, no. 5 (1991): 1106–20; Marcell et al., "Hearing Abilities of Down Syndrome," 8. In some studies, the hearing loss accounted for anywhere between four to eight percent variability. However, those studies also excluded individuals with DS with moderate to severe hearing loss. See Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1108, and Chapman et al., "Predicting Language Production," 342. In their research on production, Chapman and colleagues excluded children with moderate hearing loss and found no effect for hearing on grammatical morpheme production in children and adolescents with DS. Robin S. Chapman et al., Language Skills of Children and Adolescents with Down Syndrome: II. Production Deficits," *Journal of Speech, Language, and Hearing Research* 41, no. 4 (1998): 11. Contrarily, Laws and Hall included those with moderate to severe hearing loss and found more significant effects for hearing loss on language measurements. Laws and Hall, "Early Hearing Loss," 339. Similarly, Miolo and colleagues did not exclude participants based on the severity of hearing loss and found hearing loss to account for twenty-three percent variance in comprehension of grammatical morphemes. Miolo, Chapman, and Sindberg, "Sentence Comprehension," 183.

[30] Rates of prevalence represented in the following studies vary from 43 to 56 percent. C. Stoll et al., "Study of Down Syndrome in 238,942 Consecutive Births," In *Annales de Genetique*, 41, no. 1 (1998): 48; Michel Emile Weijerman et al., "Prevalence of Congenital Heart Defects and Persistent Pulmonary Hypertension of the Neonate with Down Syndrome," *European Journal of Pediatrics* 169, no. 10 (2010): 1195–99; Sallie B. Freeman et al., "Ethnicity, Sex, and the Incidence of Congenital Heart Defects: A Report from the National Down Syndrome Project," *Genetics in Medicine* 10, no. 3 (2008): 175; D. Paladini et al., "The Association Between Congenital Heart Disease and Down Syndrome in Prenatal Life," *Ultrasound in Obstetrics and Gynecology* 15, no. 2 (2000): 107; Claudine P. Torfs and Roberta E. Christianson, "Anomalies in Down Syndrome Individuals in a Large Population-Based Registry," *American Journal of Medical Genetics* 77, no. 5 (1998): 435; Gretchen L. Wells et al., "Congenital Heart

not have an impact on cognitive abilities, other research demonstrates that CHD can have a negative impact on cognitive and linguistic outcomes, especially in the preschool years.[31] Research shows that CHD may contribute to variation in language delay and language acquisition in children with DS.[32] It is important to note that research in the TD population among children with CHD show a wide variety of mediating factors which affect cognitive, linguistic, and other neurodevelopmental outcomes, prime among which may be "abnormal oxygenation and low blood flow in utero, after birth, and around the time of surgery."[33]

Disease in Infants with Down's Syndrome," *Southern Medical Journal* 87, no. 7 (1994): 724–27; Sallie B. Freeman et al., "Population-Based Study of Congenital Heart Defects in Down Syndrome," *American Journal of Medical Genetics* 80, no. 3 (1998): 213–17.

[31] For research demonstrating no impact see Carla M. Startin et al., "Health Comorbidities and Cognitive Abilities across the Lifespan in Down Syndrome," *Journal of Neurodevelopmental Disorders* 12, no. 1 (2020): 10, and Tracie C. Rosser et al., "Associations Between Medical History, Cognition, and Behavior in Youth with Down Syndrome: A Report from the Down Syndrome Cognition Project," *American Journal on Intellectual and Developmental Disabilities* 123, no. 6 (2018): 10–11. Tarek Alsaied and colleagues found negative effects from CHD through the preschool years, but by school years those negative effects had vanished. Tarek Alsaied et al., "Does Congenital Heart Disease Affect Neurodevelopmental Outcomes in Children with Down Syndrome?," *Congenital Heart Disease* 11, no. 1 (2016): 26–33. Jeannie Visootsak and colleagues found significant delays in motor, cognitive, and language measures for 12–14-month-old toddlers with CHD. Jeannie Visootsak et al., "Influence of Congenital Heart Defect on Psychosocial and Neurodevelopmental Outcomes in Children with Down Syndrome," *Cardiology in the Young* 26, no. 2 (2016): 1–13. See also Visootsak et al., "Neurodevelopmental Outcomes," 2688–91 for less statistically significant delays.

[32] Jeannie Visootsak et al., "Effect of Congenital Heart Defects on Language Development in Toddlers with Down Syndrome," *Journal of Intellectual Disability Research* 57, no. 9 (2013): 890–91.

[33] Tamara Gibb, "Neurocognitive Disability Is a Long-Term Consequence of Congenital Heart Surgery," *Neurology Reviews* 17, no. 1 (2009): 10. Other mediating factors include wait time until surgery, methods of vital organ support during surgery, and length of hospital stay. Jennifer M. Lynch et al., "Time to Surgery and Preoperative Cerebral Hemodynamics Predict Postoperative White Matter Injury in Neonates with Hypoplastic Left Heart Syndrome," *The Journal of Thoracic and Cardiovascular Surgery* 148, no. 5 (2014): 2181–88; William T. Mahle et al., "Relationship of Surgical Approach to Neurodevelopmental Outcomes in Hypoplastic Left Heart Syndrome," *Pediatrics* 117, no. 1 (2006): e90–e97; David C. Bellinger et al., "Neurodevelopmental Status at Eight Years in Children with Dextro-Transposition of the Great Arteries: the Boston Circulatory Arrest Trial," *The Journal of Thoracic and Cardiovascular Surgery* 126, no. 5 (2003): 1385–96; William T. Mahle and Gil Wernovsky, "Long-Term Developmental Outcome of Children with Complex Congenital Heart Disease," *Clinics in Perinatology* 28, no. 1 (2001): 235–47; David C Bellinger et al., "Developmental and Neurological Status of Children at 4 Years of Age after Heart Surgery with Hypothermic Circulatory Arrest or Low-Flow Cardiopulmonary Bypass," *Circulation* 100, no. 5 (1999): 526–32.

Vision impairment. Children with DS are at an increased risk for a number of ocular disorders such as refractive errors, nystagmus, astigmatism, and cataracts, among many others.[34] While many ophthalmic disorders result in impaired vision, some, such as slanting fissures, epicanthic folds, Brushfield spots, hypertelorism, and epiblepharon do not.[35] Vision impairments increase with age, and by the ages of five to twelve years, as many as 80 percent of children with DS may experience some type of ophthalmological disorder.[36] Tuomo Määttä and colleagues found vision impairment to be most common in individuals with DS with severe to profound cognitive disability, suggesting that poor vision is associated with cognitive impairment.[37] Additionally, visual impairment in individuals with DS has negative effects on adaptive behavior.[38] Many of the negative

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[34] Lisbeth Sandfeld Nielsen, Hanne Jensen, and Liselotte Skov, "Risk Factors of Ophthalmic Disorders in Children with Developmental Delay," *Acta Ophthalmologica* 86, no. 8 (2008): 879–81; Alexandra L. Creavin and Ray D. Brown, "Ophthalmic Abnormalities in Children with Down Syndrome," *Journal of Pediatric Ophthalmology & Strabismus* 46, no. 2 (2009): 76–82; Branka Stirn Kranjc, "Ocular Abnormalities and Systemic Disease in Down Syndrome: Retrospective Clinical Study, University Eye Hospital, Ljubljana, Slovenia," *Strabismus* 20, no. 2 (2012): 74–77; Elma Stephen et al., "Surveillance of Vision and Ocular Disorders in Children with Down Syndrome," *Developmental Medicine & Child Neurology* 49, no. 7 (2007): 513–15; Siegfried Pueschel and Stefan Gieswein, "Ocular Disorders in Children with Down Syndrome," *Down Syndrome Research and Practice* 1, no. 3 (1993): 129–32.

[35] Creavin and Brown, "Ophthalmic Abnormalities," 77.

[36] Nancy J. Roizen and David Patterson, "Down's Syndrome," *The Lancet* 361, no. 9365 (2003): 1283.

[37] Tuomo Määttä et al., "Sensory Impairments and Health Concerns Related to the Degree of Intellectual Disability in People with Down Syndrome," *Down Syndrome Research and Practice* 11, no. 2 (2006): 81. The study demonstrates that visual impairment was significantly related to intellectual disability in individuals with DS. Drawing upon their findings and previous findings, the authors suggest that poor vision may contribute to cognitive impairment. They also recognize that the relationship of impaired vision to cognition depends upon the type of visual impairment and that in some cases glasses can help to remedy the deficit in vision. See also Jacques Van Splunder et al., "Refractive Errors and Visual Impairment in 900 Adults with Intellectual Disabilities in the Netherlands," *Acta Ophthalmologica Scandinavica* 81, no. 2 (2003): 123–30; H. M. Evenhuis et al., "Prevalence of Visual and Hearing Impairment in a Dutch Institutionalized Population with Intellectual Disability." *Journal of Intellectual Disability Research* 45, no. 5 (2001): 457–64; H. M. J. Van Schrojenstein Lantman-de Valk et al., "The Need for Assessment of Sensory Functioning in Ageing People with Mental Handicap," *Journal of Intellectual Disability Research* 38, no. 3 (1994): 289–98.

[38] Christine de Weger, F. Nienke Boonstra, and Jeroen Goossens, "Differences Between Children with Down Syndrome and Typically Developing Children in Adaptive Behaviour, Executive

effects of vision impairment may be reduced through early recognition and correction (such as glasses), thus surveillance and early recognition is vital as it may "lead to improved developmental and functional outcomes for children with Down syndrome."[39]

Weak muscle tone. Hypotonia, or weak muscle tone, is present in virtually all individuals with DS, and is a contributing factor to the delay of motor development in infants and children with DS.[40] Additionally, hypotonia "affects lip and tongue movements involved in all aspects of speech production," and has been found to contribute to speech intelligibility difficulties in individuals with DS.[41]

Oral-motor structure and function. Hypotonia is only one of several factors which contribute to reduced oral-motor function.[42] Other abnormal oral structures in individuals with DS which may affect speech include "a small oral cavity, a narrow, high

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Functions and Visual Acuity," *Scientific Reports* 11, no. 1 (2021): 10; A. Fyd et al., "632. Early Intervention of Visual Impairment May Protect Adaptive Behaviour in Down Syndrome?," *Archives of Disease in Childhood* 97, no. Suppl 2 (2012): A183.

[39] Stephen et al., "Surveillance of Vision," 515. See also Määttä et al., "Sensory Impairments," 81.

[40] Jeannie Visootsak et al., "Neurodevelopmental Outcomes in Children with Down Syndrome and Congenital Heart Defects," *American Journal of Medical Henetics Part A* 155, no. 11 (2011): 2688; Ira T. Lott, "Neurological Phenotypes for Down Syndrome Across the Life Span," *Progress in Brain Research* 197 (2012): 3.

[41] Stoel-Gammon, "Down Syndrome Phonology," 94; Barbara Dodd and Lynda Thompson, "Speech Disorder in Children with Down's Syndrome," *Journal of Intellectual Disability Research* 45, no. 4 (2001): 309; Leonard Abbeduto, Steven F. Warren, and Frances A. Conners, "Language Development in Down Syndrome: From the Prelinguistic Period to the Acquisition of Literacy," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 249. It should be noted that this connection is clinical, and not supported by experimental data. Shin Ying Chu and Steven M. Barlow, "A Call for Biomechanics to Understand Hypotonia and Speech Movement Disorders in Down Syndrome," *Advances in Communication Disorder* 16, no. 1 (2016): 24–26.

[42] Elizabeth F. Barnes et al., "A Comparison of Oral Structure and Oral-Motor Function in Young Males with Fragile X Syndrome and Down Syndrome," Journal of Speech, Language, and Hearing Research 49 (2006): 904.

arched palate, irregular dentition," and enlarged tonsils and adenoids.[43] Such abnormalities are thought to contribute to "reduced speed, range of motion, and coordination of the articulators," and thus reduced speech intelligibility.[44] Though it was previously thought that individuals with DS had large tongues which resulted in speech difficulties, it seems rather that the reduced size of the oral cavity makes the tongue relatively large in comparison.[45] Boys with DS have been shown to have atypical lips, tongue, and velopharyngeal structure which contributed to reduced oral function, particularly in the movement and control of the lips, tongue, and jaw, as well as reduced speech function.[46]

Sleep disturbances. Individuals with DS are at an increased risk of suffering a variety of sleep disturbances, which can affect their physical, cognitive, behavioral, and linguistic development.[47] Medical complexities experienced by individuals with DS, such as "cardiac complications, airway, pulmonary, and hearing problems, hematologic, autoimmune, oncologic, and musculoskeletal disorders," obesity, and enlarged tonsils,

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[43] Joanne E. Roberts, Johanna Price, and Cheryl Malkin, "Language and Communication Development in Down Syndrome," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 1 (2007): 27; Abbeduto, Warren, and Conners, "Language Development," 249; Barnes et al., "A Comparison of Oral Structure," 904.

[44] Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 3; Roberts, Price, and Malkin, "Language and Communication Development," 27; Abbeduto, Warren, and Conners, "Language Development," 249.

[45] Ray D. Kent and Houri K. Vorperian, "Speech Impairment in Down Syndrome: A Review," *Journal of Speech and Language Hearing Research* 56 no. 1 (2013): 10; Abbeduto, Warren, and Conners, "Language Development," 249.

[46] Barnes et al., "A Comparison of Oral Structure," 912. While these characteristics may be present in girls with DS as well, this study was conducted only on boys.

[47] Elisa Fucà et al., "Characterization of Sleep Disturbances in Children and Adolescents with Down Syndrome and Their Relation with Cognitive and Behavioral Features," *International Journal of Environmental Research and Public Health* 18, no. 9 (2021): 1.

among others, can cause individuals with DS to be more prone to sleep problems.[48] Approximately two-thirds of children with DS suffer from obstructive sleep apnea (OSA).[49] While OSA can affect infants and children of all ages, moderate-to-severe OSA seems to be more prevalent in younger years.[50] In addition to OSA, a high prevalence of other sleep problems such as bedtime resistance, sleep anxiety, night waking, parasomnias, sleep disordered breathing, day-time sleepiness, disorders in initiating and maintaining sleep, disorders of arousal, sleep–wake transition disorders, reduced REM sleep, and increased slow-wave sleep exist among children with DS.[51]

In the DS population, sleep disturbances have been found to be predictive of attention-deficit/hyperactivity problems.[52] Additionally, sleep disturbances have a negative impact on visual-motor integration, externalized behavior (increased irritability/agitation/crying, and noncompliance), internalized behavior (anxiety/depression), the accomplishment of daily activities, communication skills,

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[48] Fucà et al., "Characterization of Sleep Disturbances," 1; Chia-Fan Lee et al., "Prevalence of Obstructive Sleep Apnea in Children with Down Syndrome: A Meta-Analysis," *Journal of Clinical Sleep Medicine* 14, no. 5 (2018): 873; Shervin S. Churchill et al., "Sleep Measurement and Monitoring in Children with Down Syndrome: A Review of the Literature, 1960–2010," *Sleep Medicine Reviews* 16, no. 5 (2012): 2.

[49] Lee et al., "Prevalence of Obstructive Sleep Apnea," 871; Mieke Maris et al., "Prevalence of Obstructive Sleep Apnea in Children with Down Syndrome," *Sleep* 39, no. 3 (2016): 702.

[50] Lee et al., "Prevalence of Obstructive Sleep Apnea," 871–73; Maris et al., "Prevalence of Obstructive Sleep Apnea," 702.

[51] Melanie Carter et al., "Sleep Problems in a Down Syndrome Population," *Archives of Disease in Childhood* 94, no. 4 (2009): 308–10; Fucà et al., "Characterization of Sleep Disturbances," 5; Lauren C. Nisbet et al., "Characterization of a Sleep Architectural Phenotype in Children with Down Syndrome," *Sleep and Breathing* 19, no. 3 (2015): 1065–71; Asaf Levanon, Ariel Tarasiuk, and Asher Tal, "Sleep Characteristics in Children with Down Syndrome," *The Journal of Pediatrics* 134, no. 6 (1999): 755–60.

[52] Igor A. Kelmanson, "Sleep Disturbances, Behavioural Problems and Adaptive Skills in Children with Down's Syndrome," *Early Child Development and Care* 187, no. 11 (2017): 1679–93; Fucà et al., "Characterization of Sleep Disturbances," 9. Contrarily, Ashworth and colleagues did not find a strong relationship between sleep and performance on continuous performance attention tasks in children with DS. Anna Ashworth et al., "The Importance of Sleep: Attentional Problems in School-Aged Children with Down Syndrome and Williams Syndrome," *Behavioral Sleep Medicine* 13, no. 6 (2015): 468.

inhibition, visuoperceptual skills, and cognitive flexibility.[53] Finally, in relation to language, poor sleep has a significant negative effect on expressive language (vocabulary and syntax) in preschoolers with DS and verbal IQ in school-aged children, and contributes to poor verbal fluency in adolescents and young adults.[54]

Cognitive Development

Though many generalities can be made regarding the cognitive phenotype of individuals with DS, vast differences exist among the cognitive profiles of individuals with DS, beginning in infancy and persisting into late adulthood.[55] Differences between the brains of children with DS and TD children are present from birth, or shortly before. While earlier studies indicated that the brain of a newborn with DS is relatively normal, more recent studies indicate that this is not so, with differences in the DS brain emerging as early as 22 weeks gestational age and increasing thereafter, particularly after birth.[56]

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[53] Fucà et al., "Characterization of Sleep Disturbances," 9–10; Shervin S. Churchill et al., "Relationship Between Sleep Disturbance and Functional Outcomes in Daily Life Habits of Children with Down Syndrome," *Sleep* 38, no. 1 (2015): 61–71; Gillian M. Nixon et al., "The Relationship Between Sleep-Disordered Breathing Severity and Daytime Adaptive Functioning in Children with Down Syndrome," *CNS Neuroscience and Therapeutics* 22, no. 11 (2016): 937; C.-C. JJ Chen, G. Spanò, and Jamie O. Edgin, "The Impact of Sleep Disruption on Executive Function in Down Syndrome," *Research in Developmental Disabilities* 34, no. 6 (2013): 2037–38; G. Andreou et al., "Cognitive Status in Down Syndrome Individuals with Sleep Disordered Breathing Deficits (SDB)," *Brain and Cognition* 50, no. 1 (2002): 48; Jennifer Breslin et al., "Obstructive Sleep Apnea Syndrome and Cognition in Down Syndrome," *Developmental Medicine & Child Neurology* 56, no. 7 (2014): 662.

[54] Jamie O. Edgin et al., "Sleep Disturbance and Expressive Language Development in Preschool-age Children with Down Syndrome," *Child Development* 86, no. 6 (2015): 12–13; Breslin et al., "Obstructive Sleep Apnea," 662; Chen, Spanò, and Edgin, "The Impact of Sleep Disruption," 2036–37.

[55] Karmiloff-Smith et al., "The Importance of Understanding Individual Differences," 5; Michael S. C. Thomas et al., "A Multi-Level Developmental Approach to Exploring Individual Differences in Down Syndrome: Genes, Brain, Behaviour, and Environment," *Research in Developmental Disabilities* 104 (2020): 3; R. Tsao and C. Kindelberger, "Variability of Cognitive Development in Children with Down Syndrome: Relevance of Good Reasons for Using the Cluster Procedure," *Research in Developmental Disabilities* 30, no. 3 (2009): 431–32.

[56] Karmiloff-Smith et al., "The Importance of Understanding Individual Differences," 4–5; Lynn Nadel, "Down's Syndrome: A Genetic Disorder in Biobehavioral Perspective," *Genes, Brain and Behavior* 2, no. 3 (2003): 158; For studies indicating that the brains of babies with DS are nearly indistinguishable from TD babies, see Osnat Bar-Peled et al., "Developmental Pattern of Muscarinic

These often-subtle early brain differences contribute to cognitive impairment in children with DS.[57]

Unlike the considerable variability of the presence of phenotypic physical features and physical impairments, cognitive impairment is present in all individuals with DS.[58] Despite the nearly universal presence of cognitive impairment in individuals with DS, cognitive ability among individuals with DS varies significantly, ranging from mild to profound impairment.[59] While the average IQ of individuals with DS is 50, IQs range

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Receptors in Normal and Down's Syndrome Fetal Brain—An Autoradiographic Study," *Neuroscience Letters* 133, no. 2 (1991): 154–58; B. W. L. Brooksbank, D. Walker, and R. Balazs, "Neuronal Maturation in the Foetal Brain in Down's Syndrome," *Early Human Development* 18, no. 4 (1989): 237–46; K. E. Wisniewski and B. Schmidt-Sidor, "Postnatal Delay of Myelin Formation in Brains from Down Syndrome Infants and Children," *Clinical Neuropathology* 8, no. 2 (1989): 55–62. For research providing evidence that prenatal brains differ, see Prachi A. Patkee et al., "Neurometabolite Mapping Highlights Elevated Myo-Inositol Profiles within the Developing Brain in Down Syndrome," *Neurobiology of Disease* 153 (2021): 1–10; Prachi A. Patkee et al., "Early Alterations in Cortical and Cerebellar Regional Brain Growth in Down Syndrome: An *in vivo* Fetal and Neonatal MRI Assessment," *NeuroImage: Clinical* 25 (2020): 1–11; Makiko Imai et al., "Functional Connectivity of the Cortex of Term and Preterm Infants and Infants with Down's Syndrome," *Neuroimage* 85 (2014): 272–78; J. A. Golden and B. T. Hyman, "Development of the Superior Temporal Neocortex Is Anomalous in Trisomy 21," *Journal of Neuropathology and Experimental Neurology* 53, no. 5 (1994): 513–20; Krystyna E. Wisniewski and Elizabeth Kida, "Abnormal Neurogenesis and Synaptogenesis in Down Syndrome Brain," *Developmental Brain Dysfunction* 7, no. 6 (1994): 289–301; B. Schmidt-Sidor et al., "Brain Growth in Down Syndrome Subjects 15 to 22 Weeks of Gestational Age and Birth to 60 Months," *Clinical Neuropathology* 9, no. 4 (1990): 181–90; K. E. Wisniewski, "Down Syndrome Children Often Have Brain with Maturation Delay, Retardation of Growth, and Cortical Dysgenesis," *American Journal of Medical Genetics* 37, no. S7 (1990): 274–81; Jesús Flórez et al., "Autoradiographic Studies of Neurotransmitter Receptors in the Brain of Newborn Infants with Down Syndrome," *American Journal of Medical Genetics* 37, no. S7 (1990): 301–305.

[57] Ephrem Engidawork and Gert Lubec, "Molecular Changes in Fetal Down Syndrome Brain," *Journal of Neurochemistry* 84, no. 5 (2003): 895–904; Robert E. Mrak and W. Sue T. Griffin, "Trisomy 21 and the Brain," *Journal of Neuropathology & Experimental Neurology* 63, no. 7 (2004): 679–85.

[58] Julie R. Korenberg et al., "Down Syndrome Phenotypes," 4998; Jones, Jones, and del Campo Casanelles, *Smith's Recognizable Patterns*, 3; Mohammed Rachidi and Carmela Lopes, "Mental Retardation in Down Syndrome: From Gene Dosage Imbalance to Molecular and Cellular Mechanisms," *Neuroscience Research* 59, no. 4 (2007): 350. Though the vast majority of the literature identifies cognitive impairment as a characteristic present in all individuals with DS, there have been reports of a few individuals with DS with an IQ within the normal range. C. J. Epstein, "Down Syndrome," I:293.

[59] Tuomo Määttä et al., "Mental Health, Behaviour and Intellectual Abilities of People with Down Syndrome," *Down Syndrome Research and Practice* 11, no. 1 (2006): 39. See John E. Rynders,

from 30 to 70.[60] Mental age (MA), the mean intellectual performance of a given age, does not typically exceed 7 or 8 years of age in individuals with DS.[61]

Similar to physical development, the cognitive development of children with DS follows the same sequence as that of TD children, though occurring at widely varying rates.[62] In contrast to TD individuals, the IQ of individuals with DS progressively

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"Promoting the Educational Competence of Students with Down Syndrome," in *Down Syndrome: A Review of Current Knowledge*, ed. Jean A. Rondal, Juan Perera, and Lynn Nadel (London: Whurr, 1999), 70, for an overview of IQ scores and levels of mental retardation across various studies.

[60] Robin S. Chapman and Linda J. Hesketh, "Behavioral Phenotype of Individuals with Down Syndrome," *Mental Retardation & Developmental Disabilities Research Reviews* 6, no. 2 (2000): 87; Julie Grieco et al., "Down Syndrome: Cognitive and Behavioral Functioning across the Lifespan," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 169, no. 2 (2015): 136; Andrea Contestabile, Fabio Benfenati, and Laura Gasparini, "Communication Breaks-Down: from Neurodevelopment Defects to Cognitive Disabilities in Down Syndrome," *Progress in Neurobiology* 91, no. 1 (2010): 2. A slightly different average (44.7), and broader range (28 to 71) was reported by Stefano Vicari and colleagues in their study of fifty-six Italian individuals with DS, Stefano Vicari et al., "Neuropsychological Profile of Italians with Williams Syndrome: An Example of a Dissociation between Language and Cognition?," *Journal of the International Neuropsychological Society* 10, no. 6 (2004): 865. Additionally, Floriana Costanza and colleagues reported individuals with DS with an IQ as high as 83. Floriana Costanzo et al., "Executive Functions in Intellectual Disabilities: A Comparison between Williams Syndrome and Down Syndrome," *Research in Developmental Disabilities* 34, no. 5 (2013): 1772. While such variations may be due in part to differing measurement of IQ, these deviations from the recognized range of IQ in individuals with DS reinforces the vast variability of cognitive abilities in individuals with DS.

[61] For the definition of mental age see Grieco et al., "Down Syndrome," 19. For information on the mean age of individuals with DS see David Gibson, *Down's Syndrome: The Psychology of Mongolism* (Cambridge: Cambridge University Press, 1978), 46; Stefano Vicari, "Motor Development and Neuropsychological Patterns in Persons with Down Syndrome," *Behavior Genetics* 36, no. 3 (2006): 356; Bruce F. Pennington et al., "The Neuropsychology of Down Syndrome: Evidence for Hippocampal Dysfunction," *Child Development* 74, no. 1 (2003): 77.

[62] Chapman and Hesketh, "Behavioral Phenotype," 87; Dante Cicchetti and Marjorie Beeghly, *Symbolic Development in Atypical Children*, New Directions for Child Development, No. 36 (San Francisco: Jossey-Bass, 1987), 6. Typically, children with DS take about twice as long to gain a month in MA, so that one month in MA takes two chronological months to reach. Penny Hauser-Cram et al., *Children with Disabilities: A Longitudinal Study of Child Development and Parent Well-Being*, Monographs of the Society for Research in Child Development (Boston: Blackwell, 2001), 81; Robert B. Reed et al., "Interrelationships of Biological, Environmental and Competency Variables in Young Children with Down Syndrome," *Applied Research in Mental Retardation* 1, no. 3 (1980): 165–66. Though the trajectory of cognitive development in children with DS seems to follow the same pattern as that of TD developing children, there is emerging evidence that the DS brain may actually have an atypical neural trajectory. Taralee Hamner et al., "Pediatric Brain Development in Down Syndrome: A Field in its Infancy," *Journal of the International Neuropsychological Society* 24, no. 9 (2018): 10.

decreases with age, though not all domains of cognition are equally affected by this decline.[63] As opposed to TD children, the rate of development of children with DS slows over time. This deceleration of intellectual growth begins in infancy, slowing noticeably after the first year.[64] The progressive decrease in IQ, then, is caused not by a loss of skills, but rather a slowing of the rate of development in comparison to TD children.[65] As the rate of their development lags behind that of their TD peers, children with DS assume a gradual decline in MA relative to their chronological age (CA) overtime.[66] Though the IQ measurement declines, raw scores continue to increase throughout childhood and into

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[63] Pennington et al., "The Neuropsychology of Down Syndrome," 77; Vicari et al., "Neuropsychological Profile of Italians," 870; Vicari, "Motor Development and Neuropsychological Patterns," 356; Tess Patterson, Charlene M. Rapsey, and Paul Glue, "Systematic Review of Cognitive Development across Childhood in Down Syndrome: Implications for Treatment Interventions," *Journal of Intellectual Disability Research* 57, no. 4 (2013): 309–10; Janet Carr, "Six Weeks to 45 Years: A Longitudinal Study of a Population with Down Syndrome," *Journal of Applied Research in Intellectual Disabilities* 25, no. 5 (2012): 416. Marian Sigman and Ellen Ruskin, "Continuity and Change in the Social Competence of Children with Autism, Down Syndrome, and Developmental Delays," *Monographs of the Society for Research in Child Development* 64, no. 1 (1999): 25–28; Pennington and colleagues found that the dysfunction in the DS brain is primarily hippocampal dysfunction rather than prefrontal dysfunction, or generalized dysfunction. They found no decline with age for prefrontal functions. Pennington et al., "The Neuropsychology of Down Syndrome," 89–90.

[64] Hodapp and Zigler, "Applying the Developmental Perspective," 16; Marchal et al., "Growing up with Down Syndrome," 442; John Corbitt, "Is Down Syndrome a Progressive Syndrome?," *Journal of the Royal Society of Medicine* 78 (1985): 499–502; M. J. Dicks-Mireaux, "Mental Development of Infants with Down's Syndrome," *American Journal of Mental Deficiency* 77, no. 1 (1972): 26–32; Lawrence E. Dameron, "Development of Intelligence of Infants with Mongolism," *Child Development* 34, no. 3 (1963): 733–38.

[65] Hauser-Cram et al., *Children with Disabilities*, 7; Donna Couzens, Monica Cuskelly, and Michele Haynes, "Cognitive Development and Down Syndrome: Age-Related Change on the Stanford-Binet Test," *American Journal on Intellectual and Developmental Disabilities* 116, no. 3 (2011): 182. For an overview of the range and trajectory of intellectual development in children with DS see Robert M. Hodapp, David W. Evans, and F. Lee Gray, "Intellectual Development in Children with Down Syndrome," in Rondal, Perera, and Nadel, *Down Syndrome: A Review of Current Knowledge*, 124–32.

[66] Robert M. Hodapp and Edward Zigler, "Applying the Developmental Perspective to Individuals with Down Syndrome," in *Children with Down Syndrome: A Developmental Perspective*, ed. Dante Cicchetti and Marjorie Beeghly (New York: Cambridge University Press, 1990), 16.

adolescence.[67] However, by early adulthood individuals with DS generally begin to experience a downward trajectory in raw score on many measurements.[68]

Intellectual decline of individuals with DS continues into adulthood and for many is exacerbated by early-onset Alzheimer's.[69] Individuals with DS are at an increased risk of developing Alzheimer's, which typically develops two to three decades earlier in individuals with DS than when compared to the general population.[70] By the age of forty nearly all individuals with DS present neuropathological markers associated with Alzheimer's, and by the age of 65, as many as 80 percent of individuals with DS may develop dementia.[71] In addition to memory loss, Alzheimer's in individuals with DS

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[67] Patterson, Rapset, and Glue, "Systematic Review of Cognitive Development," 311; Couzens, Cuskelly, and Haynes, "Cognitive Development and Down Syndrome," 181–204; Lynette V. Roberts and Jenny L. Richmond, "Preschoolers with Down Syndrome Do Not Yet Show the Learning and Memory Impairments Seen in Adults with Down Syndrome," *Developmental Science* 18, no. 3 (2015): 4055; Tsao and Kindelberger, "Variability of Cognitive Development," 427–28. Though the general trend is for scores to increase into adolescence and early adulthood, Tsao and Kindelberger found that many children stagnated on most measurements by the age of ten or eleven. Tsao and Kindelberger, "Variability of Cognitive Development," 431.

[68] Couzens, Cuskelly, and Haynes, "Cognitive Development and Down Syndrome," 196–99.

[69] Alick Bush and Nigel Beail, "Risk Factors for Dementia in People with Down Syndrome: Issues in Assessment and Diagnosis," *American Journal on Mental Retardation* 109, no. 2 (2004): 90–92; Frank R. Brown et al., "Intellectual and Adaptive Functioning in Individuals with Down Syndrome in Relation to Age and Environmental Placement," *Pediatrics* 85, no. 3 (1990): 450–52; D. A. Devenny et al., "Sequence of Cognitive Decline in Dementia in Adults with Down's Syndrome," *Journal of Intellectual Disability Research* 44, no. 6 (2000): 654–65; Mary Godfrey and Nancy Raitano Lee, "Memory Profiles in Down Syndrome across Development: A Review of Memory Abilities through the Lifespan," *Journal of Neurodevelopmental Disorders* 10, no. 1 (2018): 2; Grieco et al., "Down Syndrome," 136. It should be noted, however, that not all adults with DS experience a marked decline in cognition. Chris Oliver et al., "A Four Year Prospective Study of Age-Related Cognitive Change in Adults with Down's Syndrome," *Psychological Medicine* 28, no. 6 (1998): 1375. Carr's study showed mixed results, with a relatively stable, though not significant decline, in the IQ of adults with DS, though a much sharper decline for those with Alzheimer's. Carr, "Six Weeks to 45 Years," 414–22.

[70] Frances K. Wiseman et al., "A Genetic Cause of Alzheimer Disease: Mechanistic Insights from Down Syndrome," *Nature Reviews Neuroscience* 16, no. 9 (2015): 3; Clive Ballard et al., "Dementia in Down's Syndrome," *The Lancet Neurology* 15, no. 6 (2016): 622–36; K. E. Wisniewski, H. M. Wisniewski, and G. Y. Wen, "Occurrence of Neuropathological Changes and Dementia of Alzheimer's Disease in Down's Syndrome," *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society* 17, no. 3 (1985): 278–82.

[71] Ira T. Lott and Elizabeth Head, "Alzheimer Disease and Down Syndrome: Factors in

causes a marked decline in adaptive behavior, visuospatial organization, verbal abilities, new learning abilities, and changes in personality and behavior.[72]

Short-term and working memory. Short-term memory and working memory have traditionally been viewed as two distinct, though possibly interrelated constructs, with short-term memory referring to simple temporary storage of information while working memory involves the short-term capacity to maintain and manipulate information.[73] Verbal short-term memory is generally measured by immediate serial recall tasks such as the forward digit span or nonword repetition, while verbal working memory is often measured by more complex tasks that require manipulating information, such as a backward the digit span in which one must "(recall) lists of digits in the reverse

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Pathogenesis," *Neurobiology of Aging* 26, no. 3 (2005): 383–89; M. McCarron et al., "A Prospective 14-year Longitudinal Follow-up of Dementia in Persons with Down Syndrome," *Journal of Intellectual Disability Research* 58, no. 1 (2014): 4; Wiseman et al., "A Genetic Cause of Alzheimer Disease," 3. The actual percentage of individuals who develop dementia is extremely challenging to quantify, and percentages vary widely, due in part to the experimental design variation and in part to the many overlapping features of Alzheimer's and DS. Contestabile, Benfaniti, and Gasparini, "Communication Breaks-Down," 3; Bush and Beail, "Risk Factors for Dementia," 89–90.

[72] For memory loss see S. J. Krinsky-McHale, D. A. Devenny, and W. P. Silverman, "Changes in Explicit Memory Associated with Early Dementia in Adults with Down's Syndrome," *Journal of Intellectual Disability Research* 46, no. 3 (2002): 198–208; Oliver et al., "A Four Year Prospective," 1365–77. For adaptive behavior see Warren B. Zigman et al., "Incidence and Temporal Patterns of Adaptive Behavior Change in Adults with Mental Retardation," *American Journal on Mental Retardation* 107, no. 3 (2002): 169. For visuospatial organization and verbal abilities see Devenny et al., "Sequence of Cognitive Decline," 661–62. For learning see Oliver et al., "A Four Year Prospective," 1365–77. For personality and behavior see Sarah L. Ballet al., "Executive Dysfunction and its Association with Personality and Behaviour Changes in the Development of Alzheimer's Disease in Adults with Down Syndrome and Mild to Moderate Learning Disabilities," *British Journal of Clinical Psychology* 47, no. 1 (2008): 1–29, and Sarah L. Ball et al., "Personality and Behaviour Changes Mark the Early Stages of Alzheimer's Disease in Adults with Down's Syndrome: Findings from a Prospective Population-Based Study," *International Journal of Geriatric Psychiatry: A Journal of the Psychiatry of Late Life and Allied Sciences* 21, no. 7 (2006): 661–73.

[73] Alan Baddeley and Christopher Jarrold, "Working Memory and Down Syndrome," *Journal of Intellectual Disability Research* 51, no. 12 (2007): 925; Bart Aben, Sven Stapert, and Arjan Blokland, "About the Distinction between Working Memory and Short-Term Memory," *Frontiers in Psychology* 3 (2012): 1; Christopher Jarrold and Alan Baddeley, "Short-Term Memory in Down Syndrome: Applying the Working Memory Model," *Down Syndrome Research and Practice* 7, no. 1 (2001): 17.

order of presentation," among many other tasks.[74] However, the constructs are not as clear-cut as they may seem, and are often used ambiguously in research.[75] Though much research treats short-term memory and working memory as two separate constructs, they are here considered together, since this is a very broad overview of memory in the DS population.[76]

Short-term and working memory are foundational for thinking and learning.[77] Individuals with DS have deficits in working memory, though not all parts of working memory are equally impaired.[78] Of particular interest in the DS population are verbal (phonological) memory and visuospatial memory. Verbal memory is controlled by the phonological loop which is hypothesized to "maintain and manipulate speech-based material," while visuospatial memory, controlled by the visuospatial sketchpad, is the ability to "(hold) and (manipulate) visual and spatial information."[79] Individuals with DS have clear deficits in both verbal working memory and verbal short-term memory

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[74] Catherine Demoulin and Régine Kolinsky, "Does Learning to Read Shape Verbal Working Memory?," *Psychonomic Bulletin and Review* 23, no. 3 (2016): 704.

[75] Aben and colleagues offer a helpful review of the use of the two constructs and the ambiguity of their use in research. Aben, Stapert, and Blokland, "About the Distinction," 1–9.

[76] For a similar approach see Demoulin and Kolinsky, "Does Learning to Read Shape Verbal Working Memory?," 704.

[77] Nelson Cowan et al., "On the Capacity of Attention: Its Estimation and its Role in Working Memory and Cognitive Aptitudes." *Cognitive Psychology* 51, no. 1 (2005): 1–2; Jarrold and Baddeley, "Short-Term Memory," 19; Baddeley and Jarrold, "Working Memory," 925.

[78] Renata Nacinovich et al., "Cognitive Development and Adaptive Functions in Children with Down Syndrome at Different Developmental Stages," *Journal of Psychopathology Online First* (March 2021): 5; Stefano Vicari and Giovanni Augusto Carlesimo, "Short-Term Memory Deficits Are Not Uniform in Down and Williams Syndromes," *Neuropsychology Review* 16, no. 2 (2006): 87–94; S. Vicari, A. Carlesimo, and C. Caltagirone, "Short-Term Memory in Persons with Intellectual Disabilities and Down's Syndrome," *Journal of Intellectual Disability Research* 39, no. 6 (1995): 532–37. For a thorough review of the literature see Baddeley and Jarrold, "Working Memory," 925–31.

[79] Baddeley and Jarrold, "Working Memory," 925–26. The phonological loop also has the capacity "to convert a visual stimulus, such as a printed word, into a phonological representation by subvocal naming" (926).

(VSTM).[80] Such a deficit means that the ability for individuals with DS to successfully recall spoken information is impaired, often measured by asking participants to recall a series of digits presented to them verbally.[81] This impairment of verbal working memory seems to be a unique feature of DS associated with the phonological loop, for when compared to several varieties of control groups on VSTM tasks, individuals with DS consistently perform lower than the control group.[82]

Despite the challenges individuals with DS face in many areas of cognition and memory, the visuospatial component of short-term memory is relatively well-preserved

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[80] Nacinovich et al., "Cognitive Development," 5; S. Lanfranchi et al., "Working Memory in Down Syndrome: Is There a Dual Task Deficit?," *Journal of Intellectual Disability Research* 56, no. 2 (2012): 162–63; Rachel F. Hick, Nicola Botting, and Gina Conti-Ramsden, "Short-Term Memory and Vocabulary Development in Children with Down Syndrome and Children with Specific Language Impairment," *Developmental Medicine and Child Neurology* 47, no. 8 (2005): 536; Glynis Laws, "Working Memory in Children and Adolescents with Down Syndrome: Evidence from a Colour Memory Experiment," *Journal of Child Psychology and Psychiatry* 43, no. 3 (2002): 353–64; Christopher Jarrold, Alan D. Baddeley, and Caroline E. Phillips, "Verbal Short-Term Memory in Down Syndrome: A Problem of Memory, Audition, or Speech?," *Journal of Speech, Language, and Hearing Research* 45 (2002): 531–44.

[81] This method of assessment is called digit span. When assessed using digit span, participants with DS consistently perform lower than developmentally matched peers. Baddeley and Jarrold, "Working Memory," 927. For example, see Elizabeth Kay-Raining Bird and Robin S. Chapman, "Sequential Recall in Individuals with Down Syndrome," *Journal of Speech and Hearing Research* 37, no. 6 (1994): 1369–80; Hye-Kyeung Seung and Robin Chapman, "Digit Span in Individuals with Down Syndrome and in Typically Developing Children: Temporal Aspects," *Journal of Speech, Language, and Hearing Research* 43, no. 3 (2000): 609–20. Similar results have been found when assessing children with DS using word length experiments and sentence length experiments. K. Kanno and Y. Ikeda, "Word-Length Effect in Verbal Short-Term Memory in Individuals with Down's Syndrome," *Journal of Intellectual Disability Research* 46, no. 8 (2002): 613–18; H.-K. Seung and R. Chapman, "Sentence Memory of Individuals with Down's Syndrome and Typically Developing Children," *Journal of Intellectual Disability Research* 48, no. 2 (2004): 160–71.

[82] Baddeley and Jarrold, "Working Memory," 928; Jarrold and Baddeley, "Short-Term Memory," 18–19; Robin Chapman, "Language Learning in Down Syndrome: The Speech and Language Profile Compared to Adolescents with Cognitive Impairment of Unknown Origin," *Down Syndrome Research and Practice* 10, no. 2 (2006): 63. Though an impairment in the phonological loop is the prevailing hypothesis for the underlying cause of a VSTM deficit in individuals with DS, Vicari and colleagues found no evidence of impairment of the phonological loop and instead propose an impairment of central-executive functioning as the underlying cause of impaired VSTM. S. Vicari, L. Marotta, and G. A. Carlesimo, "Verbal Short-Term Memory in Down's Syndrome: An Articulatory Loop Deficit?," *Journal of Intellectual Disability Research* 48, no. 2 (2004): 80–92.

and is generally perceived as an area of strength for individuals with DS.[83] Thus, individuals with DS can generally recall information presented to them visually better than information presented auditorily. For example when someone "taps out a series of different special locations on a board," individuals with DS can successfully recall the pattern.[84] When presented with a single visuospatial task, children with DS can perform on par with or even above their developmentally matched peers.[85] However, when presented with a dual task (two tasks involving visuospatial processing, or a visuospatial task combined with a task which requires verbal processing), children with DS perform significantly below their peers on both tasks. This suggests that children with DS have a dual deficit in working memory: the phonological loop (as previously discussed), and a central executive impairment, which inhibits successful dual task performance.[86] Thus, though the visuospatial component is a strength for individuals with DS, when faced with multiple simultaneous tasks, children with DS do not seem to benefit from this strength.

The relationship between working memory and language development is somewhat ambiguous, though a growing body of evidence suggests that impairments in

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[83] Nacinovich et al., "Cognitive Development," 5; Jarrold and Baddeley, "Short-Term Memory," 18.

[84] This type of assessment is called a Corsi span task. Jarrold and Baddeley, "Short-Term Memory," 18.

[85] Lanfranchi et al., "Working Memory," 162–63; Hick, Botthing, and Conti-Ramsden, "Short-Term Memory," 536. Laws found that children with DS scored significantly higher on a Corsi span task than did their control group matched for receptive vocabulary scores. She also found, however, that children with DS do not possess an advantage for color memory. Laws, "Working Memory," 358–62; Vicari and colleagues found this to be true for forward span tasks, though not backward span tasks. Vicari, Carlesimo, and Caltagirone, "Short-Term Memory," 532–37.

[86] Lanfranchi et al., "Working Memory," 162–64. Vicari and colleagues also suggest a central executive impairment which affects short-term memory, evidenced by a severe deficit for children with DS to perform backward spans. Vicari, Carlesimo, and Caltagirone, "Short-Term Memory," 532–37. Roberts and Richmond found that this deficit in memory and executive function is not found in pre-schoolers, suggesting that it develops as children with DS age. Roberts and Richmond, "Preschoolers with Down Syndrome," 404–19.

VSTM negatively affects language development in children with DS.[87] Deficits in VSTM reduce sentence comprehension, especially as length and grammatical complexity increase.[88] Phonological memory is a significant predictor of vocabulary acquisition, and to a lesser extent, grammar comprehension (especially in the younger years).[89] Phonological memory not only contributes to receptive language, but contributes significantly to expressive language skills as well.[90] Additionally, it seems the

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[87] For evidence of no relationship between VSTM (as measured by digit span) and language development see Christopher Jarrold and Alan D. Baddeley, "Short-Term Memory for Verbal and Visuospatial Information in Down's Syndrome," *Cognitive Neuropsychiatry* 2, no. 2 (1997): 112; Michael M. Marcell, Pamela S. Croen, and David H. Sewell, "Language Comprehension in Down Syndrome and Other Trainable Mentally Handicapped Individuals" (paper presented at the biennial Conference on Human Development, Richmond, VA, March 29–31, 1990). Laws also found no relationship between digit span measures and language development, though she did find evidence of a link between vocabulary and verbal short-term memory as measured by nonword repetition. Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology and Psychiatry and Allied Disciplines* 39, no. 8 (1998): 1119–30. Mosse and Jarrold found that deficits in VSTM did not impair novel word-learning in children with DS. Emma K. Mosse and Christopher Jarrold, "Evidence for Preserved Novel Word Learning in Down Syndrome Suggests Multiple Routes to Vocabulary Acquisition," *Journal of Speech, Language and Hearing Research* 54, no. 4 (2011): 1137–52. Kari-Anne B. Næss and colleagues found no evidence of a longitudinal predictive relationship between VSTM and vocabulary development. Kari-Anne B. Næss et al., "Longitudinal Relationships between Language and Verbal Short-Term Memory Skills in Children with Down Syndrome," *Journal of Experimental Child Psychology* 135 (2015): 52.

[88] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185; Bernadette Witecy and Martina Penke, "Language Comprehension in Children, Adolescents, and Adults with Down Syndrome," *Research in Developmental Disabilities* 62 (2017): 193.

[89] Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 326–37; Steve Majerus and Koviljka Barisnikov, "Verbal Short-Term Memory Shows a Specific Association with Receptive but Not Productive Vocabulary Measures in Down Syndrome," *Journal of Intellectual Disability Research* 62, no. 1 (2018): 10–20; Jarrold, Baddeley, and Phillips, "Verbal Short-Term Memory," 531–44; Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down Syndrome: Hierarchical Linear Modeling," *Journal of Speech, Language, and Hearing Research* 45 (2002): 902–15; Robin S. Chapman and Linda J. Hesketh, "Language, Cognition, and Short-Term Memory in Individuals with Down Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 3–4.

[90] Glynis Laws, "Contributions of Phonological Memory, Language Comprehension and Hearing to the Expressive Language of Adolescents and Young Adults with Down Syndrome," *Journal of Child Psychology and Psychiatry* 45, no. 6 (2004): 1085–95; Glynis Laws and Dorothy V. M. Bishop, "A Comparison of Language Abilities in Adolescents with Down Syndrome and Children with Specific Language Impairment," *Journal of Speech, Language, and Hearing Research* 46 (2003): 1334; Robin and Hesketh, "Language, Cognition, and Short-Term Memory," 3–4; Rachel Fiona Hick, "Language and

relationship between language and verbal short-term memory in individuals with DS is to some extent reciprocal. Vocabulary levels are a predictor of later phonological memory skills in children with DS with higher vocabulary levels, and language impairment in individuals with DS contributes to difficulties in some verbal-memory tasks.[91] Despite these difficulties, it is possible that in some tasks, such as word identification (reading), individuals with DS are able to draw upon their visuospatial skills to compensate for their deficit in verbal-memory skills.[92]

Long-term memory. Long-term memory is "the process of storing information that can be retrieved for use in minutes, hours, or years later."[93] Individuals with DS exhibit deficits in long-term memory throughout their lifespan, generally performing below TD peers matched on MA.[94] However, not all domains of long-term memory are equally impaired in individuals with DS. For example, Vicari and colleagues found that individuals with DS have a less preserved visual-object memory than visual-spatial memory.[95] Additionally, individuals with DS seem to have much better implicit

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Memory Development in Children with Down Syndrome and Specific Language Impairment" (PhD diss., University of Manchester, 2003), 156–57; Yolanda D. Keller-Bell, "Linguistic Processing in Children with Down Syndrome" (PhD diss., Ohio State University, 2000), 80.

[91] "Higher vocabulary levels" refers to a vocabulary age over five years. Laws and Gunn, "Phonological Memory," 334; Jon Brock and Christopher Jarrold, "Language Influences on Verbal Short-Term Memory Performance in Down Syndrome: Item and Order Recognition," *Journal of Speech, Language & Hearing Research* 47, no. 6 (2004): 1334–46.

[92] Deborah J. Fidler, David E. Most, and Mark M. Guiberson, "Neuropsychological Correlates of Word Identification in Down Syndrome," *Research in Developmental Disabilities* 26, no. 5 (2005): 487–501.

[93] Godfrey and Raitano Lee, "Memory Profiles," 5.

[94] Godfrey and Raitano Lee, "Memory Profiles," 6; Pennington et al., "The Neuropsychology of Down Syndrome," 75–93.

[95] Stefano Vicari, Samantha Bellucci, and Giovanni Augusto Carlesimo, "Visual and Spatial Long-Term Memory: Differential Pattern of Impairments in Williams and Down Syndromes," *Developmental Medicine and Child Neurology* 47, no. 5 (2005): 305–11. Visual-object memory refers to an object's physical characteristics while visual-spatial memory refers to an object's "position or motion in

long-term memory skills than explicit.[96] Most markedly, individuals with DS have deficits in verbal long-term memory, and consistently score below MA-matched TD peers and individuals with various intellectual disabilities.[97] Deficits in long-term memory may affect some aspects of language development, such that deficits in phonotactic knowledge contribute to reduced sentence comprehension.[98]

Social/Emotional Behavior and Development

Individuals with DS are generally thought to be sociable and happy, and have been described as "charming," "affectionate," "outgoing," and "cheerful."[99] From infancy and continuing into school-aged years, children with DS demonstrate signs of sociability and social competence.[100] Despite some qualitative differences in social and emotional

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space" (305).

[96] Vicari, "Motor Development and Neuropsychological Patterns," 360–61; Giovanni A. Carlesimo, Luigi Marotta, and Stefano Vicari, "Long-Term Memory in Mental Retardation: Evidence for a Specific Impairment in Subjects with Down's Syndrome," *Neuropsychologia* 35, no. 1 (1997): 71–79.

[97] For MA-matched peers see Pennington et al., "The Neuropsychology of Down Syndrome," 75–93; Carlesimo, Marotta, and Vicari, "Long-Term Memory in Mental Retardation," 71–79; Sharon Nichols et al., "Mechanisms of Verbal Memory Impairment in Four Neurodevelopmental Disorders," *Brain and Language* 88, no. 2 (2004): 180–89. For individuals with intellectual disabilities see Carlesimo, Marotta, and Vicari, "Long-Term Memory in Mental Retardation," 71–79; F. Munir, Kim M. Cornish, and J. Wilding, "Nature of the Working Memory Deficit in Fragile-X Syndrome," *Brain and Cognition* 44, no. 3 (2000): 387–401; Sarah N. Mattson and Edward P. Riley, "Implicit and Explicit Memory Functioning in Children with Heavy Prenatal Alcohol Exposure," *Journal of the International Neuropsychological Society* 5, no. 5 (1999): 462–71. However, Jarrold and colleagues found that individuals with DS do not have marked deficits in verbal long-term memory, but rather visual long-term memory. Christopher Jarrold, Alan D. Baddeley, and Caroline Phillips, "Long-Term Memory for Verbal and Visual Information in Down Syndrome and Williams Syndrome: Performance on the Doors and People Test," *Cortex* 43, no. 2 (2007): 233–47.

[98] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185.

[99] Grieco et al., "Down Syndrome," 140; Deborah Fidler, David Most, and Amy Philofsky, "The Down Syndrome Behavioural Phenotype: Taking a Developmental Approach," *Down Syndrome Research and Practice* (2008): 38; Elisabeth M. Dykens, "Psychiatric and Behavioral Disorders in Persons with Down Syndrome," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 276.

[100] Grieco et al., "Down Syndrome," 140; Fidler, Most, and Philofsky, "The Down Syndrome

development, children with DS seem to develop many of the same social skills as TD developing children, though sometimes to a lesser extent.[101] Social development is a relative strength for individuals with DS, and they may often use it to compensate for other weaknesses, especially when presented with tasks which are more cognitively challenging.[102] However, this tactic of resorting to social skills when presented with difficult tasks may result in avoidance of completion of cognitively challenging tasks.[103]

Maladaptive behavior. Despite many positive characteristics, children with DS display a higher number of maladaptive social and emotional behaviors than do their

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Behavioural Phenotype," 38; Infants with DS tend to exhibit a higher level of approach behaviors than TD infants. Candace F. Zickler, Judy D. Morrow, and Marilyn J. Bull, "Infants with Down Syndrome: A Look at Temperament," *Journal of Pediatric Health Care* 12, no. 3 (1998): 111–17. Gartsetein and colleagues found higher levels of cuddliness/affiliation in infants with DS relative to TD peers. Maria A. Gartstein, Julia Marmion, and Heather L. Swanson, "Infant Temperament: An Evaluation of Children with Down Syndrome," *Journal of Reproductive and Infant Psychology* 24, no. 1 (2006): 39. Though school-aged children with DS show some signs of asocial behaviors when compared with TD peers, they are able to form healthy friendships and relationships in the classroom, similar to TD children matched on MA. Michael J. Guralnick, Robert T. Connor, and L. Clark Johnson, "The Peer Social Networks of Young Children with Down Syndrome in Classroom Programmes," *Journal of Applied Research in Intellectual Disabilities* 24, no. 4 (2011): 319–20; Stephanny F. N. Freeman and Connie Kasari, "Characteristics and Qualities of the Play Dates of Children with Down Syndrome: Emerging or True Friendships?," *American Journal on Mental Retardation* 107, no. 1 (2002): 16–31.

[101] Grieco et al., "Down Syndrome," 140; Zickler, Morrow, and Bull, "Infants with Down Syndrome," 111–17; Koviljka Barisnikov and Fleur Lejeune found that children with DS have lesser developed social knowledge and social reasoning skills than their TD peers. Koviljka Barisnikov and Fleur Lejeune, "Social Knowledge and Social Reasoning Abilities in a Neurotypical Population and in Children with Down Syndrome," *PLoS ONE* 13, no. 7 (July 20, 2018): 12–13.

[102] Fidler, Most, and Philofsky, "The Down Syndrome Behavioural Phenotype," 38; Dykens, "Psychiatric and Behavioral Disorders," 276; Grieco et al., "Down Syndrome," 140; Deborah J. Fidler, and Lynn Nadel, "Education and Children with Down Syndrome: Neuroscience, Development, and Intervention," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 266–67; Deborah J. Fidler, "The Emerging Down Syndrome Behavioral Phenotype in Early Childhood: Implications for Practice," *Infants and Young Children* 18, no. 2 (2005): 90–91.

[103] Grieco et al., "Down Syndrome," 140; Fidler, Most, and Philofsky, "The Down Syndrome Behavioural Phenotype," 38; Connie Kasari and Stephanny F. N. Freeman, "Task-Related Social Behavior in Children with Down Syndrome," *American Journal on Mental Retardation* 106, no. 3 (2001): 261–63; T. K. Pitcairn and Jennifer G. Wishart, "Reactions of Young Children with Down's Syndrome to an Impossible Task," *British Journal of Developmental Psychology* 12, no. 4 (1994): 485–89.

TD peers.[104] Though individuals with DS display a larger number of psychiatric and behavioral issues than the normal population, the prevalence of such issues among the DS population seems to be lower than among other cognitively impaired populations.[105] Problematic behaviors, present in both boys and girls, can be manifested externally or internally. Externalized behaviors are most prominent in childhood, while internalizing problems seem to be more severe in adolescence and increase into adulthood.[106] External behaviors for which children and adolescents with DS are at an increased risk include aggressive or rule-breaking behavior, social problems, attention problems, hyperactivity, and increased repetitive behavior.[107] Additionally, young children may especially be

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[104] Lisa M. Jacola et al., "Behavior and Adaptive Functioning in Adolescents with Down Syndrome: Specifying Targets for Intervention," *Journal of Mental Health Research in Intellectual Disabilities* 7, no. 4 (2014): 297; Helma B. M. van Gameren-Oosterom et al., "Problem Behavior of Individuals with Down Syndrome in a Nationwide Cohort Assessed in Late Adolescence," *The Journal of Pediatrics* 163, no. 5 (2013): 128–140; Helma B. M. van Gameren-Oosterom et al., "Development, Problem Behavior, and Quality of Life in a Population Based Sample of Eight-Year-Old Children with Down Syndrome," *PloS one* 6, no. 7 (2011): 6.

[105] Beverly A. Myers and Siegfried M. Pueschel, "Psychiatric Disorders in Persons with Down Syndrome," *Journal of Nervous and Mental Disease* 179, no. 10 (1991): 611–12; Dykens, "Psychiatric and Behavioral Disorders," 272; Elisabeth M. Dykens and Connie Kasari, "Maladaptive Behavior in Children with Prader-Willi Syndrome, Down Syndrome, and Nonspecific Mental Retardation," *American Journal on Mental Retardation* 102, no. 3 (1997): 234. For a comprehensive overview of neurobehavioral disorders in individuals with DS see George Capone et al., "Neurobehavioral Disorders in Children, Adolescents, and Young Adults with Down Syndrome," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics* 142, no. 3 (2006): 158–172.

[106] van Gameren-Oosterom et al., "Problem Behavior," 136; Dykens, "Psychiatric and Behavioral Disorders," 273–74; Grieco et al., "Down Syndrome," 140; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens and Kasari, "Maladaptive Behavior," 234; Jeannie Visootsak and Stephanie Sherman, "Neuropsychiatric and Behavioral Aspects of Trisomy 21," *Current Psychiatry Reports* 9, no. 2 (2007): 135–40; E. M. Dykens et al., "Maladaptive Behaviour in Children and Adolescents with Down's Syndrome," *Journal of Intellectual Disability Research* 46, no. 6 (2002): 489.

[107] Jacola et al., "Behavior and Adaptive Functioning," 298; van Gameren-Oosterom et al., "Development, Problem Behavior", 5–6; van Gameren-Oosterom et al., "Development, Problem Behavior", 5–6; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens et al., "Maladaptive Behaviour," 488–89; Valérie Côté et al., "Behavioural Characteristics Related to Adaptive Functioning in Young Persons with Tuberous Sclerosis Complex, Down Syndrome and Fragile x Syndrome," *Journal of Developmental and Physical Disabilities* 33 (2021): 288.

prone to hyperactivity, tantrums, impulsivity, stubbornness, and disobedience.[108] Internal behaviors for which individuals with DS are more at risk include somatic complaints, anxiety, depression, and withdrawal.[109] Adolescents tend to withdraw more, engage in secretive activity, and experience higher rates of anxiety and depression than children.[110] Maladaptive behaviors such as attention problems and social withdrawal have been found to negatively impact adaptive functioning in adolescents with DS.[111]

Adaptive functioning. Adaptive functioning (sometimes referred to as adaptive behavior) refers to an individual's ability to successfully function in his or her environment, and encompasses communication, social, and practical skills.[112] In relation to their TD peers, older children with DS lag further behind in adaptive functioning skills than do younger children, possibly due to the increasing environmental demands in early adolescence and adolescence.[113] However, individuals with DS continue to increase their adaptive functioning skills into adulthood, and even maintain them relative to cognitive plateau or decline.[114] Children with DS score highest on measures of daily living skills

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[108] Matthew S. Siegel and Wendy E. Smith, "Psychiatric Features in Children with Genetic Syndromes: Toward Functional Phenotypes," *Child and Adolescent Psychiatric Clinics of North America* 19, no. 2 (2010): 236; Capone et al., "Neurobehavioral Disorders," 160; Grieco et al., "Down Syndrome," 140.

[109] Jacola et al., "Behavior and Adaptive Functioning," 298; van Gameren-Oosterom et al., "Development, Problem Behavior," 5–6; van Gameren-Oosterom et al., "Development, Problem Behavior," 5–6; Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens et al., "Maladaptive Behaviour," 488–89.

[110] Dykens et al., "Maladaptive Behaviour," 488–89.

[111] Jacola et al., "Behavior and Adaptive Functioning," 299–300.

[112] Anastasia Dressler et al., "Adaptive Behaviour in Down Syndrome: A Cross-Sectional Study from Childhood to Adulthood," *Wiener Klinische Wochenschrift* 122, no. 23 (2010): 674–75.

[113] Nacinovich et al., "Cognitive Development," 5. However, not all adolescents plateau or decline during these years. Elisabeth M. Dykens, Robert M. Hodapp, and David W. Evans, "Profiles and Development of Adaptive Behavior in Children with Down Syndrome," *Downs Syndrome Research and Practice* 9, no. 3 (2006): 48–49.

[114] Dressler et al., "Adaptive Behaviour," 679–80.

which rely heavily on implicit memory.[115] While most children with DS have relatively strong levels of social competence, others do not.[116] Expressive communication seems to be the weakest skill for children with DS, whereas receptive skills are a relative strength.[117]

Behavioral comorbidities. Children with DS are ten-times more likely to receive a diagnosis of autism spectrum disorders (ASD) than are the general population, though possibly less than other people with learning disabilities, with a prevalence rate between 6 to 10 percent.[118] Many of the clinical symptoms of ASD, such as stereotypy, obsessional traits, and deficits in communication and social skills, are similar to those of

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[115] Nacinovich et al., "Cognitive Development," 5; Dressler et al., "Adaptive Behaviour," 679; Dykens, Hodapp, and Evans, "Profiles and Development," 48.

[116] For high levels of social competence in children see Nacinovich et al., "Cognitive Development," 5; Dykens, Hodapp, and Evans, "Profiles and Development," 48; Deborah Fidler, Susan Hepburn, and Sally Rogers, "Early Learning and Adaptive Behaviour in Toddlers with Down Syndrome: Evidence for an Emerging Behavioural Phenotype?," *Down Syndrome Research and Practice* 9, no. 3 (2006): 42. For lower levels of social competence in children see Dressler et al., "Adaptive Behaviour," 679.

[117] Dykens, Hodapp, and Evans, "Profiles and Development," 48; Fidler, Hepburn, Rogers, "Early Learning," 42. It should be noted that, at least in the Dykens' study, these expressive and receptive skills are not based off "measures of grammar, vocabulary, or other aspects of language that are characteristic of previous studies," but rather measures of adaptive communication. Dykens, Hodapp, and Evans, "Profiles and Development," 48.

[118] C. A. Molloy et al., "Differences in the Clinical Presentation of Trisomy 21 with and without Autism," *Journal of Intellectual Disability Research* 53, no. 2 (2009): 144; Peder Rasmussen et al., "Autistic Disorders in Down Syndrome: Background Factors and Clinical Correlates," *Developmental Medicine and Child Neurology* 43, no. 11 (2001): 750; Rosane Lowenthal et al., "Prevalence of Pervasive Developmental Disorder in Down's Syndrome," *Journal of Autism and Developmental Disorders* 37, no. 7 (2007): 1395; Lindsey Kent et al., "Comorbidity of Autistic Spectrum Disorders in Children with Down Syndrome," *Developmental Medicine and Child Neurology* 41, no. 3 (1999): 156; Jens Lund, "Psychiatric Aspects of Down's Syndrome," *Acta Psychiatrica Scandinavica* 78, no. 3 (1988): 369–74. Susan Hepburn and colleagues found a 15 percent prevalence in a group of toddlers with DS, though the most often cited range is 6 to 10 percent. Susan Hepburn et al., "Autism Symptoms in Toddlers with Down Syndrome: A Descriptive Study," *Journal of Applied Research in Intellectual Disabilities* 21, no. 1 (2008): 9. Despite the numbers found in these studies, Capone and colleagues suspect that the actual prevalence of ASD in the DS population to be one in twenty, a twenty-five-fold increase over the general population. George T. Capone et al., "Down Syndrome and Comorbid Autism-spectrum Disorder: Characterization Using the Aberrant Behavior Checklist," *American Journal of Medical Genetics Part A* 134, no. 4 (2005): 373.

DS, making a diagnosis for ASD in children with DS difficult.[119] Additionally, ASD seems to manifest itself somewhat differently in children with DS than children without DS.[120] As a result, children with DS are often not diagnosed with ASD until later in childhood or adolescence.[121] Children with a dual-diagnosis of DS and ASD tend to display more anxious behavior, social withdrawal, and stereotypy (especially odd or bizarre behavior) than their peers with DS without an ASD diagnosis.[122] Children with a dual-diagnosis also have lower cognition and poorer language and adaptive behavior skills than their peers with DS without ASD.[123]

Another common dual-diagnosis which individuals with DS may receive which affects their behavior is attention-deficit/hyperactivity disorder (ADHD). Prevalence of ADHD among children with DS is generally reported as 6 to 8 percent.[124] However, a few studies have reported significantly higher rates, from 30 to 44 percent.[125]

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[119] Molloy et al., "Differences in the Clinical Presentation," 148; Kent et al., "Comorbidity of Autistic Spectrum Disorders," 157; John C. Carter et al., "Autistic-Spectrum Disorders in Down Syndrome: Further Delineation and Distinction from Other Behavioral Abnormalities," *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics* 144, no. 1 (2007): 92; Capone et al., "Down Syndrome and Comorbid Autism-spectrum Disorder," 375; Dykens, "Psychiatric and Behavioral Disorders," 273; Grieco et al., "Down Syndrome," 142.

[120] Carter et al., "Autistic-Spectrum Disorders," 92.

[121] Rasmussen and colleagues found that the mean age for an ASD diagnosis in individuals with DS was 14.4 years, compared to a mean of 6.9 years for those diagnosed without DS. Rasmussen et al., "Autistic Disorders," 751.

[122] Carter et al., "Autistic-Spectrum Disorders," 92.

[123] Molloy et al., "Differences in the Clinical Presentation," 148–49; Capone et al., "Down Syndrome and Comorbid Autism-Spectrum Disorder," 378.

[124] van Gameren-Oosterom et al., "Development, Problem Behavior," 1; Dykens, "Psychiatric and Behavioral Disorders," 273; Myers and Pueschel, "Psychiatric Disorders," 611; Lina Patel et al., "Behavioral Characteristics of Individuals with Down Syndrome," *Journal of Mental Health Research in Intellectual Disabilities* 11, no. 3 (2018): 223.

[125] Sivan Ekstein et al., "Down Syndrome and Attention-Deficit/Hyperactivity Disorder (ADHD)," *Journal of Child Neurology* 26, no. 10 (2011): 1292; Määttä et al., "Mental Health," 39; Jonathan M. Green, J. Dennis, and L. A. Bennets, "Attention Disorder in a Group of Young Down's Syndrome Children," *Journal of Intellectual Disability Research* 33, no. 2 (1989): 117.

This discrepancy may be due in part to the fact that many children with DS display attention problems and hyperactivity, and the exact process of ADHD diagnosis in children with DS is not clear.[126]Additionally, children with DS are at an increased risk to be diagnosed with other behavioral disorders such as conduct or oppositional disorders.[127] These diagnoses differ from general behaviors of opposition or other maladaptive behaviors in children with DS in that they are more persistent, severe, and intense.[128] Despite the higher prevalence of such disorders, however, children and youth with DS are not very likely to engage in acts of extreme aggression.[129]

Language Development

Language is one of the "most impaired domains of functioning in individuals with DS."[130] While individuals with DS have a marked deficit in language development, not all facets of language are equally impaired.[131] The language profile of individuals with DS is characterized by receptive strengths and expressive weaknesses, especially expressive grammar, with additional, though less marked, weaknesses in phonology and pragmatics.[132] While the general pattern of language development in children with DS

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[126] Ekstein et al., "Down Syndrome," 1292–93; Green, Dennis, and Bennets, "Attention Disorder," 120; Jacola et al., "Behavior and Adaptive Functioning," 300. For example, Määttä and colleagues reports that 33 percent of their participants "had behaviour suggestive of attention deficit hyperactivity disorder," though they were not officially diagnosed. Määttä et al., "Mental Health," 39, 41.

[127] Myers and Pueschel, "Psychiatric Disorders," 612–13; Dykens, "Psychiatric and Behavioral Disorders," 273.

[128] Capone et al., "Neurobehavioral Disorders," 161–62.

[129] Dykens et al., "Maladaptive Behaviour," 489; Dykens, "Psychiatric and Behavioral Disorders," 273.

[130] Abbeduto, Warren, and Conners, "Language Development," 247.

[131] Næss et al., "Longitudinal Relationships," 43–55.

[132] For reviews of the language abilities of individuals with DS see Martin et al., "Language Characteristics," 1–23; Abbeduto, Warren, and Conners, "Language Development," 247–61; Roberts, Price, and Malkin, "Language and Communication Development," 26–35; Robin S. Chapman and

often follows that of TD children, Fabbretti and colleagues describe the language of children with DS as "qualitatively different" than that of TD children.[133] However, this qualitative difference is not clear, and further research is needed.[134] This section will examine the various facets of language development in individuals with DS, covering lexical, syntactic, morphological, and phonological development, as well as phonological awareness, pragmatics, and the interplay of language and cognition.

Lexical development. Lexical development refers to the acquisition and development of vocabulary.[135] Individuals with DS differ in their development of the two modalities of vocabulary, receptive and expressive. Receptive vocabulary tends to be a strength for individuals with DS, while expressive vocabulary lags behind that of receptive and is generally considered a weakness. In other words, individuals with DS can understand more words than they can speak.[136] Overall, the vocabulary of children with DS has been shown to be simpler than that of their TD peers.[137] As in other domains

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Elizabeth Kay-Raining Bird, "Language Development in Childhood, Adolescence, and Young Adulthood in Persons with Down Syndrome," in *The Oxford Handbook of Intellectual Disability and Development*, ed. Jacob A. Burack et al. (New York: Oxford University Press, 2011), 167–83.

[133] D. Fabbretti et al., "A Story Description Task in Children with Down's Syndrome: Lexical and Morphosyntactic Abilities," *Journal of Intellectual Disability Research* 41, no. 2 (1997): 177. See also Glynis Laws and Dorothy V. M. Bishop, "Verbal Deficits in Down's Syndrome and Specific Language Impairment: A Comparison." *International Journal of Language & Communication Disorders* 39, no. 4 (2004): 423–51, especially 426–27 for a discussion of delay versus deviance.

[134] Abbeduto, Warren, and Conners, "Language Development," 251–53, 257.

[135] Bruce M. Rowe and Diane P. Levine, *A Concise Introduction to Linguistics* (Oxfordshire: Routledge, 2015) 4; Jack C. Richards and Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 339.

[136] See for example a novel word learning task, in which individuals with DS responded correctly to comprehension probes 28 percent of the time and to production probes only 6 percent of the time. Elizabeth Kay-Raining Bird et al., "Novel Word Acquisition in Children with Down Syndrome: Does Modality Make a Difference?," *Journal of Communication Disorders* 33, no. 3 (2000): 258.

[137] Miguel Galeote et al., "The Acquisition of Different Classes of Words in Spanish Children with Down Syndrome," *Journal of Communication Disorders* 75 (2018): 60, 65; Laura Zampini and Laura D'Odorico, "Lo sviluppo del vocabolario nei bambini con sindrome di Down: dati per età cronologica e di

of development and language, the lexical abilities of individuals with DS varies widely.[138]

Receptive vocabulary development in children with DS follows the same basic pattern as that of TD children and is generally considered a strength for individuals with DS.[139] Individuals with DS often have receptive vocabulary skills on par with their nonverbal cognition, and those skills can even surpass MA.[140] However, individuals in DS may have a dissociation between breadth and depth of vocabulary comprehension, such that while they can comprehend a large number of words, they have a "significant impairment in acquiring concept knowledge."[141] The growth of receptive vocabulary skills of individuals with DS can continue into young adulthood, after which time they

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svilupp," *Psicologia clinica dello sviluppo* 16, no. 2 (2012): 331–46; Laura Zampini and Laura D'Odorico, "Lexical and Syntactic Development in Italian Children with Down's Syndrome," *International Journal of Language & Communication Disorders* 46, no. 4 (2011): 386–96; Arianna Bello, Daniela Onofrio, and Maria Cristina Casell, "Nouns and Predicates Comprehension and Production in Children with Down Syndrome," *Research in Developmental Disabilities* 35, no. 4 (2014): 761–75. For differing results see Elena Checa, Miguel Galeote, and Pilar Soto, "The Composition of Early Vocabulary in Spanish Children with Down Syndrome and Their Peers with Typical Development," *American Journal of Speech-Language Pathology* 25, no. 4 (2016): 605–19.

[138] Laura Zampini and Laura D'Odorico, "Vocabulary Development in Children with Down Syndrome: Longitudinal and Cross-Sectional Data," *Journal of Intellectual and Developmental Disability* 38, no. 4 (2013): 313–14.

[139] Miguel Galeote et al., "The Development of Vocabulary in Spanish Children with Down Syndrome: Comprehension, Production, and Gestures," *Journal of Intellectual and Developmental Disability* 36, no. 3 (2011): 191; Laws et al., "Receptive Vocabulary and Semantic Knowledge," 502.

[140] Chapman et al., "Language Skills: Production Deficits," 9. The authors note that the way in which MA is assessed will affect its relationship to receptive vocabulary skills. See also Abbeduto, Warren, and Conners, "Language Development," 250–51. Chapman and colleagues describe the adolescents in their study as having "advanced vocabulary comprehension." Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1114. For clear evidence of receptive vocabulary skills surpassing MA see Galeote et al., "The Development of Vocabulary," 191.

[141] Laws et al., "Receptive Vocabulary and Semantic Knowledge," 502.

may begin to decline.[142] Significant factors for receptive vocabulary in individuals with DS are nonverbal cognition (MA), CA and to a lesser degree, hearing status.[143]

While expressive vocabulary development in children with DS follows the same general pattern as that of TD children, children with DS lag behind their peers considerably in reaching milestones of development, with significant individual variation.[144] When compared to MA-matched peers on measurements of expressive vocabulary, individuals with DS generally score significantly lower, and their progress is much slower.[145] Some research demonstrates that the deficiency in expressive vocabulary

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[142] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 115. For evidence of no decline, and even continued growth after twenty years of age, see Carr, "Six Weeks to 45 Years," 417. An earlier study by Carr showed a slight, though not significant increase, in receptive vocabulary scores in individuals with DS from ages thirty to thirty-five years. Janet Carr, "Patterns of Ageing in 30–35-year-olds with Down's Syndrome," *Journal of Applied Research in Intellectual Disabilities* 16, no. 1 (2003): 33. For mixed, though somewhat outdated results, regarding receptive vocabulary growth in adults with DS see Jean-Adolphe Rondal and Annick Comblain, "Language in Adults with Down Syndrome," *Down's Syndrome, Research and Practice* 4, no. 1 (1996): 8.

[143] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1114–15. Chapman and colleagues found that CA was a much stronger predictor of receptive vocabulary than MA, accounting for 64 percent of the variance, as opposed to 14 percent for MA. Kay-Raining Bird found MA to be a stronger predictor for vocabulary comprehension than CA. However, Kay-Raining Bird's investigation was of novel word learning, not current vocabulary level. Kay-Raining Bird, "Novel Word Acquisition," 254–55. See also Susan J. Loveall et al., "Receptive Vocabulary Analysis in Down Syndrome," *Research in Developmental Disabilities* 55 (2016): 12.

[144] Kari-Anne B. Næss, Johanne Ostad, and Egil Nygaard, "Differences and Similarities in Predictors of Expressive Vocabulary Development between Children with Down Syndrome and Young Typically Developing Children," *Brain Sciences* 11, no. 3 (2021): 2; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 311; Danielle te Kaat-van den Os et al., "Expressive Vocabulary Development in Children with Down Syndrome: A Longitudinal Study," *Journal of Policy and Practice in Intellectual Disabilities* 14, no. 4 (2017): 316; Eva Berglund, Mårten Eriksson, and Iréne Johansson, "Parental Reports of Spoken Language Skills in Children with Down Syndrome," *Journal of Speech, Language, and Hearing Research* 44 (2001): 188.

[145] Næss, Ostad, and Nygaard, "Differences and Similarities," 10; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 315–16; Chapman et al., "Language Skills: Production Deficits," 6; Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 772. Galeote and colleagues found that the trajectory of expressive development skills, both oral and gestural, for young children with DS followed that of TD children and found no significant differences in expressive vocabulary between the two groups. Galeote et al., "The Development of Vocabulary," 192–93.

becomes especially salient in adolescence.[146] Predictors for expressive vocabulary in children with DS are home literacy environment, auditory memory, receptive vocabulary, phonological awareness, and oral motor skills.[147] Though receptive vocabulary and auditory memory also predict expressive vocabulary in TD children, they seem to be much more significant factors for children with DS.[148] As with receptive vocabulary, expressive vocabulary in children with DS is more closely related to MA rather than CA.[149]

The process of vocabulary acquisition and the ability of children with DS to learn novel words varies somewhat from that of TD children. However, the evidence is not unambiguous. While some studies demonstrate unimpaired novel word learning capabilities of children with DS, others reveal deficits.[150] Children with DS generally need more exposure than their MA matched peers to produce a new word. Kay-Raining

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[146] Andrea McDuffie, Robin S. Chapman, and Leonard Abbeduto, "Language Profiles of Adolescents and Young Adults with Down Syndrome and Fragile X Syndrome," in *Speech and Language Development and Intervention in Down Syndrome and Fragile X Syndrome*, ed. Joanne E. Roberts, Robin S. Chapman, and Steven F. Warren, Communication and Language Intervention (Baltimore: Paul H. Brookes, 2008), 117–42; Abbeduto, Warren, and Conners, "Language Development," 250. Chapman and colleagues found no evidence of a plateau in expressive language skills in adolescence. Chapman et al., "Language Skills: Production Deficits," 13. For differing results see Joanne Roberts et al., "Receptive Vocabulary, Expressive Vocabulary, and Speech Production," 188.

[147] Næss, Ostad, and Nygaard, "Differences and Similarities," 11–12.

[148] Næss, Ostad, and Nygaard, "Differences and Similarities," 12.

[149] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316; Kay-Raining Bird, "Novel Word Acquisition," 254–55; Zampini and D'Odorico, "Lo sviluppo del vocabulario," 331–46.

[150] For studies demonstrating unimpaired novel word learning in individuals with DS see Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1137–52, and Robin S. Chapman, Elizabeth Kay-Raining Bird, and Scott E. Schwartz, "Fast Mapping of Words in Event Contexts by Children with Down Syndrome," *Journal of Speech and Hearing Disorders* 55, no. 4 (1990): 761–70. For studies demonstrating impaired novel word learning see Kay-Raining Bird, "Novel Word Acquisition," 241–66. Jarrold, Thorn, and Stephens found unimpaired abilities to learn novel word referents and impaired abilities to learn novel word forms. Christopher Jarrold, Annabel S.C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 196–218.

Bird and colleagues found that fifteen exposures to a novel word was not always sufficient for young children with DS to produce the word when solicited.[151] However, older children and adolescents with DS were able to spontaneously produce novel words in the retelling of a story, after only three exposures to the word, at the same rate as MA-matched TD controls, though they did have more difficulty defining the word than the TD participants.[152]

While children with DS may perform on par with MA-matched TD peers on levels of static receptive vocabulary knowledge, it seems that they may not learn novel words in the receptive mode as quickly.[153] There is some evidence that signs or gestures may support spoken word comprehension and production in children with DS, but the data is not clear.[154] A principal factor in impaired word learning for individuals with DS seems to be deficits in VSTM, possibly mediated (constrained) by phonological

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[151] It is important to note that the MA-matched TD children also had low production, though higher than the participants with DS, which was virtually non-existent. Kay-Raining Bird, "Novel Word Acquisition," 257–58.

[152] Kay-Raining Bird, Chapman, and Schwartz, "Fast Mapping of Words and Story Recall," 1297.

[153] Kay-Raining Bird, "Novel Word Acquisition," 258–59. An early fast mapping study by Chapman and colleagues found that participants with DS performed just as well as the MA-matched TD control group and found no significant differences in production or comprehension. Chapman, Kay-Raining Bird, and Schwartz, "Fast Mapping of Words in Event Contexts," 761–70. However, the lack of differences may be due to the simplistic nature of the task. Elizabeth Kay-Raining Bird, Robin S. Chapman, and Scott E. Schwartz, "Fast Mapping of Words and Story Recall by Individuals with Down Syndrome," *Journal of Speech, Language, and Hearing Research* 47 (2004): 1288

[154] Kay-Raining Bird, "Novel Word Acquisition," 259–61; Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 772; Danielle J.A. te Kaat-van den Os et al., "Do Gestures Pave the Way?: A Systematic Review of the Transitional Role of Gesture during the Acquisition of Early Lexical and Syntactic Milestones in Young Children with Down Syndrome," *Child Language Teaching and Therapy* 31, no. 1 (2015): 71–84. Dimitrova and colleagues found that parents' verbal translation of children's signed gestures facilitates expressive word learning in young children with DS, just as in TD children. Nevena Dimitrova, Şeyda Özçalışkan, and Lauren B. Adamson, "Parents' Translations of Child Gesture Facilitate Word Learning in Children with Autism, Down Syndrome and Typical Development," *Journal of Autism and Developmental Disorders* 46, no. 1 (2016): 227–28.

awareness skills.[155] However, in multiple tasks, Mosse and Jarrold found that impaired VSTM was not a barrier to children with DS learning novel words.[156] They suggest that to compensate for impaired VSTM, individuals with DS draw upon "a domain-general process reflecting long-term memory for serial order" to learn new words.[157] More research is needed to clarify the novel word learning abilities of individuals with DS and the process of their vocabulary acquisition.

Grammatical development. Grammar is generally divided into two domains: syntactic and morphological. However, the two are often combined and referred to as morphosyntax, as reflected in the literature on language development in individuals with DS. Grammatical skills in individuals with DS are markedly impaired, so much so that Perovic refers to a "selective grammatical deficit" in individuals with DS.[158]

Syntax refers to the way in which phrases, clauses, and sentences are structured and can be thought of as grammar at the sentence level.[159] Though the order of

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[155] Christopher Jarrold, Annabel S. C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 211–12. Verbal (phonological) short-term memory may be especially important for word learning for young school-aged children. Susan E. Gathercole et al., "Phonological Memory and Vocabulary Development during the Early School Years: A Longitudinal Study," *Developmental Psychology* 28, no. 5 (1992): 887–98.

[156] Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1142, 1145.

[157] Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1143.

[158] Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1627. This claim is bolstered by research by Yoder and colleagues which demonstrates that the ability for individuals to properly process speech sound is "strongly associated with the degree of impairment in morphological comprehension." Paul J. Yoder et al., "Association between Differentiated Processing of Syllables and Comprehension of Grammatical Morphology in Children with Down Syndrome," *American Journal on Mental Retardation* 111, no. 2 (2006): 146. In other words, impairment in grammatical comprehension may hinder individuals with DS from effectively processing spoken speech. Research also suggests that morphosyntactic skills may affect the acquisition of verbs in individuals with DS. Galeote et al., "The Acquisition of Different Classes of Words," 69.

[159] Andrew Carnie, *Syntax: A Generative Introduction*, 3rd ed. (Oxford: Wiley-Blackwell, 2012), 4; Rowe and Levin, *A Concise Introduction*, 111.

development of syntactical skills seems comparable in TD children and children with DS, the rate of development for children with DS is slower.[160] Syntactical comprehension skills of individuals with DS lags behind that of their lexical skills, and this gap increases with age.[161] Syntactic comprehension skills of individuals with DS are sometimes found to be lower than their MA, though results depend on how syntactic comprehension is measured.[162] Moreover, the grammar skills of children with DS seems to be lower even than that of children with other intellectual disabilities.[163] Complex syntax is especially difficult for individuals with DS to understand, so that as complexity of sentences increases, comprehension decreases.[164]

Expressive syntax seems to be one of the weakest language skills in individuals with DS and rather consistently measures below MA.[165] However, expressive syntax continues to grow well into adolescence and even into young adulthood, whereas

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[160] Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 187, 189; Miguel Galeote et al., "Early Grammatical Development in Spanish Children with Down Syndrome," *Journal of Child Language* 41, no. 1 (2014): 127; Fabbretti et al., "A Story Description Task," 176–77.

[161] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children," 1115; Chapman et al., "Language Skills: Production Deficits," 9; Witecy and Penke, "Language Comprehension," 192; Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 186, 189.

[162] Chapman et al., "Language Skills: Production Deficits," 9; Laura Zampini et al., "Prosodic Skills in Children with Down Syndrome and in Typically Developing Children," *International Journal of Language & Communication Disorders* 51, no. 1 (2016): 80. Chapman and colleagues found that syntactic comprehension skills were on par with MA. Chapman et al., "Language Skills: Production Deficits," 9.

[163] M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *Journal of Intellectual Disability Research* 63, no. 12 (2019): 1438. Chapman also found that children and adolescents with DS scored lower on measures of syntactic comprehension than did children of cognitive impairment of unknown origin matched for cognitive skills. Chapman, "Language Learning in Down Syndrome," 63.

[164] Witecy and Penke, "Language Comprehension," 192.

[165] See for example Chapman et al., "Language Skills: Production Deficits," 6, 9; Sarah E. Michael, Nan Bernstein Ratner, and Rochelle Newman, "Verb Comprehension and Use in Children and Adults with Down Syndrome," *Journal of Speech, Language & Hearing Research* 55 no. 6 (2012): 1744.

it seems that receptive syntax may begin to slow down or decline earlier.[166] Not all expressive syntactic skills of individuals with DS are equally impaired. Individuals in DS seem to produce longer utterances when telling a story as opposed to engaging in conversation.[167] Despite longer and more frequent utterances in storytelling, individuals with DS tend to omit grammatical morphemes and words, especially verbs and function words.[168] Overall, individuals with DS produce more single word utterances and fewer multi-word utterances than TD MA-matched peers, and produce very few complex sentences.[169] Predictors of syntactic comprehension are CA, MA, and to a much lesser

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[166] Abbeduto, Warren, and Conners, "Language Development," 252. For growth in expressive syntax see Elin T. Thordardottir, Robin S. Chapman, and Laura Wagner, "Complex Sentence Production by Adolescents with Down Syndrome," *Applied Psycholinguistics* 23, no. 2 (2002): 163–83; Chapman et al., "Predicting Language Production," 340–50; Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change;" 902–15; Chapman et al., "Language Skills: Production Deficits," 1–21. For decline in receptive syntax see McDuffie, Chapman, and Abbeduto, "Language Profiles of Adolescents and Young Adults," 117–42; Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change;" 902–15; Laws and Gunn, "Phonological Memory," 326–37. However, Witecy and Penke found that individuals with DS continued to grow in receptive syntactic abilities throughout adolescence (up to nineteen years old), and plateau in adulthood (twenties and thirties). Witecy and Penke, "Language Comprehension," 184–96.

[167] Chapman et al., "Language Skills: Production Deficits," 9. This is especially true if children can preview the story beforehand and/or have visual supports. Chapman, "Language Learning in Down Syndrome," 63; Miles, Chapman, and Sindberg, "Sampling Context Affects MLU," 325–37. See also Roberts, Price, and Malkin, "Language and Communication Development," 30; Martin et al., "Language Characteristics," 7. However, van Bysterveldt and Westerveld found that "significant delays in grammatical ability" despite support from photographs. Anne K. van Bysterveldt and Marleen F, Westerveld, "Children with Down Syndrome Sharing Past Personal Event Narratives with their Teacher Aides: A Pilot Study," *International Journal of Disability, Development and Education* 64, no. 3 (2017): 259.

[168] Chapman et al., "Language Skills: Production Deficits," 7–9; Fabbretti et al., "A Story Description Task," 165–79; Michael, Bernstein Ratner, and Newman, "Verb Comprehension and Use," 1745; Miles, Chapman, and Sindberg, "Sampling Context Affects MLU," 332; Linda J. Hesketh and Robin S. Chapman, "Verb Use by Individuals with Down Syndrome," *American Journal on Mental Retardation* 103, no. 3 (1998): 288–304.

[169] Zampini and D'Odorico, "Lexical and Syntactic Development," 386–96; Fabbretti et al., "A Story Description Task," 175, 177; Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641. In young children with DS, Galeote and colleagues found that even though the children with DS were able to produce sentences of similar length than TD controls matched for vocabulary levels, their sentences were less complex. Galeote et al., "Early Grammatical Development in Spanish Children," 125.

degree, hearing status.[170] Additionally, working memory (as measured by auditory short-term memory and visual short-term memory) has been found to be a significant factor for syntactic comprehension, with phonological memory playing an especially important role for young children.[171] Comprehension seems to be a main factor in expressive syntax, while CA and auditory and visual short-term memory may also play a role.[172]

Morphology refers to the formation and internal structure of words and can be thought of as grammar (rules) at the word level.[173] Like syntactic abilities, morphological skills of individuals with DS lag behind their lexical skills and are generally considered a weakness.[174] Abedutto and colleagues note that "grammatical morphology has often been found to be especially problematic for adolescents and young adults with DS" and seems

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[170] Chapman, Schwartz, and Kay-Raining Bird, "Language Skills of Children,"1114–15; Witecy and Penke, "Language Comprehension," 191–92; Chapman and colleagues did not find hearing status to be a predictor for syntax. Chapman et al., "Language Skills: Production Deficits," 8. Chapman, Hesketh, and Kistler found that nonverbal cognition did not affect syntactic comprehension or production. Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 912. See Chapman, "Language Learning in Down Syndrome," 64, for more similar results to Chapman, Hesketh, and Kistler.

[171] Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 910; Witecy and Penke, "Language Comprehension," 193. For young children see Laws and Gunn, "Phonological Memory," 334.

[172] Chapman, Hesketh, and Kistler, "Predicting Longitudinal Change," 908–10; van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 258. Chapman and colleagues suggest that CA and cognition are mediated through comprehension for expressive syntax. Chapman et al., "Predicting Language Production," 347. Michael and colleagues found that measurements of sentence memory, though not general working memory, played a role in measurements of syntactic production. Michael, Bernstein Ratner, and Newman, "Verb Comprehension and Use," 1746. Chapman found that hearing status is correlated with syntax production (MLU), but only in the interview context, while phonological working memory is correlated with syntax production in both the interview and narrative modes. Chapman, "Language Learning in Down Syndrome," 64.

[173] Mark Aronoff and Kirsten Fudeman, *What Is Morphology?* (Oxford: Wiley-Blackwell, 2011), 2; Rowe and Levin, *A Concise Introduction*, 85; Andrea D. Sims and Martin Haspelmath, *Understanding Morphology* (London: Hodder Education, 2010), 1.

[174] Stefano Vicari, Maria Cristina Caselli, and Francesca Tonucci, "Asynchrony of Lexical and Morphosyntactic Development in Children with Down Syndrome," *Neuropsychologia* 38, no. 5 (2000): 634–44; Chapman et al., "Language Skills: Production Deficits," 11; Fabbretti et al., "A Story Description Task," 165–79; Perovic, "Syntactic Deficit in Down Syndrome," 1616–30; Checa, Galeote, and Soto, "The Composition of Early Vocabulary," 615.

to be even weaker than syntactical abilities, even in young children.[175] Chapman found that children and adolescents with DS scored significantly below children with cognitive impairment of unknown origin matched for cognitive abilities on measurements of grammatical morpheme comprehension.[176]

Individuals (children and adults) with DS tend to understand plural morphemes better than past tense morphemes.[177] When matched with TD children on measurements of mean length of utterance, children with DS produced fewer tense-related and non-tense related morphemes, especially regular past tense morphemes (*-ed*), and third person singular morphemes (*-s*), confirming that despite the amount of words they produce, their language is grammatically weaker.[178] However, individuals with DS seem fairly adept at producing irregular past tense and third person singular forms.[179] Finally, it seems that children with DS are not as easily able to acquire novel morphemes as TD peers matched

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[175] Abbeduto, Warren, and Conners, "Language Development," 252. For evidence of enhanced morphological impairment in adolescents and adults with DS see Chapman et al., "Language Skills: Production Deficits," 11; Miolo, Chapman, and Sindberg, "Sentence Comprehension," 181. For evidence of a morphological deficit in young children which exceeds that of syntax see Fabbretti et al., "A Story Description Task," 178. Eadie and colleagues found that expressive grammatical morphology of children with DS was significantly impaired when compared to TD children matched on the expressive syntactic measurement of mean length of utterance. Eadie et al., "Profiles of Grammatical Morphology," 720–32.

[176] Chapman, "Language Learning in Down Syndrome," 63.

[177] Witecy and Penke found this to be true for adults, while Joffe and Varlokosta found similar results for children ages five to fourteen. Witecy and Penke, "Language Comprehension," 192; Victoria Joffe and Spyridoula Varlokosta, "Language Abilities in Williams Syndrome: Exploring Comprehension, Production and Repetition Skills," *Advances in Speech Language Pathology* 9, no. 3 (2007): 221.

[178] Patricia A. Eadie et al., "Profiles of Grammatical Morphology and Sentence Imitation in Children with Specific Language Impairment and Down Syndrome," *Journal of Speech, Language, and Hearing Research* 45 (2002): 720–32. See also Chapman et al., "Language Skills: Production Deficits," 11, and Laws and Bishop, "A Comparison of Language Abilities," 1335, for similar results. However, Laws and Bishop found that individuals with DS with a mean length of utterance (MLU) of 4.5 or more did not differ significantly from controls matched on MLU and mental age on the number of correctly produced regular and irregular past tense forms. Laws and Bishop, "A Comparison of Language Abilities," 1335–36.

[179] Laws and Bishop, "A Comparison of Language Abilities," 1335; Eadie et al., "Profiles of Grammatical Morphology," 727–28. However, Joffe and Varlokosta found that participants with DS performed equally poor on regular and irregular verbs in an elicitation task. Joffe and Varlokosta, "Language Abilities in Williams Syndrome," 219.

either for language ability or MA, suggesting that children with DS have difficulty "learning and generalizing implicit grammatical rules."[180] Grammatical morpheme comprehension is correlated to hearing status, likely due to the need to distinguish similar high frequency sounds for proper comprehension.[181]

Phonological development. Phonology refers to the sounds in a language and how those sounds combine into larger units and can be thought of as the grammar of sound patterns of a language.[182] Children with DS have a marked speech production deficit which causes their speech to often be difficult to understand.[183] This deficit is not merely the result of lower cognition, but rather a disorder of phonological acquisition unique to the DS population.[184] While there has been an ongoing debate as to whether the deficit is a disorder or a delay, Dodd and Thompson found that all participants with DS in their study exhibited inconsistent errors in speech, indicative of a disorder rather than delay.[185] Individuals with DS experience phonological difficulties in both perceiving and

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[180] Keller-Bell, "Linguistic Processing," 96.

[181] Miolo, Chapman, and Sindberg, "Sentence Comprehension," 185; Chapman, "Language Learning in Down Syndrome," 64.

[182] Rowe and Levin, *A Concise Introduction*, 61; Bruce Hayes, *Introductory Phonology* (Oxford: Wiley-Blackwell, 2009), 19.

[183] K. Burgoyne, S. Buckley, and R. Baxter, "Speech Production Accuracy in Children with Down Syndrome: Relationships with Hearing, Language, and Reading Ability and Change in Speech Production Accuracy over Time," *Journal of Intellectual Disability Research* 65 no. 12 (2021): 1021–22.

[184] Chapman et al., "Predicting Language Production," 347; Perovic, "Syntactic Deficit in Down Syndrome," 1619; Barbara Dodd and Laura Thompson, "Speech Disorder in Children with Down's Syndrome," *Journal of Intellectual Disability Research* 45, no. 4 (2001): 314.

[185] Dodd and Thompson, "Speech Disorder," 314. For initial arguments of a delay see J.A. Rondal, "Down's Syndrome," in *Language Development in Exceptional Circumstances*, ed. Dorothy Bishop and Kay Mogford (Hove, UK: Psychology Press, 1993), 165–76. For initial arguments of a possible disorder see Carol Stoel-Gammon, "Speech Development of Infants and Children with Down Syndrome," in *Speech Evaluation in Medicine*, ed. John K. Darby (New York: Grune and Stratton, 1981), 341–60. See also research conducted by Roberts and colleagues for evidence of "developmental differences," not simply delay. Joanne Roberts et al., "A Comparison of Phonological Skills of Boys with Fragile X Syndrome and Down Syndrome," *Journal of Speech and Language Hearing Research* 48 (2005): 980–95.

producing speech sounds resulting in impairments in fluency and intelligibility.[186] For example, Fabbretti and colleagues found that young children with DS misarticulated certain words more often than their TD controls matched on mean length of utterance in a story description task.[187]

Additionally, the systematic phonological errors (phonological processes) made by individuals with DS seem to persist for longer periods than in TD developing children.[188] Based upon single-word responses, Roberts and colleagues found that boys with DS performed below MA-matched TD boys and boys with Fragile X syndrome on measurements of articulation, sound accuracy, and phonological processes, demonstrating both greater delays and developmental differences compared to the other two groups.[189] Barnes and colleagues used connected speech samples and found that boys with DS showed greater delays on measurements of consonant production accuracy, proportion of whole word proximity, and phonological processes when compared to MA-matched boys with Fragile X syndrome with and without autism and TD boys.[190] Receptive vocabulary, phoneme blending, word reading, hearing status, and age are significant factors in speech production accuracy for individuals with DS.[191]

Difficulties in phonological development is only one of many factors which

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[186] For a helpful and thorough review see Ray D. Kent and Houri K. Vorperian, "Speech Impairment in Down Syndrome: A Review," *Journal of Speech and Language Hearing Research* 56 no. 1 (2013): 1–43. See also Stoel-Gammon, "Down Syndrome Phonology," 93–100.

[187] Fabbretti et al., "A Story Description Task," 178, Though not a story description task, in their assessments of speech, Burgoyne and colleagues found participants articulated less "than 10% of consonant sounds accurately." Burgoyne, Buckley, and Baxter, "Speech Production Accuracy," 1021–32.

[188] Martin et al., "Language Characteristics," 4.

[189] Roberts et al., "A Comparison of Phonological Skills," 980–95.

[190] Elizabeth Barnes et al., "Phonological Accuracy and Intelligibility in Connected Speech of Boys with Fragile X Syndrome or Down Syndrome," *Journal of Speech, Language, and Hearing Research* 52 (2009): 1048–61.

[191] Burgoyne, Buckley, and Baxter, "Speech Production Accuracy," 1021–32; Laws and Hall, "Early Hearing Loss," 340; Stoel-Gammon, "Down Syndrome Phonology," 93–100.

contribute to unintelligible speech in individuals with DS. Other factors which affect speech intelligibility include hearing status, age, speech-motor skills, verbal apraxia (motor planning disorders), and prosody.[192] Boys with DS were found to have significantly reduced intelligibility when compared to MA-matched TD boys using connected speech samples.[193] Intelligibility (as measured by the proportion of complete and intelligible utterances over total utterances) in individuals with DS seems to be particularly impaired when telling a story, as opposed to when engaged in conversation.[194] In their personal narrative task, van Bysterveldt and Westerveld found intelligibility rates from 69 to 98 percent, even after intelligibility related eligibility criteria.[195]

Phonological awareness is the conscious focus on the or awareness of the sound structure of a language.[196] Individuals with DS have a clear deficit in phonological awareness, though the root of this deficit is not clear.[197] Phonological awareness tasks

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[192] Chapman et al., "Predicting Language Production," 347; van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 260–61; Kent and Vorperian, "Speech Impairment in Down Syndrome," 1–43; Libby Kumin, "Speech Intelligibility and Childhood Verbal Apraxia in Children with Down Syndrome," *Down Syndrome Research and Practice*, 10, no. 1 (2006): 10–22.

[193] Barnes et al., "Phonological Accuracy and Intelligibility," 1055–56. They did not, however, differ from MA-matched boys with Fragile X syndrome, with or without autism. Intelligibility was measured by percentage of intelligible words.

[194] Chapman et al., "Language Skills: Production Deficits," 9. The authors suggest that "availability of referential context in conversation benefits transcription of Down syndrome speech disproportionately" (9).

[195] van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 260. See Miles, Chapman, and Sindberg for much higher rates of intelligibility. Sally Miles, Robin Chapman, and Heidi Sindberg, "Sampling Context Affects MLU in the Language of Adolescents with Down Syndrome," *Journal of Speech, Language, and Hearing Research* 49 (2006): 331.

[196] Linda Cupples and Teresa Iacono, "Phonological Awareness and Oral Reading Skill in Children with Down Syndrome," *Journal of Speech, Language, and Hearing Research* 43, no. 3 (2000): 595; Abbeduto, Warren, and Conners, "Language Development," 256.

[197] Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-Term Memory," 211–12; Dodd and Thompson, "Speech Disorder," 308.

such as syllable segmentation, syllable deletion, phoneme awareness and identification, and particularly rhyming, are impaired in individuals with DS.[198] Moreso, phonological awareness and decoding skills seem to lag behind word recognition skills.[199] Reduced phonological awareness seems to play a role in difficulties for individuals with DS to learn new word forms as well expressive vocabulary deficits.[200] Additionally, phonological awareness significantly impacts reading abilities for children with DS, particularly reading speed and accuracy.[201] Despite the marked weakness in phonological awareness in individuals with DS, they can improve their phonological awareness skills to varying degrees through targeted interventions.[202]

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[198] Brock and Jarrold, "Language Influences on Verbal Short-Term Memory," 1341–42; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *Journal of Intellectual Disability Research* 50, no. 7 (2006): 477–91; Margaret J. Snowling, Charles Hulme, and Robin C. Mercer, "A Deficit in Rime Awareness in Children with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 471–95; Cláudia Cardoso-Martins, Mirelle França Michalick, and Tatiana Cury Pollo, "Is Sensitivity to Rhyme a Developmental Precursor to Sensitivity to Phoneme?: Evidence from Individuals with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 439–54; Cupples and Iacono, "Phonological Awareness and Oral Reading Skill," 603.

[199] Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *American Journal of Speech-Language Pathology* 9, no. 4 (2000): 319–30.

[200] However, it does not seem to affect their ability to learn new word referents. Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-Term Memory," 211. For differing results see Mosse and Jarrold, "Evidence for Preserved Novel Word Learning," 1148. For the relationship between phonological awareness and expressive vocabulary see Næss, Ostad, and Nygaard, "Differences and Similarities," 1–19, and Glynis Laws and Deborah Gunn, "Relationships between Reading, Phonological Skills and Language Development in Individuals with Down Syndrome: A Five Year Follow-Up Study," *Reading and Writing* 15, no. 5 (2002): 541–43.

[201] Verucci, Menghini, and Vicari, "Reading Skills and Phonological Awareness," 482–83; Snowling, Hulmne, and Mercer, "A Deficit in Rime Awareness," 471–95; Cupples and Iacono, "Phonological Awareness and Oral Reading Skill," 595–608; Laws and Gunn, "Relationships between Reading," 541–43.

[202] Pamela Baylis and Margaret J. Snowling, "Evaluation of a Phonological Reading Programme for Children with Down Syndrome," *Child Language Teaching and Therapy* 28, no. 1 (2012): 39–56; Patricia L. Cleave, Elizabeth Kay-Raining Bird, and Derrick C. Bourassa, "Developing Phonological Awareness Skills in Children with Down Syndrome," *Canadian Journal of Speech-Language Pathology & Audiology* 35, no. 4 (2011): 332–43; Anne Katherine van Bysterveldt, Gail Gillon, and Susan Foster-Cohen, "Integrated Speech and Phonological Awareness Intervention for Pre-School Children with Down Syndrome," *International Journal of Language and Communication Disorders* 45, no. 3 (2010):

Pragmatics. Pragmatics refers to the effect of context (such as social or affective) and situations on the meaning of language.[203] Pragmatic development is the ability to understand and use language in social contexts and includes skills such as requesting, initiating and taking turns in conversation, signaling noncomprehension, narrating events, nonverbal communication, and modifying speech to the needs of the listener or situation.[204] When compared to other domains of language in individuals with DS, pragmatics is a relative strength, though not in all aspects.[205] Vicari and colleagues note that children with DS have "good overall communicative abilities" despite "the deficiencies in their linguistic code."[206] While some aspects of pragmatics in individuals

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320–35; Kristina Goetz et al., "Training Reading and Phoneme Awareness Skills in Children with Down Syndrome," *Reading and Writing* 21, no. 4 (2008): 395–412; Anne K. van Bysterveldt, Gail T. Gillon, and Catherine Moran, "Enhancing Phonological Awareness and Letter Knowledge in Preschool Children with Down Syndrome," *International Journal of Disability, Development and Education* 53, no. 3 (2006): 301–29; Esther J. Kennedy and Mark C. Flynn, "Training Phonological Awareness Skills in Children with Down Syndrome," *Research in Developmental Disabilities* 24, no. 1 (2003): 44–57.

[203] Rowe and Levin, *A Concise Introduction*, 170; Richards and Schmidt, *Longman Dictionary*, 449.

[204] Roberts, Price, and Malkin, "Language and Communication Development," 30; Abbeduto, Warren, and Conners, "Language Development," 253; Gary E. Martin et al., "A Multimethod Analysis of Pragmatic Skills in Children and Adolescents with Fragile X Syndrome, Autism Spectrum Disorder, and Down Syndrome," *Journal of Speech, Language, and Hearing Research* 61, no. 12 (2018): 3023.

[205] Roberts, Price, and Malkin, "Language and Communication Development," 30; Martin et al., "Language Characteristics," 6; Abbeduto, Warren, and Conners, "Language Development," 253. For example, Miles and Chapman found that pragmatic skills exceed expressive language skills and align more closely to measurements of receptive language and cognition. Sally Miles and Robin S. Chapman, "Narrative Content as Described by Individuals with Down Syndrome and Typically Developing Children," *Journal of Speech, Language, and Hearing Research* 45 (2002): 186. Similar results were found by Boudreau and Champan. Donna M. Boudreau and Robin S. Chapman, "The Relationship between Event Representation and Linguistic Skill in Narratives of Children and Adolescents with Down Syndrome," *Journal of Speech, Language, and Hearing Research* 43, no. 5 (2000): 1154. Smith and colleagues found that pragmatic skills far exceeded the combined linguistic skills measured by the Children's Communication Checklist-2. Elizabeth Smith, Kari-Anne B. Næss, and Christopher Jarrold, "Assessing Pragmatic Communication in Children with Down Syndrome," *Journal of Communication Disorders* 68 (2017): 19.

[206] Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641. Some research suggests that individuals with DS can compensate for grammatical and expressive deficiencies through the use of circumlocution and a greater number of simpler utterances. Abbeduto, Warren, and Conners, "Language Development," 253.

with DS seem on par with MA-matched peers, other aspects are considerably impaired.[207] Though the pattern of development may be similar to that of TD children, the evidence is not clear.[208]

In one study which compared the pragmatic skills of children and adolescents with various neurodevelopmental disabilities to a control group of TD children, participants with DS showed no deficits on measurements of key pragmatic skills.[209] Yet

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[207] For studies demonstrating pragmatic performance on par with MA peers see Robert E. Owens and James D MacDonald, "Communicative Uses of the Early Speech of Nondelayed and Down Syndrome Children," *American Journal of Mental Deficiency* 86, no. 5 (1982): 503–10; Truman E. Coggins, Robert L. Carpenter, and Nathaniel O. Owings, "Examining Early Intentional Communication in Down's Syndrome and Nonretarded Children," *International Journal of Language & Communication Disorders* 18, no. 2 (1983): 98–106. Franco and Wishart matched children on expressive language capabilities and found similar usage of gestures between the two groups. Fabia Franco and Jennifer G. Wishart, "Use of Pointing and Other Gestures by Young Children with Down Syndrome," *American Journal of Mental Retardation* 100, no. 2 (1995): 174–75. For studies demonstrating pragmatic performance below MA-matched peers see Michelle Lee et al., "A Multi-Method Investigation of Pragmatic Development in Individuals with Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 122, no. 4 (2017): 289–309; Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 10–23; Leonard Abbeduto et al., "Signaling Noncomprehension of Language: A Comparison of Fragile X Syndrome and Down Syndrome," *American Journal on Mental Retardation* 113, no. 3 (2008): 214–30; Leonard Abbeduto et al., "Collaboration in Referential Communication: Comparison of Youth with Down Syndrome or Fragile X Syndrome," *American Journal on Mental Retardation* 111, no. 3 (2006): 170–83. Laws and Bishop found that while their participants with DS scored below the level of controls, they generally did not score so low as to indicate pragmatic impairment. Glynis Laws and Dorothy V. M. Bishop, "Pragmatic Language Impairment and Social Deficits in Williams Syndrome: A Comparison with Down's Syndrome and Specific Language Impairment," *International Journal of Language & Communication Disorders* 39, no. 1 (2004): 59. Among many other factors, one factor in determining whether or not individuals with DS measure at or below TD peers on a particular pragmatic skill may be age at the time of testing. Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19.

[208] Abbeduto, Warren, and Conners, "Language Development," 250; Roberts, Price, and Malkin, "Language and Communication Development," 30. Berglund and colleagues found that the order of development of pragmatic skills in children with DS was "strikingly similar" to that of TD peers, though lagging behind when matched on vocabulary size. Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 189. Lee and colleagues found that not only was the growth of pragmatic skill in individuals with DS slower than TD peers, but that violations of some pragmatics skills increased marginally with age, while others decreased. Lee et al., "A Multi-Method Investigation," 12–13.

[209] Martin et al., "A Multimethod Analysis of Pragmatic Skills," 3032. Participants were assessed on measurements of "noncontingent language ((loosely related or tangential, as well as off-topic or irrelevant language), perseveration (excessive verbal self-repetition of a word, phrase, sentence, or topic), initiations (nonobligatory, self-initiated contributions), and nonresponsiveness (failure to respond when a response is obligatory)" (3024). It should be noted that in this study it was not possible to compare participants matched by MA, and thus analyses controlled for nonverbal MA and other language

contrary to other studies in which pragmatic skills were found to exceed those of grammar in individuals with DS, Berglund and colleagues found that the lag of pragmatic skills in participants with DS in comparison to a TD group was larger than that of grammatical skills.[210] Individuals with DS seem to perform best on pragmatic tasks of nonverbal communication, social communication, and event retelling.[211] Conversely, particularly impaired pragmatic skills include understanding context, signaling of noncomprehension, and effectively conveying one's intent.[212] Correlates of pragmatic

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measurements (3026).

[210] Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 189. In the Berglund study, participants were matched on receptive vocabulary level. In particular, they found that individuals with DS talked about ownership, missing things, and understood talk about missing things less than TD controls (187). For evidence of pragmatic skills on par with or stronger than grammar see Miles and Chapman, "Narrative Content," 175–89; Boudreau and Chapman, "Relationship between Event Representation and Linguistic Skill," 1146–59; McDuffie, Chapman, and Abbeduto, "Language Profiles of Adolescents and Young Adults," 117–42; Jane S. Leifer and Michael Lewis, "Acquisition of Conversational Response Skills by Young Down Syndrome and Nonretarded Young Children," *American Journal of Mental Deficiency* 88 no. 6 (1984): 610–18.

[211] For nonverbal communication see Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19; Angela E. John and Carolyn B. Mervis, "Comprehension of the Communicative Intent behind Pointing and Gazing Gestures by Young Children with Williams Syndrome or Down Syndrome," *Journal of Speech, Language, and Hearing Research* 53 no. 4 (2010): 950–60; Eliza Porto-Cunha and Suelly Cecilia Olivan Limongi, "Communicative Profile Used by Children with Down Syndrome," *Pró-Fono Revista de Atualização Científica* 20 (2008): 243–48; Franco and Wishart, "Use of Pointing and Other Gestures," 160–82; For social communication see Laws and Bishop, "Pragmatic Language Impairment," 59; Coggins, Carpenter, and Owings, "Examining Early Intentional Communication," 98–106; Owens and MacDonald, "Communicative Uses of the Early Speech," 503–10. For event retelling see Boudreau and Chapman, "Relationship between Event Representation and Linguistic Skill," 1146–59; Miles and Chapman, "Narrative Content," 175–89; McDuffie, Chapman, and Abbeduto, "Language Profiles of Adolescents and Young Adults," 117–42. Event retelling strength seems to depend upon the availability of visual support. Miles, Chapman, and Sindberg, "Sampling Context Affects MLU," 325–37; Roberts, Price, and Malkin, "Language and Communication Development," 30; Martin et al., "Language Characteristics," 7. However, van Bysterveldt and Westerveld found that children with DS struggled with narrating personal past events, even with their own photos. van Bysterveldt and Westerveld, "Sharing Past Personal Event Narratives," 259.

[212] For context see Smith, Næss, and Jarrold, "Assessing Pragmatic Communication," 19; Laws and Bishop, "Pragmatic Language Impairment," 54. For noncomprehsion signaling see Gary E. Martin et al., "Signaling of Noncomprehension in Communication Breakdowns in Fragile X Syndrome, Down Syndrome, and Autism Spectrum Disorder," *Journal of Communication Disorders* 65 (2017): 22–34; Abbeduto et al., "Signaling Noncomprehension of Language," 214–30. For conveying intent see Abbeduto et al., "Collaboration in Referential Communication," 170–83. In this study participants with DS showed great difficulty in describing an object to a listener whom the participant could not see.

skills in individuals with DS include executive functioning, general cognitive abilities, structural language abilities (such as speech production and syntax), and theory of mind.[213]

Language and cognition. Though individuals with DS have cognitive impairments, their language impairments exceed what would be expected given their levels of cognition.[214] For example, lexical development often lags behind cognitive development.[215] This is especially true for expressive lexical development and has also been found to be true for receptive lexical development, though not as consistently.[216] Despite other studies which demonstrate that expressive vocabulary development lags behind MA, when Galeote and colleagues combined gesture production with vocal production, they found no difference between children with DS and TD children and contend that the children with DS in their study "show no specific dissociation between cognitive and lexical development."[217] The wide variance in results among studies could

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[213] Lee et al., "A Multi-Method Investigation," 13–14; Laws and Bishop, "Pragmatic Language Impairment," 59. Theory of mind is the ability to reason about, predict, and explain the behavior of oneself and others, particularly when the other holds different beliefs than oneself, and is impaired in individuals with DS. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 12–13.

[214] Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 761.

[215] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316. For differing results see Galeote et al., "The Development of Vocabulary," 192.

[216] Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 11–12; Abbeduto, Warren, and Conners, "Language Development," 250; Zampini and D'Odorico, "Lo sviluppo del vocabulario," 331–46. Chapman found vocabulary comprehension skills were comparable to MA while expressive were not. Chapman et al., "Language Skills: Production Deficits," 9. Bello, Onofio, and Caselli found that children with DS lagged behind MA-matched peers in both comprehension and production. Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 770.

[217] Miguel Galeote et al., "The Acquisition of Productive Vocabulary in Spanish Children with Down Syndrome," *Journal of Intellectual and Developmental Disability* 33, no. 4 (2008): 298. Vicari and colleagues likewise found no evidence for a dissociation between cognitive and lexical development in young children with DS. Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic

likely be due to the variance in types of words and the formatting of the assessments.[218] However, even when compared to other populations with cognitive impairment, individuals with DS demonstrate a higher level of linguistic impairment "than would be predicted using their cognitive level."[219] The gap between linguistic performance and cognition is even more pronounced in measurements of grammar.[220] These results seem to reveal a general asynchrony between cognitive abilities and language abilities specific to individuals with DS.[221]

Development," 641.

[218] Leonard Abbeduto and Robin S. Chapman, "Language Development in Down Syndrome and Fragile X Syndrome: Current Research and Implications for Theory and Practice," in *Developmental Theory and Language Disorders*, ed. Paul Fletcher and Jon F. Miller, Trends in Language Acquisition Research 4 (Amsterdam: John Benjamins, 2005), 60; Abbeduto, Warren, and Conners, "Language Development," 250; Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316. Not only did Galeote and colleagues include gestures in their measurement, but they also modified the assessment used from its original form to make adapt it to the developmental profile of individuals with DS. Galeote et al., "The Acquisition of Productive Vocabulary," 296. More research is needed to determine the effects of assessments and what types of measurement most accurately represent the abilities of individuals with DS. Chapman found that individuals with DS score higher on the PPVT-3 than the TACL-3 vocabulary test. Chapman, "Language Learning in Down Syndrome," 63–64.

[219] Zampini and D'Odorico, "Vocabulary Development in Children with Down Syndrome," 316; Abbeduto, Warren, and Conners, "Language Development," 253. See for example Abbeduto et al., "The Linguistic and Cognitive Profile," 9–15; Chapman, "Language Learning in Down Syndrome," 63; Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 490–508; Joanne Roberts et al., "Receptive Vocabulary, Expressive Vocabulary, and Speech Production of Boys with Fragile X Syndrome in Comparison to Boys with Down Syndrome," *American Journal on Mental Retardation* 112, no. 3 (2007): 177–93; Paul J. Yoder and Steven F. Warren, "Early Predictors of Language in Children with and without Down Syndrome," *American Journal on Mental Retardation* 109, no. 4 (2004): 285–300. Interestingly, Loveall and colleagues found that on measurements of receptive vocabulary, individuals with DS performed below individuals with non-specific etiology intellectual disability when controlling for nonverbal cognition and phonological memory, but above the TD group when controlling for the same. Loveall et al., "Receptive Vocabulary Analysis," 8. This may be due to the higher CA of the participants with intellectual disability (12–13).

[220] Vicari, Caselli, and Tonucci, "Asynchrony of Lexical and Morphosyntactic Development," 641.

[221] Bello, Onofio, and Caselli, "Nouns and Predicates Comprehension," 770; Chapman et al., "Predicting Language Production," 347. However, research conducted by Facon and colleagues reveals that the strength of the relationship between vocabulary and cognition depends on the type of vocabulary (relational vs. general), with a greater effect found for relational vocabulary. They also argue that the trajectory of vocabulary development in relation to cognitive ability is similar, no matter the diagnosis of

Bilingualism in DS

While to date there are no published studies of L2 acquisition in the FL context documenting FL acquisition among individuals with DS, much can be gleaned from research on bilingualism in individuals with DS.[222] However, the FL context is not identical to the bilingual context. Carmen Muñoz helps to clarify how the FL context may differ from the bilingual or naturalistic second language learning context. In the FL context: 1) instruction is generally restricted to only two to four sessions of less than one hour per week (though in the elementary context, students generally receive much less)[223] 2) the main source of input is the teacher, and students may or may not be exposed to sufficient quantity or quality of input 3) peers do not utilize the target language to communicate with each other, and 4) students are not exposed to the target language outside of the classroom.[224] Though differences between the context of the FL classroom and bilingualism should be acknowledged, it is beneficial to explore the findings of bilingualism in individuals with DS, as it is the closest context to FL learning researched

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the individual. Bruno Facon, Yannick Courbois, and David Magis, "A Cross-Sectional Analysis of Developmental Trajectories of Vocabulary Comprehension among Children and Adolescents with Down Syndrome or Intellectual Disability of Undifferentiated Aetiology," *Journal of Intellectual and Developmental Disability* 41, no. 2 (2016): 146. Similarly, Berglund and colleagues found a similar growth pattern in various domains of language and suggest that growth patterns are common, independent of diagnosis. Berglund, Eriksson, and Johansson, "Parental Reports of Spoken Language Skills," 188.

[222] Two studies (outside of the North American context) report on FL teaching to individuals with DS, though they focus on methods of teaching and assessment, not on FL acquisition by the students with DS. Hossein Talebzadeh and Mahvash Pourhanifeh, "Investigating Practical Knowledge-Base (PKB) of Special-Education Teachers: The Case of Teaching Individuals with Down Syndrome (IDS) in the English as a Foreign Language (EFL) Context of Iran," *Applied Research on English Language* 11, no. 2 (2022): 25–50 and Gholam-reza Abbasian and Fatemeh Ebrahimi, "Assessing Down Syndrome EFL Learner's Language Ability: Incorporating Learners-Teachers' Perspectives," *English Language Teaching* 13, no. 3 (2020): 45–67.

[223] Though meeting times and frequency vary greatly, some elementary programs may meet as little as twenty minutes once a week. Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 20.

[224] Carmen Muñoz, "Symmetries and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning," *Applied Linguistics* 29, no. 4 (2008): 578–79.

to date in individuals with DS.

The field of research in bilingualism in DS was begun by two pioneering case studies which documented the abilities of individuals with DS to become bilingual.[225] Since then, various studies have emerged documenting the language abilities of bilingual individuals with DS, clearly demonstrating that individuals of DS are capable of becoming bilingual.[226] While the second language abilities of children with DS varies greatly, the general language profile of bilingual children with DS conforms to that of their monolingual peers with DS.[227] When assessed on various domains in the dominant language, they perform below their TD peers in most language measurements.[228] Like

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[225] Vallar and Papagno investigated the abilities of a young trilingual woman with DS. Giuseppe Vallar and Costanza Papagno, "Preserved Vocabulary Acquisition in Down's Syndrome: The Role of Phonological Short-Term Memory," *Cortex* 29, no. 3 (1993): 467–83. Interestingly, in a 2001 study on the same woman, they report that she is learning her fourth language, Spanish. Costanza Papagno and Giuseppe Vallar, "Understanding Metaphors and Idioms: A Single-Case Neuropsychological Study in a Person with Down Syndrome," *Journal of the International Neuropsychological Society* 7, no. 4 (2001): 517. The second pioneer study in the field is Woll and Grove conducted a case study on the abilities of bilingual twins. Bencie Woll and Nicola Grove, "On Language Deficits and Modality in Children with Down Syndrome: A Case Study of Twins Bilingual in BSL and English," *The Journal of Deaf Studies and Deaf Education* 1, no. 4 (1996): 271–78. Though somewhat dated research, these case studies continue to be referenced widely in the literature.

[226] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 53–54.

[227] Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *American Journal of Speech-Language Pathology* (2005): 194–96; Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *Journal of Communication Disorders*, Article in Press (2016): 7; Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 92; Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1, (2008): 16; Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *Journal of Communication Disorders* 93 (2021): 10; Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 4.

[228] See for example Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 14–15. Interestingly, in a syntactic bootstrapping task experiment (to learn novel words) conducted by Cleave and colleagues, the monolingual group of children with DS performed further below the monolingual group of TD children than did the bilingual group of children with DS below the TD

their monolingual peers with DS, bilingual children with DS exhibit strengths in receptive vocabulary and weaknesses in expressive language, especially morphosyntax, in both languages.[229] However, children with DS generally perform on par with their monolingual peers with DS in their dominant language.[230] This growing body of evidence suggests that exposure to a second language in the bilingual context is not harmful to the L1 development of children with DS, as long as the L1 continues to receive adequate support.[231]

In their second language, bilingual children with DS generally perform as well as TD bilingual controls matched on developmental level on measures of receptive vocabulary, suggesting that children with DS may be able to "(acquire) second-language vocabulary skills on par with" bilingual TD developing children with the same nonverbal

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bilingual group. Patricia L. Cleave et al., "Syntactic Bootstrapping in Children with Down Syndrome: The Impact of Bilingualism," *Journal of Communication Disorders* 49 (2014): 50. It is important to note that in the studies of language development in children with DS, including studies of bilingualism in DS, participants with DS are compared to developmentally matched controls. The controls are matched with participants on MA, not CA. Thus, when referring to TD controls, "peers" refers to developmentally matched, not chronologically matched, peers, and participants with DS are typically chronologically older than TD controls.

[229] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 195; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 92; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 17; Ward and Sanoudaki, "Language Profiles," 11; Katsarou and Andreou, "Bilingualism in Down Syndrome," 5.

[230] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Rebeca A. N. Valdivia, "Documenting the Communicative Competence of Bilingual Preschoolers with Down Syndrome" (PhD diss., University of Illinois at Urbana-Champaign, 2005), 159; Feltmate and Bird found varied individual differences across all measurements and contend that the absence of any pattern of differences suggests that the introduction of an L2 is not detrimental to L1 development. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 15.

[231] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 94; Kay-Raining Bird, "The Case for Bilingualism," 266; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 197; Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3 (2011): 398, 400; Katsarou and Andreou, "Bilingualism in Down Syndrome," 4–5. Feltmate and Kay-Raining Bird nuance the understanding that bilingualism does not disadvantage the L1 inferring that evidence demonstrates this is true when the L1 is the child's dominant language, or the two languages are balanced. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 19. Further research is needed for other contexts.

cognitive abilities.[232] Ward and Sanoudaki note that though their bilingual participants with DS performed on par with the TD bilingual participants matched for nonverbal cognitive ability in measures of receptive vocabulary, they performed "significantly lower" on measures of expressive vocabulary.[233] This is to be expected given the difficulties in expressive language typical of individuals with DS. Bilingual children with DS are equally capable of learning novel words as are their monolingual peers matched on nonverbal cognition with DS.[234]

Neither bilingualism nor exposure to a second language poses a disadvantage to the cognitive development of individuals with DS.[235] Moreover, some research suggests that bilingualism may offer benefits for individuals with DS. For example, Feltmate and Kay-Raining Bird found that bilingual children with DS were shown to have a larger overall vocabulary than monolingual children with DS matched on nonverbal mental age.[236] In the syntactic bootstrapping task conducted by Cleave and colleagues, bilingualism was not disadvantageous to children with DS, but neither did it offer any advantage. They propose that if a different type of task were used, one in which participants must ignore competing information to complete the task, the benefits of

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[232] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196. The authors caution that a "small sample size may have masked significant differences" (196). Trudeau and colleagues suggest similar results in their study of bilingual infants with DS. Trudeau et al., "Développement lexical chez les enfants," 399–400.

[233] Ward and Sanoudaki, "Language Profiles," 11.

[234] Cleave et al., "Syntactic Bootstrapping," 51.

[235] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down Syndrome," *Journal of Intellectual Disability Research* 55, no. 3 (2011): 351–56; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 187–99; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 8; Mirko Uljarević et al., "Practitioner Review: Multilingualism and Neurodevelopmental Disorders–an Overview of Recent Research and Discussion of Clinical Implications," *Journal of Child Psychology and Psychiatry* 57, no. 11 (2016): 1205–17.

[236] Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 16.

bilingualism may manifest themselves.[237] Kay-Raining Bird suggests that metalinguistic advantages may exist for bilingual individuals with DS, but sufficient research has yet to be conducted.[238] However, in their single case study of a bilingual-biliterate child with DS, Burgoyne and colleagues found no metalinguistic benefits conferred from bilingualism.[239] Additionally, Ward and Sanoudaki found no advantages in phonological awareness conferred by bilingualism in children with DS. The authors suggest that this may be due to the bilingual context in Wales, or to the young MA and CA of the participants.[240] Thus, while it is possible that bilingualism may offer metalinguistic benefits to bilinguals with DS, this area clearly requires more research.

Several factors seem to correlate significantly with second language development in bilingual children with DS, including working memory, nonverbal cognition (often calculated as MA), CA, input, and phonological awareness.[241] According to a study by Ward and Sanoudaki, the strongest of these factors may be working memory, particularly for receptive skills.[242] However, other studies which explored factors related to L2 development in bilingual children with DS did not examine working memory, and further research is needed to draw clear conclusions on which factors most strongly correlate with L2 development. MA seems to be another factor of considerable

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[237] Cleave et al., "Syntactic Bootstrapping," 51.

[238] Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 93.

[239] Kelly Burgoyne et al., "Bilingualism and Biliteracy in Down Syndrome: Insights from a Case Study," *Language Learning* 66, no. 4 (2016): 961.

[240] Ward and Sanoudaki, "Language Profiles," 11.

[241] Ward and Sanoudaki found that working memory, nonverbal cognition, CA, and phonological awareness accounted for 90 percent of the variation in DS groups. Ward and Sanoudaki, "Language Profiles," 11. See also Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 53, 60.

[242] Ward and Sanoudaki, "Language Profiles," 11–12.

significance.[243] In their study on bilingualism in children with DS, Kay-Raining Bird and colleagues found that the participant with the highest MA also scored the highest on all measures of language ability in both languages among the bilingual participants with DS.[244] However, a low MA does not necessarily preclude a child with DS from becoming bilingual, as the child in this same study with the lowest MA also demonstrated evidence of second language skills.[245] Ward and Sanoudaki argue that the role of nonverbal cognition in language development of bilingual children with DS is not as significant as in the TD population.[246] CA, though not as robustly as MA, also plays a role in second language development in bilingual children with DS, especially grammar.[247]

Despite the evidence for a strong link between MA and language development, MA alone cannot guarantee language development without sufficient input. Feltmate and Kay-Raining Bird found in their study of four bilingual children with DS that the child with the second-highest MA scored the lowest on all measures of the L2 (French), likely due to limited exposure.[248] Progress in the L2 seems especially sensitive to amount and frequency of exposure, even more so than the L1.[249] In the bilingual context, the amount of input seems to be even more significant than duration of exposure.[250] While many

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[243] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196.

[244] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196. Similarly, in another study, the child with the highest MA and CA scored the highest of all bilingual participants with DS on all language measurements. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

[245] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196.

[246] Ward and Sanoudaki, "Language Profiles," 12.

[247] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 195–96.

[248] Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18.

[249] Trudeau et al., "Développement lexical chez les enfants," 399; Ward and Sanoudaki, "Language Profiles," 12.

[250] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Ward and

factors play into the success of bilingualism in individuals with DS, the evidence makes clear that individuals with DS can indeed become bilingual.

Not only can children with DS become bilingual, but they can also become biliterate. Kelly Burgoyne and colleagues conducted a case study on a bilingual child with DS ("MB") who is proficient in both Russian (L1) and English (L2).[251] Despite the vast differences in the two alphabets, MB demonstrated reading abilities in both languages. In English, her L2, she performed on par with her peers matched on word-reading ability (both with and without DS) in measurements of word reading, though her reading comprehension fell below that of her TD peers, typical for children with DS.[252] In Russian, her L1, MB performed on par with the TD control group in some, but not all, of the measurements, despite not having received formal reading instruction in Russian, unlike the control group. While not all children with DS may be able to attain the levels of biliteracy which MB demonstrates, MB is a clear example of a child with DS who has achieved relative success in becoming both bilingual and biliterate.[253]

One case study examines the abilities of a child with DS in the French immersion context in Canada. Martin and colleagues document the language abilities of Jake, a middle-school boy who entered French immersion in third grade.[254] Jake was assessed in grades six and eight on French and English language and reading abilities. At both testing times, Jake's English abilities (L1) were stronger than his French (L2).

Sanoudaki, "Language Profiles," 12; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 60.

[251] Burgoyne et al., "Bilingualism and Biliteracy in Down Syndrome," 945–71.

[252] Unlike other studies in language development in children with DS, MB was matched not on MA but on word-reading ability.

[253] Though not to the same degree, an earlier case study also suggests that individuals with DS can become biliterate. Vallar and Papagno, "Preserved Vocabulary Acquisition," 467–83.

[254] Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–29.

Except for one measurement (*Concepts and Following Directions*), Jake's English language and reading scores continued to improve while in French immersion. After four years of French immersion (Time 1), Jake had attained French language capabilities equivalent to that of a TD monolingual four- or five-year-old, and French reading abilities in the six-to-seven-year-old range. However, with the exception of one measurement (*Concepts et Exécution de Directives*), Jake did not improve in his French abilities from Time 1 to Time 2.[255]

When compared to a group of monolingual English-speaking students with DS matched for CA at Time 2, Jake scored higher than all but one of the participants on all measures of English language and reading.[256] Though Jake scored higher than the mean of the monolingual group on all measurements, this only reached statistical significance for the *Recalling Sentences* subtest. Better abilities in this child with DS compared to age-matched monolinguals with DS could be due to a metalinguistic bilingual advantage, but the evidence is not clear, and further research is needed.[257] In addition to the standardized measurements, it was also reported that Jake could successfully code-switch and use the French language both in the classroom and the community. Jake is another clear example of a bilingual/biliterate individual with DS, but one who did not receive exposure to the L2 until much later in childhood.

L2 Learning in DLD and Learning Disabilities

Though the cognitive and language profiles of individuals with DS do not

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[255] It is interesting to note that the same measurement in which he did not improve in English, he did improve in French. This could be related to the environment where he was exposed to the two languages.

[256] All participants in the control group were within three years of Jake's CA. Martin et al., "Bilingual Outcomes," 7.

[257] Martin et al., "Bilingual Outcomes," 23.

conform to that of any specific language or intellectual disability, such are the closest populations with research available on L2 acquisition in the FL context. Though research on bilingualism and L2 learning in developmental disabilities is sparse, far more research on bilingualism has been conducted on children with DLD and developmental disabilities than children with DS.[258] However, only a few have been conducted in the FL context. Given the dearth of research on FL learning in children with developmental and learning disabilities and DLD, this section will review a sampling of the literature on L2 learning in these populations first in the immersion context, followed by a full review of the literature in the FL context.

Kay-Raining Bird and colleagues document in some detail the academic abilities of English-speaking children with special education needs in an inclusive Early French Immersion (EFI) program.[259] Participants had a variety of communicative, behavioral, learning, intellectual and/or physical disabilities, though it does not seem that any of the participants had DS. Children began EFI in kindergarten and completed province-wide tests at the end of third grade in English on academic measurements of reading, writing, and math and were compared to same-age peers enrolled in an English Language of Instruction (ELoI) program. The majority of the students in EFI with disabilities met the provincial standards of reading, writing, and math, surpassing the percentage of ELoI students with disabilities that met the standards. However, it appears that overall, those students participating in EFI had "less severe learning difficulties" than

[258] Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11; Elizabeth Kay-Raining Bird, Natacha Trudeau, and Ann Sutton, "Pulling it All Together: The Road to Lasting Bilingualism for Children with Developmental Disabilities," *Journal of Communication Disorders* 63 (2016): 65; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 67; Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *Journal of Communication Disorders* 63 (2016): 83.

[259] Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–30.

those participating in ELoI.[260] EFI participants "were able to achieve functional French language and reading skills after only 3 years of French Immersion," and with the exception of one student, all participants demonstrated "French language abilities at or above a four-year-old level and French word reading skills at or above a six-and-a-half-year-old level."[261] Other studies found similar results, suggesting that many children with various intellectual, language, and learning disabilities can acquire an L2 in the dual-language setting without detrimental effects to the L1.[262]

Regarding L2 acquisition in the FL context, one study investigates the abilities of children with special education needs, while two investigate the abilities of children with DLD. Peker and Regalla examine L1 and L2 development of pre-kindergarteners with and without special needs in an inclusive FL program.[263] The special needs included developmental delays, language impairments, social/emotional disorders, and autism spectrum disorder. Students in the study participated in thirty-minute French classes twice a week for two school years. Instruction was based upon an animated video series, and included interactive activities such as TPR, games, and songs. Students were assessed on French (L2) vocabulary based on the FL classroom curriculum, English (L1) vocabulary based on the FL classroom curriculum, and standardized measurements of English vocabulary. As would be expected, TD students scored higher than students with

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[260] Kay-Raining Bird et al., "Access and Outcomes," 24.

[261] Kay-Raining Bird et al., "Access and Outcomes," 25. It is important to note the possible effect of selection bias in these results, "as only a small subset of parents chose to have their child with SEN participate in direct testing." (24).

[262] Marjorie L. Myers, "Achievement of Children Identified with Special Needs in Two-Way Spanish Immersion Programs" (PhD diss., George Washington University, 2009); Fred Genesee and Tara W. Fortune, "Bilingual Education and At-Risk Students," *Journal of Immersion and Content-Based Language Education* 2, no. 2 (2014): 198–99.

[263] Hilal Peker and Michele Regalla, "Making Exemption the Exception, Not the Rule: Inclusion of All Students in Foreign Language Education," *Foreign Language Annals* 54, no. 1 (2021): 73–90.

special needs on all measurements in both languages, reaching significance on French classroom assessments and English standardized assessments. However, all students, with and without special needs, demonstrated evidence of L2 vocabulary acquisition. Additionally, all students improved in their English vocabulary skills from the pre-test to the post-test, suggesting that L2 exposure does not impede development in the L1, even for students with special needs. This study also demonstrates the ability of students with various language and developmental disabilities to acquire L2 vocabulary in the FL context.

Zoutenbier and Zwitserlood were the first to investigate FL learning in children with DLD.[264] Sixth-grade Dutch students began learning English as a FL in fifth grade and received thirty to forty-five minutes of instruction weekly. Students came from various schools for children with DLD in the Netherlands, and the methods of instruction varied. Students were assessed on various Dutch and English language skills. The method of assessment for the English language test was a multiple-choice paper and pencil test which measured listening skills, auditory vocabulary, reading skills, and written vocabulary. While participants came from both multilingual and monolingual backgrounds, they did not differ significantly in their performance on the English language assessment. The majority of the participants performed "poorly" when compared to TD children as measured by norm-referenced scores, and the authors suggest that children with DLD may not be able to learn a FL due to their "poor word decoding skills and impaired morphosyntactic skills in their first language."[265] However, the assessment largely depended on reading, and participants had a limited response time for the auditory sections. Modifications were not offered for the participants, despite the

[264] Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13.

[265] Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

fact that children with DLD have language deficits, and the authors themselves admit the test may have not been the most appropriate for children with DLD.[266] Additionally, the study revealed that performance in Dutch and English were related, and the authors suggest that children with DLD first build strong L1 skills before beginning to learn a FL.[267]

Tribushinina and colleagues investigated the English FL acquisition of children with DLD in Russia and compared them to TD controls matched for classroom English FL exposure.[268] As opposed to Zoutenbier and Zwitserlood, they utilized methods of assessment more amenable to children with DLD for English measurements, namely picture matching tasks. Assessments were administered three times: after one year of English language instruction, the midpoint of year two, and at the end of year two. After one year in the FL class, participants with DLD and TD participants did not differ in their receptive English vocabulary skills. However, the TD children progressed well beyond the children with DLD in receptive vocabulary skills after one-and-a-half and two years of instruction. Though in the initial analysis, TD children surpassed the children with DLD on measurements of receptive English grammar after one year of instruction, upon controlling for outside exposure to English, both groups performed similarly. Nonetheless, similar to vocabulary, TD participants showed much greater improvement in grammar than participants with DLD in the second year of classes. Based on these results the authors contend that ninety minutes a week of instruction is insufficient for children with DLD to make progress in a FL.[269] However, it is significant to note that all

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[266] Zoutenbier and Zwitserlood, "Exploring the Relationship," 10.

[267] Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

[268] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *Journal of Communication Disorders* 88 (2020): 1–17.

[269] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second

children showed evidence of acquisition, and differing methods of instruction and greater outside exposure to the language may bolster the FL abilities of children with DLD.[270]

Instructional methods for L2 learning. One formidable barrier to individuals with DS and other language and/or learning disabilities participating in the FL classroom is the lack of training and resources for teachers.[271] Teachers are often not adequately trained to effectively include such students in the FL classroom, and what research that exists is not readily available to teachers.[272] This section will provide a brief overview of the available literature pertaining to instructional methods and strategies for children with language, learning, or developmental disabilities for L2 learning, focusing on the middle school years and below.

Mady and Muhling reviwed literature pertaining to supporting students with special education needs in French as a second language education. No reviewed studies addressed instruction in the elementary FL context, and none addressed individuals with DS. The review also reveals the dearth of resources in this area, especially in the FL

Language," 13.

[270] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 13.

[271] Katy Arnett and Callie Mady, "A Critically Conscious Examination of Special Education within FSL and its Relevance to FSL Teacher Education Programs," *Canadian Journal of Applied Linguistics* 13, no. 1 (2010): 29–30. The same is true for bilingual education and children with intellectual disabilities. Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 225.

[272] Callie Mady and Stefanie Muhling, "Instructional Supports for Students with Special Education Needs in French as a Second Language Education: A Review of Canadian Empirical Literature," *Journal of Education and Learning* 6, no. 3 (2017): 14; Wendy Carr, *Teaching Core French in British Columbia: Teachers' Perspectives*. Research Report for British Columbia Association of Teachers of Modern Languages, 2007. https://www.bcatml.org/research--reports.html; Paradis, "An Agenda for Knowledge-Oriented Research," 80; Arnett and Mady, "Exemption and Exclusion," 95; Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30; Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11.

context.[273] However, the review identified helpful strategies such as the use of gestures, visual supports, use of the target language, and group work/peer support to support L2 learning for children with special education needs. In a separate article, Emily Duvall offers tips on how to make classroom modifications and accommodations for students with disabilities in the FL classroom.[274] While such an article is helpful, it does not equip FL teachers with specific instructional strategies to deliver the language to students with disabilities.[275]

One the most helpful resources for FL teachers of children with special education needs to date is a study conducted by Joy and Murphy.[276] Joy and Murphy describe an integrated intensive French as a second language immersion program in which students of various learning and developmental disabilities, including at least one child with DS, underwent five months of French instruction for three hours a day along with TD peers. They emphasized the unique nature of the program as one which utilized an "authentic and integrated focus on implicit language learning with language as a means of communication."[277] All instruction took place in the L2 (French), and teachers

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[273] Mady and Muhling, "Instructional Supports for Students with Special Education Needs," 14–22. Peker and Regalla also note that the majority of studies on the integration of students with special needs in the FL classroom have been conducted at the high school level or college levels. Peker and Regalla, "Making Exemption the Exception," 75.

[274] Emily D. Duvall, "Including Students with Disabilities in a Foreign Language Class," *Teaching Exceptional Children* 38, no. 6 (2006): 42–48.

[275] Similarly, in her review of the literature on students with learning disabilities in the FL learning environment, Wight notes that much research focuses on modifications and accommodations which can be made to aid students with learning disabilities. Mary Caitlin S. Wight, "Students with Learning Disabilities in the Foreign Language Learning Environment and the Practice of Exemption," *Foreign Language Annals* 48, no. 1 (2015): 48–50. Her review likewise does not provide specific instructional strategies for delivering input.

[276] Rhonda Joy and Elizabeth Murphy, "The Inclusion of Children with Special Educational Needs in an Intensive French as a Second-Language Program: From Theory to Practice," *Canadian Journal of Education* 35, no. 1 (2012): 102–19.

[277] Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 106.

used strategies such as music, drama, and easy to read books which children take home with them to deliver content. Teaching techniques such as scaffolding, modeling, repetition, and pictures for comprehension support were employed. Learning was cross-curricular, active, hands-on, and activity based, and students often worked in groups. Though no statistical data is available, they report that at the end of the program, "many students with (special educational needs) can do basic communication in the French language and have a positive attitude towards French," demonstrating the ability of children with learning disabilities to begin to acquire an L2, even in a short period of time, given the appropriate environment and instructional support.[278]

Two case studies highlight specific strategies which may help students with learning and/or intellectual disabilities learn L2 vocabulary in the FL context. Roberto Olmeda Casanova documented the effectiveness of music to help an eight-year-old Spanish-speaking child with DS learn vocabulary in English. In a targeted intervention outside of the FL classroom, the participant was introduced to vocabulary through songs and corresponding images. After six-weeks of treatment for thirty-minutes, three times a week, the student correctly identified 81 percent of the targeted items, suggesting that music with targeted vocabulary could be an effective strategy for teaching L2 vocabulary in the FL context to children with DS.[279]

Barwasser and colleagues implemented a strategy of storytelling, supplemented with vocabulary flash cards, and self-graphing score cards for participants to keep track of their learning.[280] The four seventh-grade girls with learning disabilities

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[278] Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 112.

[279] Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto Rico, 2012).

[280] Anne Barwasser, Turid Knaak, and Matthias Grünke, "The Effects of a Multicomponent Storytelling Intervention on the Vocabulary Recognition of Struggling English as a Foreign Language Learners with Learning Disabilities," *Insights into Learning Disabilities* 17, no. 1 (2020): 35–53.

examined in this study steadily improved in their vocabulary recognition throughout the duration of the intervention, with two participants correctly identifying all thirty words at the end of the intervention. After two weeks, the majority of the learned words had been retained by all four participants. While it is apparent that this combination of strategies was successful to aid the students in learning FL vocabulary, due to the nature of methodology, it is unclear which of these strategies contributed to the most learning. Though some research exists on instructional methods to support children with learning or intellectual disabilities in the FL classroom, much is lacking, and almost no research is geared specifically toward children with DS.

Factors in L2 Acquisition

This section will provide an overview of factors which affect L2 acquisition or correlate with L2 acquisition in children. Special attention will be given to the FL context as well as those factors which may have an augmented impact on individuals with DS due to their relationship to the developmental profile of individuals with DS. Factors which may affect L2 acquisition may be divided into those which are internal to the learner and those which are external. Internal factors pertinent to the FL context include age of onset (how old the child is when they begin learning the L2), short-term memory, nonverbal cognition, analytic reasoning, CA (as representing cognitive maturity) and knowledge of another language. External factors include input quantity, input quality, length of exposure to the language, outside exposure to the language, and social economic status.[281] Though all of the aforementioned factors play a role in L2 acquisition, the actual picture is quite complex. What follows is an overview of the most

[281] He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 551–52; Sharon Unsworth, Aafke Hulk, and Theodoros Marinis, "Internal and External Factors in Child Second Language Acquisition: Introduction," *Linguistic Approaches to Bilingualism* 1 (2011): 207; Johanne Paradis, "Individual Differences in Child English Second Language Acquisition: Comparing Child-Internal and Child-External Factors," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 214–18.

salient factors in child L2 acquisition, and those most pertinent to the DS population.

Though it is commonly thought that "the earlier the better" for FL learning, this notion is not entirely supported by research.[282] While an earlier start poses various potential benefits for L2 learning, older learners generally learn at a faster rate than younger learners and may reap greater benefits in the long run.[283] Jasone Cenoz found that with the same number of hours of FL instruction, late starters outperformed early starters in almost every measurement of English proficiency.[284] In their study between two cohorts, Jaekel and colleagues found that though the early start cohort initially outperformed the late start cohort, this gap eventually closed and at the final data collection the late start cohort outperformed the early start cohort on measures of reading and listening comprehension.[285] Many other studies reveal the advantages of L2 learning

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[282] Muñoz provides an extended chart which overviews the literature and shows vast discrepancies in results regarding age of onset in relation to L2 learning. Carmen Muñoz, "Age-Related Differences in Foreign Language Learning. Revisiting the Empirical Evidence," *International Review of Applied Linguistics in Language Teaching* 46 (2008): 210–17. Though somewhat outdated, Marinova-Todd and colleagues provide a helpful overview of literature which does not support the idea that older learners cannot successfully learn an L2. Marinova-Todd, Stefka H., D. Bradford Marshall, and Catherine E. Snow. "Three Misconceptions about Age and L2 Learning," *TESOL Quarterly* 34, no. 1 (2000): 9–34. See also Muñoz, "Symmetries and Asymmetries of Age Effects," 578–96.

[283] Nils Jaekel et al., "From Early Starters to Late Finishers? A Longitudinal Study of Early Foreign Language Learning in School," *Language Learning* 67, no. 3 (2017): 634, 649; Muñoz, "Symmetries and Asymmetries of Age Effects," 579.

[284] Jasone Cenoz, "The Influence of Age on the Acquisition of English: General Proficiency, Attitudes and Code-Mixing," in *Age and the Acquisition of English as a Foreign Language*, ed. María del Pilar García Mayo and María Luisa García Lecumberri (Bristol, UK: Multilingual Matters, 2003), 89. It should be noted that in the study conducted by Cenoz, learners were studying English as a third language. Lecumberri and Gallardo analyzed data from the same study as Cenoz and found similar advantages for later age of onset for English sound perception and pronunciation. María Luisa García Lecumberri and Francisco Gallardo, "English FL Sounds in School Learners of Different Ages," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 115–35. In a similar study of English as a third language among Catalan-Spanish speakers, Muñoz found that later age of onset did provide some advantages to oral skill development, though not unambiguously. Carmen Muñoz, "Variation in Oral Skills Development and Age of Onset," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 161–81. See also Carmen Muñoz, "The Effects of Age on Foreign Language Learning: The BAF Project," in *Age and the Rate of Foreign Language Learning*, ed. Carmen Muñoz, Second Language Acquisition 19 (Bristol, UK: Multilingual Matters, 2006), 1–40.

[285] Jaekel et al., "From Early Starters to Late Finishers?," 645–47.

afforded by later age of onset for both TD children and children with DLD.[286] Age may be an even more crucial factor for children with DLD learning a second language than TD children.[287] It should be taken into account, however, that the majority of these studies do not measure final L2 learning, which could result in differing outcomes.[288]

The later age of onset advantage may not be entirely attributable to age. As Jaekel and colleagues point out, "a crucial distinction needs to be made between age of onset and amount of exposure."[289] This distinction is especially important in the FL context, where exposure in the classroom is much more limited than the immersion or

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[286] See Sun et al., "Individual Differences," 561; María del Pilar García Mayo, "Age, Length of Exposure and Grammaticality Judgements in the Acquisition of English as a Foreign Language," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 94–114; Vasiliki Chondrogianni and Theodoros Marinis, "Differential Effects of Internal and External Factors on the Development of Vocabulary, Tense Morphology and Morpho-Syntax in Successive Bilingual Children," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 337; Simone E. Pfenninger and David Singleton, "Affect Trumps Age: A Person-In-Context Relational View of Age and Motivation in SLA," *Second Language Research* 32, no. 3 (2016): 311–45; Carmen Muñoz, ed. *Age and the Rate of Foreign Language Learning*. Second Language Acquisition, 19 (Bristol, UK: Multilingual Matters, 2006). In their investigation of FL learning in children with DLD, Tribushinina and colleagues found a later age of onset beneficial for vocabulary development, but not grammar. This may be due to the floor effect of L2 grammar development in the children with DLD, and further exposure to the language would be needed to determine the effects of age of onset. Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14. Though they do not have empirical data to support it, Zoutenbier and Zwitserlood suggest that a later age of onset is best for children with DLD so that they can have sufficient time to develop strong L1 skills. Zoutenbier and Zwitserlood, "Exploring the Relationship," 11.

[287] Elma Blom and Johanne Paradis, "Sources of Individual Differences in the Acquisition of Tense Inflection by English Second Language Learners with and without Specific Language Impairment," *Applied Psycholinguistics* 36, no. 4 (2015): 971–72.

[288] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood: Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese Children," *Neuroscience Research* 70, no. 2 (2011): 204; Pfenninger and Singleton, "Affect Trumps Age," 336. Muñoz notes the importance of this caveat, pointing out that final attainment is a very difficult thing to measure in the FL context. Muñoz, "Symmetries and Asymmetries of Age Effects," 583. One notable study which investigates effects of age of onset and attainment at the end of normal schooling found that an early age of onset does not necessarily result in higher performance. Other crucial factors in attainment are the type of learning and amount and intensity of input. Simone E. Pfenninger, "The Misunderstood Variable: Age Effects as a Function of Type of Instruction," *Studies in Second Language Learning and Teaching* 4, no. 3 (2014): 529–56.

[289] Jaekel et al., "From Early Starters to Late Finishers?," 633.

naturalistic setting.[290] For example, Ojima and colleagues found that any advantage of an earlier age of onset in FL learning disappeared after controlling for hours of exposure to the L2, noting that "longer hours of exposure," rather than an earlier age of onset, "led to significantly higher English proficiency."[291] Similarly, Mihaljević Djigunović and colleagues compared a cohort of Hungarian students studying English as a FL to their Croatian peers and found that though the Hungarian cohort had an earlier age of onset, they failed to outperform the Croatian cohort, despite more frequent teaching times and smaller class size. This seeming anomaly may be accounted for by poorer quality of English language instruction and less quality outside exposure to the language experienced by the Hungarian cohort. The authors conclude that factors such as an early start cannot guarantee better outcomes, and other crucial variables like instruction quality and exposure to the language must be taken into account.[292] Muñoz summarizes the findings related to age of onset and exposure to the language well when she states that "an early start leads to success *but only provided that it is associated with enough*

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[290] Jaekel et al., "From Early Starters to Late Finishers?," 634; Ojima et al., "Age and Amount of Exposure," 203; María del Pilar García Mayo and María Luisa García Lecumberri, introduction to *Age and the Acquisition of English as a Foreign Language*, vii. For a thorough analysis of the difference between a naturalistic L2 learning setting and the FL setting, and its implications for age of onset see 578–96. Muñoz clarifies that the "influence of age of L2 learning may be moderated by the learning context." Muñoz, "Revisiting the Empirical Evidence," 199.

[291] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood: Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese Children," *Neuroscience Research* 70, no. 2 (2011): 203.

[292] Jelena Mihaljević Djigunović, Marianne Nikolov, and István Ottó, "A Comparative Study of Croatian and Hungarian EFL Students," *Language Teaching Research* 12, no. 3 (2008): 433–52. For similar conclusions regarding other important factors besides age see David Singleton, "Critical Period or General Age Factor(s)?," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 3–22, especially the conclusion. See also Jonathan Leather, "Phonological Acquisition in Multilingualism," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 23–58, in specific relation to phonology and Stefka H. Marinova-Todd, "Know your Grammar: What the Knowledge of Syntax and Morphology in an L2 Reveals about the Critical Period for Second/Foreign Language Acquisition," in García Mayo and García Lecumberri, *Age and the Acquisition of English*, 59–73, in relation to grammar.

significant exposure."[293]

While ample evidence exists of the many advantages in L2 learning for late starters, this does not necessarily imply that children should begin learning an L2 at a later age, as L2 exposure poses many other benefits to children. Carolyn and Lafayette found that those students participating in a FL program outperformed their peers on all academic measurements.[294] Thus, age of onset is simply one of many factors to be considered in L2 learning. In fact, an earlier age of onset may be one of the most effective ways to increase hours of exposure, potentially more important to L2 acquisition than age of onset.[295]

Length of exposure is a crucial factor for successful L2 acquisition, and it seems that "the longer the exposure to the L2, the more native-like L2 performance becomes."[296] However, length of exposure alone is not always sufficient. As demonstrated in previously mentioned studies, also crucial are frequency, quantity, and quality of exposure.[297] Sun and colleagues found external factors, particularly quantity of input, to be a more significant predictor of L2 vocabulary in the FL context than internal factors such as age of onset or short-term memory in a TD population.[298] Anne Vermeer

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[293] Muñoz, "Symmetries and Asymmetries of Age Effects," 591. For a salient example, see Pfenninger, "The Misunderstood Variable," 529–56.

[294] Carolyn Taylor and Robert Lafayette, "Academic Achievement through FLES: A Case for Promoting Greater Access to Foreign Language Study among Young Learners," *The Modern Language Journal* 94, no. 1 (2010): 22–42.

[295] Ojima et al., "Age and Amount of Exposure," 204. See also Jaekel et al., "From Early Starters to Late Finishers?," 635.

[296] García Mayo, "Age, Length of Exposure and Grammaticality Judgements," 103. See also Chondrogianni and Marinis, "Differential Effects of Internal and External Factors," 338–39.

[297] Muñoz, "Symmetries and Asymmetries of Age Effects," 584; Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 1–21.

[298] Sun et al., "Individual Differences," 560. See also Ojima et al., "Age and Amount of Exposure," 197–205. Graham and colleagues found quantity of exposure to the language in the classroom

found that vocabulary acquisition is "strongly related to the frequency of language input," so much so that frequency of input, whether written or oral, "(explains) half the variance or more."[299] Repetition of words has a significant effect on acquisition, and incidental acquisition of novel vocabulary words in an L2 requires multiple exposures to the word, somewhere between ten to twenty or even more.[300]

Closely related to quantity of exposure is quality of exposure, or what Paradis refers to as the "richness of the (L2) environment."[301] While the quality of L2 input can vary in any situation, the variation in the FL classroom is especially salient, and can considerably impact L2 acquisition. Kersten and colleagues found that teacher behavior, as measured by quantity and quality of verbal input, had a significant effect on learners' grammar comprehension.[302] Quality of classroom input is highly dependent upon teacher fluency, and teacher fluency in the language is an important factor in student L2 learning, especially grammar, though it can affect vocabulary development as well.[303]

(teaching time) to be especially important in the elementary years. Suzanne Graham et al., "Early Language Learning: The Impact of Teaching and Teacher Factors," *Language Learning* 67, no. 4 (2017): 950. Cumulative exposure, not age of onset, was also found to be a key factor in L2 vocabulary development of sequential bilinguals with DLD, a population often compared individuals with DS for language development. Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *International Journal of Language & Communication Disorders* 56, no. 1 (2021): 102–16.

[299] Anne Vermeer, "Breadth and Depth of Vocabulary in Relation to L1/L2 Acquisition and Frequency of Input," *Applied Psycholinguistics* 22, no. 2 (2001): 230.

[300] Stuart Webb, "The Effects of Repetition on Vocabulary Knowledge," *Applied Linguistics* 28, no. 1 (2007): 60; Rob Waring and Misako Takaki, "At What Rate do Learners Learn and Retain New Vocabulary from Reading a Graded Reader?," (2003): 150–51.

[301] Paradis, "Individual Differences in Child English Second Language Acquisition," 230. Paradis found that both quantity and quality of exposure are important factors in child L2 acquisition.

[302] Kristin Kersten et al., "Quality of L2 Input and Cognitive Skills Predict L2 Grammar Comprehension in Instructed SLA Independently," *Languages* 6, no. 3 (2021): 1–19.

[303] Graham et al., "Early Language Learning," 951; Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 527–48; Kees deBot, "The Effectiveness of Early Foreign Language Learning in the Netherlands," *Studies in Second Language Learning and Teaching* 4, no. 3 (2014): 414.

Significant exposure to the language can occur not only in the classroom, but outside the classroom. Outside exposure to input has been found to be a notable factor in L2 acquisition.[304] Though outside exposure to the L2 does seem to play a significant role in L2 acquisition, not all types of exposure are equally beneficial. A study by Muñoz and colleagues of elementary-aged L2 learners found that while audiovisual material was a significant factor in L2 acquisition, especially receptive grammar, playing videogames and listening to music did not affect L2 acquisition.[305] Just as in classroom input, both the quantity and quality of outside exposure makes a difference in L2 acquisition.

While various internal and external factors correlate with L2 acquisition in any population, such as those discussed above, three learner internal factors are particular of interest for the purposes of this study due to their atypical development in individuals with DS: nonverbal cognition, VSTM, and L1 vocabulary. Nonverbal cognition has been found to correlate with L2 development in the TD population, and may be especially important in the beginning stages of L2 acquisition.[306] For example, Sun and colleagues found that nonverbal cognition was a significant predictor of L2 receptive grammar.[307] While not as strong as grammar, nonverbal cognition also influences L2 vocabulary development.[308] Though nonverbal cognition does affect L2 development, it "may not be

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[304] Sun et al., "Individual Differences," 560; Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 120–21; Muñoz, "Contrasting Effects of Starting Age," 14–15.

[305] Muñoz, Cadierno, and Casas, "Different Starting Points," 1076–109. Similar findings were found by Lindgren and Muñoz. Lindgren and Muñoz, "The Influence of Exposure," 122.

[306] Jaekel et al., "From Early Starters to Late Finishers?," 652.

[307] Sun et al., "Individual Differences," 560–61. See also Kersten et al., "Quality of L2 Input," 12.

[308] Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 61. Paradis found that nonverbal IQ was a significant predictor of both vocabulary and verb morphology (grammar). Paradis, "Individual Differences in Child English Second Language Acquisition,"

specific enough in what it measures to be predictive of children's language learning outcomes as reliably as a true language aptitude test."[309]

One key component of language aptitude is verbal memory.[310] Verbal short-term memory (VSTM), also known as phonological short-term memory (PSTM), is an individual's ability to recall spoken information.[311] VSTM seems to be a foundational component for FL acquisition, though its precise relationship to the various components of L2 learning is still under investigation.[312] Research clearly supports the notion that VSTM correlates with L2 vocabulary acquisition in TD populations in both the classroom context and naturalistic contexts.[313] More specifically, VSTM seems to play a "crucial role" in "the initial stages of learning vocabulary in a new language," especially when

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[309] Golberg, Paradis, and Crago, "Lexical Acquisition over Time," 61.

[310] Paradis, "Individual Differences in Child English Second Language Acquisition," 214.

[311] Jarrold and Baddeley, "Short-Term Memory in Down Syndrome," 17.

[312] Lia Efstathiadi, "Early Foreign Language Learning: Intensive Exposure, Vocabulary Development and the Cognitive Skills Involved," *Belgrade English Language and Literature Studies* 11, no. 1 (2019): 96; Thomai Alexiou, "Young Learners' Cognitive Skills and their Role in Foreign Language Vocabulary Learning," in *Early Learning of Modern Foreign Languages: Processes and Outcomes*, ed. Marianne Nikolov (Bristol, UK: Multilingual Matters, 2009), 55–56. Of the five internal factors investigated, Paradis found that PSTM was the "strongest predictor for both vocabulary and verb morphology." Paradis, "Individual Differences in Child English Second Language Acquisition," 229.

[313] For VSTM and acquisition in the L2 classroom context see Unsworth et al., "An Investigation of Factors," 543; Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 664–67; Pascale M. J. Engel de Abreu and Susan E. Gathercole, "Executive and Phonological Processes in Second-Language Acquisition," *Journal of Educational Psychology* 104, no. 4 (2012): 981–82; Leif Michael French, *Phonological Working Memory and Second Language Acquisition: A Developmental Study of Francophone Children Learning English in Quebec* (Lewiston, N.Y.: Edwin Mellen Press, 2006), 90–108, 113–116; and Elvira V. Masoura and Susan E. Gathercole, "Contrasting Contributions of Phonological Short-Term Memory and Long-Term Knowledge to Vocabulary Learning in a Foreign Language," *Memory* 13, no. 3–4 (2005): 422–29. For VSTM and acquisition in the naturalistic L2 context see Josje Verhagen and Paul Leseman, "How do Verbal Short-Term Memory and Working Memory Relate to the Acquisition of Vocabulary and Grammar? A Comparison between First and Second Language Learners," *Journal of Experimental Child Psychology* 141 (2016): 65–82.

that language is highly unfamiliar to the learner.[314] However, not all research supports this claim. Kormos and Sáfár found almost no relationship between PSTM as measured by nonword repetition tasks and L2 skills in beginning language learners, while they found significant correlations between nonword repetition scores and composition task (composed of vocabulary and grammatical accuracy) in pre-intermediate learners. While this may seem contrary to the findings presented above, no direct measure of L2 vocabulary acquisition was conducted. Additionally, the majority of the L2 instruction received by the students was explicit grammar and vocabulary memorization and practice rather than more implicit methods.[315] Additionally, Efstathiadi found that while PSTM played a crucial role in L2 vocabulary acquisition, central executive working memory was a stronger predictor of comprehension and production than was PSTM in early stages of L2 acquisition.[316]

While it seems evident that VSTM correlates with vocabulary development in L2 learners, its direct influence on grammar is less clear.[317] Several studies have found that VSTM predicts grammar development in the L2, especially as mediated by L2

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[314] Masoura and Gathercole, "Contrasting Contributions," 427. See also Engel de Abreu and Gathercole, "Executive and Phonological Processes," 982; French, *Phonological Working Memory*, 121–27; Elvira V. Masoura and Susan E. Gathercole, "Phonological Short-Term Memory and Foreign Language Learning," *International Journal of Psychology* 34, no. 5–6 (1999): 386; Elisabet Service and Viljo Kohonen, "Is the Relation between Phonological Memory and Foreign Language Learning Accounted for by Vocabulary Acquisition?," *Applied Psycholinguistics* 16, no. 2 (1995): 155–72.

[315] Judit Kormos and Anna Sáfár, "Phonological Short-Term Memory, Working Memory and Foreign Language Performance in Intensive Language Learning." *Bilingualism: Language and Cognition* 11, no. 2 (2008): 261–71.

[316] Efstathiadi, "Early Foreign Language Learning," 97.

[317] Despite the robust evidence that VSTM supports L2 vocabulary, French and O'Brien found very little connection between phonological memory and L2 vocabulary development in a five-month intensive L2 learning program, with phonological memory exerting only a slight influence on productive vocabulary development and no influence on receptive vocabulary after controlling for initial vocabulary abilities. Leif M. French and Irena O'Brien, "Phonological Memory and Children's Second Language Grammar Learning," *Applied Psycholinguistics* 29, no. 3 (2008): 478. However, "there was a significant relationship between phonological memory and lexical knowledge on entry into the study" (476).

vocabulary, though not all studies have demonstrated such robust links.[318] However, emerging evidence seems to indicate that VSTM correlates to L2 grammar, even when controlling for L2 vocabulary knowledge. This holds true in both instructed L2 learning and in a naturalistic L2 setting.[319]

Children with DS have deficits in VSTM, and these deficits seem to negatively affect their L1 development. Verhegan and Leseman found that "VSTM . . . (affects) L1 and L2 learning similarly" and suggest that this may "have implications for L2 children with poor verbal memory skills."[320] Thus, VSTM may thus serve as a useful predictor for FL vocabulary acquisition in children with DS. However, due to a lack of research among children with DS and populations with other memory impairments this claim has yet to be substantiated and would be an important topic for future research.[321]

The final factor of L2 acquisition of pertinence to this study is the relationship between L1 skills and L2 acquisition. Broadly speaking, L1 skills have been shown to correlate with L2 proficiency.[322] Sparks and colleagues found that measures of L1 skills

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[318] For studies demonstrating that VSTM predicts L2 grammar development mediated by L2 vocabulary see Verhagen and Leseman, "Verbal Short-term Memory and Working Memory," 65–82; French, *Phonological Working Memory*, 110–12, 128–30; Elisabet Service, "Phonology, Working Memory, and Foreign-Language Learning," *The Quarterly Journal of Experimental Psychology Section A* 45, no. 1 (1992): 21–50; Service and Kohonen, "Relation between Phonological Memory and Foreign Language Learning," 155–72. Paradis found a clear link between PSTM and verb morphology. However, vocabulary was not controlled for, therefore it is not possible to determine whether this effect was unmediated by L2 vocabulary. Paradis, "Individual Differences in Child English Second Language Acquisition," 229; Josje Verhagen, Paul Leseman, and Marielle Messer, "Phonological Memory and the Acquisition of Grammar in Child L2 Learners," *Language Learning* 65, no. 2 (2015): 420. Engel de Abreu and Gathercole found that PSTM was related to L2 grammar as mediated by L2 vocabulary. However, after controlling for SES an L1 vocabulary, this link no longer remained. Engel de Abreu and Gathercole, "Executive and Phonological Processes," 981–82.

[319] For instructed L2 learning see French and O'Brien, "Phonological Memory and Children's Second Language," 476–77. For a naturalistic L2 setting see Verhagen, Leseman, and Messer, "Phonological Memory and the Acquisition of Grammar," 440–41.

[320] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

[321] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

[322] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2

in elementary school correlated with L2 aptitude in high school and suggest that "L1 skills may be an important source of individual differences among L2 learners."[323] In children with DLD, relationships between L1 and L2 seem to increase as the child increases in proficiency in both languages, and the relationship seem stronger for receptive skills. Additionally, relationships between L1 and L2 appear to be stronger in TD children than in children with DLD.[324]

L1 vocabulary may have a particular influence on L2 development. L1 vocabulary is positively linked to L2 listening comprehension, L2 phonological awareness, and L2 vocabulary acquisition.[325] Additionally, L1 vocabulary is especially important in developing L2 reading skills.[326] Though receptive vocabulary is a relative strength in individuals with DS, their L1 vocabulary levels are generally below that of their TD peers, thus L1 vocabulary, as well as their overall L1 language skills, could affect their L2 development.

Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Richard Sparks et al., "Long-Term Crosslinguistic Transfer of Skills from L1 to L2," *Language Learning* 59, no. 1 (2009): 203–43.

[323] Sparks et al., "Long-Term Crosslinguistic Transfer," 226–27.

[324] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14–15.

[325] For listening comprehension see Vandergrift and Baker, "Learner Variables in Second Language Listening," 407. For phonological awareness see Brenda K. Gorman, "Relationships between Vocabulary Size, Working Memory, and Phonological Awareness in Spanish-Speaking English Language Learners," *American Journal of Speech-Language Pathology* 21 (2012): 117. For L2 vocabulary development see Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50, and Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 1–13.

[326] Tong Li et al., "Longitudinal Predictors of Spelling and Reading Comprehension in Chinese as an L1 and English as an L2 in Hong Kong Chinese Children," *Journal of Educational Psychology* 104, no. 2 (2012): 295–99; C. Patrick Proctor et al., "The Intriguing Role of Spanish Language Vocabulary Knowledge in Predicting English Reading Comprehension," *Journal of Educational Psychology* 98, no. 1 (2006): 165–67.

Many factors, both internal and external, work together to affect L2 acquisition. Some of these factors, such as nonverbal cognition and VSTM, may be especially salient in children with DS in the FL context. Much research is needed to investigate these topics.

CHAPTER 3

METHODOLOGICAL DESIGN

This chapter describes the procedures and methods used in the present study to assess the lexical development of Spanish as a second language in the FL context in children with DS and participation of children with DS in the FL classroom. Included are the purpose statement, research questions, design overview, research population, research delimitations, limits of generalization, instrumentation, and procedures.

Purpose Statement

The purpose of this study was to describe the participation of elementary-aged children with Down syndrome in a six-week foreign language class and to measure the receptive and expressive lexical acquisition of Spanish as a foreign language in students with Down syndrome.

Research Question Synopsis

The research questions explored two major categories: participation of students with Down syndrome in the foreign language classroom and the initial stages of second language acquisition in children with Down syndrome.

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?

d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?

e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?

2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?

3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which of the following variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome? The variables of interest are chronological age, nonverbal cognition, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education.

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Design Overview

This research utilized an exploratory mixed methods multiple case study design. A mixed methods multiple case study design was employed to develop an enhanced understanding of initial second language acquisition in children with DS through the collection of both quantitative and qualitative data and the analysis of multiple cases.[1] The method of case studies is applicable, since there is very little research conducted on the nature of second language acquisition in individuals with DS, especially in the FL context.[2] In line with the exploratory mixed methods research design this study consisted of three main phases: qualitative, instrumentation development, and a

[1] John W. Creswell and Vicki L. Plano Clark, *Designing and Conducting Mixed Methods Research*, 3rd ed. (Los Angeles: SAGE, 2018), 116.

[2] Paul D. Leedy and Jean Ellis Ormrod, *Practical Research: Planning and Design*, 11th ed. (New York: Pearson, 2016), 254; Sue Buckley recommends case studies as a starting point for researching L2 acquisition in children with DS. Sue Buckley, "Can Children with Down Syndrome Learn More than One Language?," *Down Syndrome News and Update* 2, no. 3 (2002): 100.

quantitative assessment including implementation of the instrumentation.[3] The quantitative data of those students participating in the case studies was combined with their qualitative data to provide a fuller and more complete description of the initial stages of L2 acquisition in the FL context in children with DS through "the generation of . . . multiple cases."[4] Additionally, the quantitative data on all participants, not just those participating in the case studies, was analyzed to compare the receptive and expressive lexical acquisition of children with DS, to determine which variables correlate with L2 acquisition in children with DS in the FL context, and to determine the impact of participation in the FL classroom on L1 vocabulary development.

Phase One: Qualitative

The first phase of an exploratory mixed methods research design involves the "collection and analysis of qualitative data."[5] The first phase of the present study consisted of two primary components: implementation of an intervention, that is, teaching Spanish to children with DS, and multiple case studies of children with DS who were participating in the Spanish FL classroom. Prior to the intervention, all participants were given three categories of assessments: nonverbal intelligence, English vocabulary, and a measurement of verbal short-term memory (VSTM). These assessments served to develop a profile for each participant and serve as a predictor measure for how participants may differ in their acquisition of Spanish.[6] L1 control group participants were also administered a battery of tests measuring nonverbal intelligence and English

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[3] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[4] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 106.

[5] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[6] Elena Tribushinina, Elena Dubinkina-Elgart, and Nadezhda Rabkina, "Can Children with DLD Acquire a Second Language in a Foreign-Language Classroom? Effects of Age and Cross-Language Relationships," *Journal of Communication Disorders* 88 (2020): 10.

vocabulary.

The intervention lasted for six weeks, during which time all participants attended Spanish class every day, Monday through Friday, for forty-five minutes. The six weeks was divided into two three-week sessions, with a week of no class in-between. An intensive class may be more appropriate for children with DS, as opposed to meeting once a week over an extended period of time, since frequency is a crucial factor in L2 learning for children with DS.[7] The classes took place in a classroom at Down Syndrome of Louisville (DSL), an organization in Louisville, KY which provides "comprehensive, specialized developmental and educational services for individuals with Down Syndrome."[8] The classes took place during the six-week academic enrichment summer camp held at DSL, and were part of the camp curriculum. I taught the Spanish classes, while the regular classroom teachers served as assistants during Spanish class. Each class had three classroom teachers, resulting in an average ratio of one assistant per three to four children. Assistants were trained before classes began on their role and proper protocol in Spanish class.

There were three distinct classes which served different age groups and developmental levels: lower, middle, and upper. Class placements were based upon a complex mixture of factors including CA, grade completed, academic needs and abilities, and needed behavioral support.[9] Each class had between six to nine students, though the number varied between sessions one and two. Instruction in the class took place in Spanish, while English was utilized mainly for classroom management, and to establish

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[7] Elizabeth Kay-Raining Bird, "The Case for Bilingualism in Children with Down Syndrome," in *Language Disorders from a Developmental Perspective*, ed. Rhea Paul (Mahwah, NJ: Lawrence Erlbaum Associates, 2007), 267.

[8] Down Syndrome of Louisville, "Our Local Service Area," accessed March 9, 2022, https://dsoflou.org/about-us/our-local-service-area/.

[9] Class placement decisions were made by staff at DSL.

meaning of the Spanish language when necessary. The curriculum was based upon principles of communicative language teaching, in which "meaningful communication and language use (is the) focus of all classroom activities."[10] Rather than focusing on the formal properties of the language through the study of grammar, with an emphasis on translation and memorization, the focus of instruction was on communication using the L2. The primary means of instruction was through story listening, acting out the stories, Total Physical Response (TPR), music, and games.[11] The stories told in class were made into picture books and sent home with the students each time a new story was presented in class. Parents were encouraged to read the books with their children at home, but not required. Each book had a QR code linked to a recording of me reading the book so that those that do not read in Spanish could follow along with their children at home.[12]

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[10] Jack C. Richards and Richard W. Schmidt, *Longman Dictionary of Language Teaching and Applied Linguistics*, 4th ed. (London: Pearson, 2013), 99.

[11] Story listening is a strategy in which the teacher tells a story in the target language, making it comprehensible through pictures, drawings, gestures, and limited use of the L1. Beniko Mason et al., "The Effects and Efficiency of Hearing Stories on Vocabulary Acquisition by Students of German as a Second Foreign Language in Japan," *Indonesian Journal of English Language Teaching* 5, no. 1 (2008): 4. TPR is a strategy in which students hear a command or action spoken in the target language, see it modeled, then perform the action themselves. James J. Asher, "The Total Physical Response Approach to Second Language Learning," *The Modern Language Journal* 52, no. 1 (1969): 4. In their review on age-related factors and FL learning, Marianne Nikolov and Jelena Mihaljević Djigunović recommend that given the time and input constraints of the elementary FL classroom and the cognitive profiles of young children, FL teaching in the elementary classroom should mimic as much as possible "natural" language learning. Marianne Nikolov and Jelena Mihaljević Djigunović, "Recent Research on Age, Second Language Acquisition, and Early Foreign Language Learning," *Annual Review of Applied Linguistics* 26 (2006): 242. The strategies employed in the Spanish intervention were intended to use the language in a way which children would naturally use language, through stories, music, games, action, and play.

[12] The methods of teaching used in the intervention align well with those described by Joy and Murphy in their study of eight grade-six inclusive intensive French as a second language classes. These classes, which included children with special education needs, including at least one with DS, used strategies such as music, drama, and easy to read books which children take home with them, all of which were used in my class. Teaching techniques such as scaffolding, modeling, and pictures for comprehension support were also be employed. As in the classes described by Joy and Murphy, the goal of my class was for "students (to learn) without knowing that they're learning . . . having fun and learning at the same time." Joy and Murphy, "The Inclusion of Children with Special Educational Needs," 111. In the post intervention interviews, one teacher commented that the student has a positive experience because "Teaching (was) through playful activities or fun stories," and that the child "wanted to do it because it was fun and didn't realize that he was being taught something." Additionally, Barwasser and colleagues found

During the intervention phase, four children took part in a case study. Multiple sources of information aided in providing a fuller picture of each child's acquisition and their experience in the class.[13] Data for the case studies was collected through video recording, observation and journaling, and surveys and interviews. Classes were video recorded so that I could accurately record the habits of participation and evidence of acquisition of the Spanish language as demonstrated in the classroom of those students participating in the case studies.[14] I also kept an electronic journal in which I recorded my thoughts and observations classes, particularly of the children participating in the case studies. The assistants provided their feedback through daily journaling, for which I provided the prompts, a survey after the first three weeks and a survey and interview at the end of the course. Finally, parents provided feedback concerning their child's attitude and use of Spanish outside of the classroom through a survey after the course. In addition, at the end of the intervention parents of all participants were given a brief survey to document their child's out-of-class exposure to Spanish. Case study journal observation questions, mid- and post-intervention assistant survey and interview questions, and the post-intervention parental survey can be found in appendices eight through eleven.

Phase Two: Instrumentation Development

The second phase of an exploratory mixed methods research design is intended

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that storytelling is an effective strategy to teach vocabulary to students with learning disabilities. Barwasser, Knaak, and Grünke, "The Effects of a Multicomponent Storytelling Intervention," 35–53. Olmeda Casanova found music to be an effective strategy to teach FL vocabulary to a child with DS. Roberto Olmeda Casanova, "The Effect of Using Music as a Socio-Affective Strategy to Teach English to a Second Grade Down Syndrome Student" (EdD diss., University of Puerto Rico, 2012).

[13] Leedy and Ormrod, *Practical Research*, 253–54.

[14] Participation was received from all parents of students participating in the classes, both intervention and non-intervention participants to be recorded for the purposes of data collection.

to serve as a bridge between the qualitative data and quantitative data collection. In phase two the researcher typically creates an instrument based off of the qualitative data collected in phase one in order to collect quantitative data in the third phase.[15] The purpose of such instrumentation development is to base the quantitative feature on "the culture or setting of participants rather than (pulling it) 'off the shelf' for use. With the culture-specific development of the measure or instrument, the likelihood increases that it will be seen as relevant to the group being studied."[16]

Such a "culture-specific" instrumentation was needed in this context to truly capture the acquisition of the participants in the class, and is not without precedent. In their study of FL acquisition of children with Developmental Language Disorder, Tribushinina and colleagues found that standardized tests did not truly capture "the material that the children were directly exposed to in their English lessons and may not have been sensitive enough to measure growth in this population." They thus recommend that future studies develop assessments which "directly (address) the material covered (in the) lessons."[17] In their study of FL acquisition of children with special needs, Peker and Regalla administered an assessment of L2 vocabulary based upon each thematic unit, though they used no standardized measurement of L2 language acquisition.[18] Though not in the context of children with special needs, Nicolay and Poncelet administered tests of L2 vocabulary designed to "directly probe the vocabulary learned at school" for immersion students at the end of kindergarten and first grade, while they administered

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[15] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[16] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 84.

[17] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

[18] Hilal Peker, and Michele Regalla, "Making Exemption the Exception, Not the Rule: Inclusion of All Students in Foreign Language Education," *Foreign Language Annals* 54, no. 1 (2021): 80.

standardized tests at the end of second grade.[19]

Thus, during the second phase of this study, I developed instrumentation with which to assess the Spanish lexical acquisition of all participants in the class. I developed one instrument to assess receptive lexical acquisition and one instrument to assess expressive lexical acquisition. This instrumentation was modeled off of standardized instrumentation used in other studies to assess lexical acquisition of Spanish but used vocabulary from the class curriculum. Thus, while the format of the assessments was similar to that of standardized assessments commonly used in the field of language acquisition, the content of the assessments was tailored to the input participants had received in the class. The development of my own instrumentation is in line with a three-phase exploratory mixed methods design "in which the researcher first begins by exploring with qualitative data and analysis, then builds a feature to be tested . . . and tests this feature in a quantitative third phase."[20] While instrumentation development typically occurs after the completion of phase one, due to the short nature of the course (six weeks), instrumentation development took place simultaneously with the course, based on the planned curriculum.

Phase Three: Quantitative Assessment

The third phase of an exploratory mixed methods design is that in which quantitative data is gathered though the implementation of the instrumentation created in phase two.[21] The quantitative portion of this study assessed the receptive and expressive lexical development in Spanish of the intervention participants. For each domain

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[19] Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 661–62.

[20] John W. Creswell and J. David Creswell, *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches,* 5th ed. (Los Angeles: SAGE, 2017), 224.

[21] Creswell and Plano Clark, *Designing and Conducting Mixed Methods,* 87.

(receptive and expressive) I administered a standardized test and my own instrumentation which I developed in the second stage. The use of standardized tests will allow the research to be replicated in future studies and allows for a more standardized comparison. However, since the development of my own instrumentation "(captured) the material that the children were directly exposed to" in class, it "may reveal better performance and give a wider range of performance" than what can be captured through the standardized assessments.[22] Results from these assessments were analyzed to compare the Spanish receptive and expressive lexical development of the intervention participants and to determine which variables correlate to L2 acquisition in children with DS in the FL context. The qualitative and quantitative data was then combined to provide an overall language acquisition profile of each child who participated in the case studies.

Additionally, in this phase all participants, including the L1 control group of students with DS, were administered English vocabulary assessments to measure their L1 vocabulary. The results of the post-intervention English vocabulary assessments were compared to the pre-intervention English vocabulary assessments to measure any change in participants' L1 vocabulary skills. The results of these assessments helped to answer the question of the impact of participation in the FL classroom on the L1 development of children with DS and were also included in the overall language acquisition profile of the case study participants.[23]

Research Population and Sample

The research population is monolingual English-speaking children with DS. The research sample consisted of eleven (kindergarten–sixth grade) monolingual English-

[22] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

[23] In the final analysis, the L1 control group data was not considered, to be discussed further in chapter five. However, I have retained in my explanation information regarding the participation and assessment of the L1 control since I gathered data on them with the intention of utilizing it.

speaking children with DS attending the summer academic enrichment camp at DSL. With one exception, these intervention participants had no significant prior exposure to the Spanish language, nor were they enrolled in any other type of Spanish language learning class for the duration of the study. One participant had participated in a schoolyear of Spanish classes two years prior but did not seem to recall any Spanish during pre-intervention assessments. All intervention participants had a diagnosis of DS, as reported by a parent or guardian, and had not experienced a traumatic brain injury. Though children with autism spectrum disorder might typically be excluded from such a study since autism is a confounding factor for language development, due to multiple participants with a dual diagnosis of DS and autism, two children with autism were included in the class and data collection. However, their data will be analyzed separately in a subsequent study. All participants were reported to have no more than mild hearing loss. Though hearing loss affects language acquisition, to exclude all participants with hearing loss may have excluded a large portion of the DS population and would thus not be representative of the DS population.[24] Intervention participant ages, grades, nonverbal cognition scores, and Spanish class attended can be seen in table A1 in appendix 18.

Each of the three classed consisted of six to nine students with DS, though not all students in the class participated in data collection. Contrary to the typical practice of a three-phase exploratory mixed methods research design in which separate research participants are used in phase one than in phase three, the same participants participated in both the qualitative and quantitative portions of the study. While the exploratory mixed methods design typically uses random sampling in the quantitative phase so as to "objectively generalize the results to a population," this research necessitated that those students who participated in the class, based off of which the instrumentation will be

[24] For similar criterion see Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 102–103.

formed, be the same participants who received the assessment.[25] Thus, the reasons for using different populations in the quantitative and qualitative phases of the study offered in the literature are not applicable in this study.[26]

The research sample of children with DS was recruited primarily through DSL, and were not drawn from one school, but from all over the greater Louisville metro area. All intervention participants also attended the summer academic enrichment camp at DSL. Of those children that participated in the Spanish intervention one or two per class were part of the multiple case study, for a total of four case studies.[27] Before the start of classes, a general invitation was extended to parents of all intervention participants for their child to participate in a case study. They were provided with an information sheet which outlined what would be required of them and their child for the child to participate in the case study. In order to secure a sufficient number of case studies, follow-up invitations were extended via email to parents of select students. These invitations were based upon classroom placement, and pre-intervention nonverbal cognition and L1 vocabulary scores, with the intention of having at least one case study per class representing a variety of cognitive and linguistic abilities.

Additionally, as the Spanish classes were part of the curriculum of the academic enrichment summer camp at DSL, all participants of the camp attended the Spanish intervention, though not all chose to participate in the data collection. Parents of participants at the summer camp were given the option for their student not to attend

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[25] Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 193.

[26] See Creswell and Creswell, *Research Design*, 225; Creswell and Plano Clark, *Designing and Conducting Mixed Methods*, 192–93.

[27] The number of intervention participants far exceeded the recommended number of participants for a multiple case study. While everyone's data was included in the quantitative assessment of language acquisition, it was not feasible to conduct an in-depth case study of every participant in the study. John Creswell and Cheryl Poth offer four to five cases as the norm for multiple case studies. John W. Creswell and Cheryl N. Poth, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (Los Angeles: SAGE, 2016), 161.

Spanish class, though all agreed for their child to participate. Agreement to participate forms were collected from all camp participants. Finally, a separate control group of three monolingual English-speaking children with DS who did not participate in the Spanish intervention class were recruited for the purposes of investigating research question number five (English vocabulary). The majority of the English vocabulary control group participants were recruited through direct recommendation by my contacts at DSL. Contacts at local churches and homeschool communities were also used to recruit L1 control group participants and pilot test participants. Pilot test participants consisted of thirteen monolingual English-speaking kindergarten through fifth grade TD children, four monolingual English-speaking children with DS (first through fifth grades), and one child with DS (fourth grade) whose L1 was Spanish.

Research Delimitations

This study assessed the receptive and expressive lexical acquisition of elementary-aged children with DS. The focus of this study was lexical acquisition, as measurement of vocabulary is a meaningful assessment of language acquisition.[28] Moreover, vocabulary development may be especially important for syntactic development in individuals with intellectual disability such as DS, thus measuring

[28] Batia Laufer and Zahava Goldstein note that "tests of vocabulary size have been shown to predict success in reading, writing, and general language proficiency as well as academic achievement." Batia Laufer and Zahava Goldstein, "Testing Vocabulary Knowledge: Size, Strength, and Computer Adaptiveness," *Language Learning* 54, no. 3 (2004): 401–402. See also Beatriz González-Fernández and Norbert Schmitt, "Vocabulary Acquisition," in *The Routledge Handbook of Instructed Second Language Acquisition*, ed. Shawn Loewen and Masatoshi Sato, Routledge Handbooks in Applied Linguistics (New York: Routledge, 2017), 280. J. Charles Alderson contends that vocabulary is a useful measure of language proficiency, especially a knowledge of low-frequency words. J. Charles Alderson, "Judging the Frequency of English Words," *Applied Linguistics* 28, no. 3 (2007): 384. For the necessity of vocabulary for reading in L2 see Batia Laufer, "The Lexical Plight in Second Language Reading: Words You Don't Know, Words You Think You Know, and Words You Can't Guess," in *Second Language Vocabulary Acquisition: A Rationale for Pedagogy*, ed. James Coady and Thomas Huckin (Cambridge: Cambridge University Press, 1997), 20–34. For vocabulary and academic achievement see Muriel Saville-Troike, "What Really Matters in Second Language Learning for Academic Achievement?," *TESOL Quarterly* 18, no. 2 (1984): 199–219.

vocabulary development is a reasonable first step to measuring initial language acquisition.[29] Given the limited exposure that students were to have to the language during the study, it was speculated that vocabulary production would likely be minimal.[30] Though some may have deemed that it was thus not worth measuring expressive vocabulary, since this study was the first of its kind and children with DS currently have limited access to participation in the FL classroom, it was decided to be advantageous to use this opportunity to measure participants' expressive vocabulary acquisition.[31] Assessing both the receptive and expressive lexical acquisition of participants presents a fuller picture of their acquisition and fluency (or lack thereof). This study did not assess reading abilities or writing abilities in Spanish. In addition, this study did not assess grammatical acquisition.[32] Since exposure to the L2 was severely limited and individuals with DS are shown to have marked deficits in grammatical receptivity and expression, as well as difficulties in literacy skills, a longer intervention would be more effective to

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[29] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 111; Margje van der Schuit et al., "How Cognitive Factors Affect Language Development in Children with Intellectual Disabilities," *Research in Developmental Disabilities* 32, no. 5 (2011): 1884–94.

[30] Before the start of the study, it was suspected that the participants with DS may not be able to produce any significantly measurable amount of language after such limited contact with the language. Sharon Unsworth et al., "An Investigation of Factors Affecting Early Foreign Language Learning in the Netherlands," *Applied Linguistics* 36, no. 5 (2015): 532. See also Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 6.

[31] Per a Zoom conversation with Elizabeth Kay-Raining Bird, leading scholar in bilingualism in individuals with DS, on February 1, 2021. Additionally, Sini Smolander and colleagues note that previous studies investing L2 acquisition in children with DLD have largely neglected to investigate vocabulary acquisition, and "have rarely included both receptive and expressive modes." Sini Smolander et al., "L2 Vocabulary Acquisition of Early Sequentially Bilingual Children with TD and DLD Affected Differently by Exposure and Age of Onset," *International Journal of Language & Communication Disorders* 56, no. 1 (2021): 76. Thus, despite the limitations, the need exists to study both receptive and expressive vocabulary acquisition.

[32] By *grammatical* I am referring to the "syntactic and morphological properties of a language." Heike Behrens, "Grammatical Categories," in *The Cambridge Handbook of Child Language*, ed. Edith L. Bavin (Cambridge: Cambridge University Press, 2009), 200.

study grammar acquisition as well as reading and writing abilities.[33]

Furthermore, the intent of this study was to explore the initial stages of language acquisition in the FL context. The intervention only lasted for six weeks and thus is constrained by a limited time frame. Language acquisition is a slow process which requires thousands of hours of exposure.[34] During the span of this study, children were exposed to approximately twenty-two and a half hours of Spanish language instruction. Since quantity of input is a key factor in FL vocabulary acquisition, only minimal amounts of acquisition were expected.[35] Despite this constraint, this reflects the reality of

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[33] In her review of the research, Alexandra Perovic concludes that the impaired linguistic abilities of individuals with DS "usually mean impaired grammar." Alexandra Perovic, "Syntactic Deficit in Down Syndrome: More Evidence for the Modular Organisation of Language," *Lingua* 116, no. 10 (2006): 1619. See also Leonard Abbeduto et al., "The Linguistic and Cognitive Profile of Down Syndrome: Evidence from a Comparison with Fragile X Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 11, 13; M. Koizumi, Y. Saito, and M. Kojima, "Syntactic Development in Children with Intellectual Disabilities–Using Structured Assessment of Syntax," *Journal of Intellectual Disability Research* 63, no. 12 (2019): 1438. For literacy skills see Kari-Anne B. Næss et al., "Reading Skills in Children with Down Syndrome: A Meta-Analytic Review," *Research in Developmental Disabilities* 33, no. 2 (2012): 737–47; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 8–9; L. Verucci, D. Menghini, and S. Vicari, "Reading Skills and Phonological Awareness Acquisition in Down Syndrome," *Journal of Intellectual Disability Research* 50, no. 7 (2006): 477–91; Donna Boudreau, "Literacy Skills in Children and Adolescents with Down Syndrome," *Reading and Writing* 15, no. 5 (2002): 497–525; Elizabeth Kay-Raining Bird, Patricia L. Cleave, and Lyndsey McConnell, "Reading and Phonological Awareness in Children with Down Syndrome: A Longitudinal Study," *American Journal of Speech-Language Pathology* 9, no. 4 (2000): 319–30.

[34] Shiro Ojima et al., "Age and Amount of Exposure to a Foreign Language during Childhood: Behavioral and ERP Data on the Semantic Comprehension of Spoken English by Japanese Children," *Neuroscience Research* 70, no. 2 (2011): 203–4. It has been estimated that approximately ten years of living in country is necessary to reach ultimate attainment, though even this measurement is highly dependent upon quality interaction and input in the target language. Carmen Muñoz, "Symmetries and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning," *Applied Linguistics* 29, no. 4 (2008): 582–84. Muñoz calculates that in the FL language context, a learner would need 245 years to attain the same level of acquisition. Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 3, 16n1. Given that Muñoz made her calculation based upon four one-hour sessions per week, in the elementary FL context, up to four times the length of said exposure, or even more, would be necessary.

[35] Collins and Muñoz contend that it would require a "considerable number of courses and additional practice time to reach anywhere close to a threshold of exposure that could result in even an intermediate level of FL knowledge." Laura Collins and Carmen Muñoz, "The Foreign Language Classroom: Current Perspectives and Future Considerations," *The Modern Language Journal* 100, no. S1 (2016): 138.

FL instruction, especially in the elementary years, and thus should be taken as a fairly accurate representation of what may be expected in the elementary FL context.[36] It is important to note that though the input was minimal, the frequency (every day for six weeks) is different from that of the typical elementary FL classroom where students may attend only once or twice a week. However, the compact nature of the classes may have proven beneficial for students, as frequency and intensity of exposure are key factors in L2 acquisition in bilingual children with DS.[37]

Finally, this study intended to determine if participation in the FL class impacts L1 vocabulary development of children with DS as measured by a standardized assessment. The six-week span of this study offers only a limited time frame to measure L1 vocabulary growth in participants. While measurable growth may not be expected in such a time frame, it should be expected that the L1 vocabulary abilities of students would not decrease under normal circumstances. Comparison with the control group of children with DS who did not participate in the Spanish intervention should be sufficient to determine if participation in the FL class impacts the L1 vocabulary of the participants with DS.

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[36] A 2016 study published by the *Modern Language Journal* found that a typical FL class consists of approximately 37.5 hours of instruction. Collins and Muñoz, "The Foreign Language Classroom," 138. The format of elementary language instruction varies widely, with some classes meeting as little as once a week for twenty minutes, while the average varies "between two and five times per week, in sessions ranging from 15 to 60 minutes." Helena Curtain, Richard Donato, and Victoria Gilbert, "Elementary School Foreign Language Programs in the United States," in *Foreign Language Education in America: Perspectives from K–12, University, Government, and International Learning*, ed. Steven Berbeco (London: Palgrave Macmillan, 2016), 20.

[37] Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3 (2011): 399; Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *Journal of Communication Disorders* 93 (2021): 12; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 60.

Limits of Generalization

Several limits exist to the generalization of the findings in this study. First, those participants with DS in this study may not be fully representative of all individuals with DS. The cognitive and language abilities of individuals with DS vary greatly, and it is likely that the lower or upper scale of language and cognitive abilities present in some individuals with DS was not fairly represented in the study. Secondly, the context of the class in which the students will learn Spanish is not in the context of the school setting. Elementary FL programs vary vastly in the amount and frequency of exposure to the second language, as well as curriculum content and methodology.[38] Variance in any one of these factors will inevitably result in varying second language acquisition outcomes. While the frequency of exposure for this class was higher than what is typical for an elementary FL class, the duration of exposure was much less. Additionally, unlike a typical school setting, many participants in the study did not know each other apart from their participation in the summer camp. This could have raised their affective filter and lowered their receptibility to acquisition.[39] Therefore, the acquisition achieved by the students in the study may not be equal to what they might attain were the class in their own school with their classmates.

Finally, this study assessed the acquisition of Spanish vocabulary by native English speakers, and it should not be presumed that the same results would be obtained given different languages.[40] Spanish and English share the same alphabet and many

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[38] Curtain, Donato, and Gilbert, "Elementary School Foreign Language Programs," 19–20, 25–31.

[39] Krashen's Affective Filter hypothesis posits that when the affective filter is high, language acquisition decreases. See Stephen D. Krashen, *Principles and Practice in Second Language Acquisition*, internet ed., Stephen Krashen, 2009, 30–33. It should be noted, however, that most of these students were together all day for six weeks, so any barrier that the affective filter may have caused as a result of being unfamiliar with each other likely decreased as the camp progressed.

[40] Smolander et al. recognize that results of vocabulary acquisition may vary depending on the similarity and differences of the L1 and L2. Smolander et al., "L2 Vocabulary Acquisition," 76. Muñoz and colleagues found that linguistic proximity aided young L2 learners in vocabulary comprehension and

cognates, and the similarities may benefit acquisition.[41] As cognates may facilitate vocabulary learning, the same level of acquisition may not be achieved, given the same amount of input, when acquiring a language with fewer cognates.[42]

Instrumentation

During the various phases, I administered the assessments, along with one staff of DSL trained in administering clinical assessments.[43] I was the only one to administer any Spanish language assessments.

Phase One

Before beginning the intervention of Spanish classes, students were administered three categories of assessments: nonverbal cognition (NVC), verbal short-term memory (VSTM), and English vocabulary. Since one requirement for participation in the study was that students have no significant prior exposure to Spanish, no Spanish language pre-test was given. Based upon the following reasons, this battery of assessments served to develop a profile for those students participating in the case study,

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acquisition. Carmen Muñoz, Teresa Cadierno, and Isabel Casas, "Different Starting Points for English Language Learning: A Comparative Study of Danish and Spanish Young Learners," *Language Learning* 68, no. 4 (2018): 1100.

[41] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," 55.

[42] Martin Willis and Yoshie Ohashi, "A Model of L2 Vocabulary Learning and Retention," *The Language Learning Journal* 40, no. 1 (2012): 127, 131, 133. Eva Lindgren and Carmen Muñoz found that cognate linguistic difference in a key predictor of receptive language acquisition. Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 105–29. However, Smolander and colleagues argue that the usefulness of cognates in acquiring vocabulary is limited. Smolander et al., "L2 Vocabulary Acquisition," 74. Caroline Floccia et al. found that phonological similarity is helpful for vocabulary production, while typological and morphological closeness contribute to vocabulary comprehension. Caroline Floccia et al., "Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance: III: Analyses and Results for Study 1: Estimating the Effect of Linguistic Distance on Vocabulary Development," *Monographs of the Society for Research in Child Development* 83, no. 1 (2018): 60.

[43] The staff who helped administer assessments has a Masters in Counseling Psychology. She administered the KBIT-2 during the first two days of the camp, outside of the time of Spanish class.

served as a predictor for Spanish vocabulary acquisition for all participants, and helped to answer the research questions.

First, since individuals with DS have a marked deficit in language, NVC is typically used to measure cognitive ability in language acquisition studies of individuals with DS rather than verbal cognition.[44] Utilizing measurements of NVC gives a more accurate representation of the child's cognitive capacities than would an assessment which relies upon verbal abilities due to the deficits in language typically experienced by individuals with DS.[45] Such an approach ensures that lack of language development is not confused with deficits in cognition.[46] NVC has been shown to correlate with language development in children with DS and possibly with L2 acquisition in the TD population, and thus may serve as an important predictor of FL acquisition.[47]

Secondly, measurement of participants' English vocabulary provided a useful predictor of possible L2 acquisition and helped to develop a richer profile for those students participating in the case studies. Studies of L2 vocabulary acquisition often include an initial measurement of L1 vocabulary. At times this measurement is included to track L1 development through the course of a study.[48] Other times the relationship of

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[44] Chapman and Kay-Raining Bird, "Language Development," 167. See for example Ward, "Profiling the Language Abilities," 107; Cuskelly, Povey, and Jobling, "Trajectories of Development," 114; Bernadette Witecy and Martina Penke, "Language Comprehension in Children, Adolescents, and Adults with Down Syndrome," *Research in Developmental Disabilities* 62 (2017): 186.

[45] Godfrey and Raitano Lee, "Memory Profiles," 3.

[46] Chapman and Kay-Raining Bird, "Language Development," 167.

[47] Chapman and Kay-Raining Bird, "Language Development," 168, 174. For correlation of nonverbal cognition and L2 development in the TD population see He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 560–61; Kristin Kersten et al., "Quality of L2 Input and Cognitive Skills Predict L2 Grammar Comprehension in Instructed SLA Independently," *Languages* 6, no. 3 (2021): 1–19; Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 61.

[48] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second

L1 vocabulary to L2 acquisition may be under investigation, as L1 vocabulary levels have been shown to correlate with L2 acquisition in TD populations.[49] In studies of sequential bilingualism and FL acquisition in children with DLD, measurements of L1 vocabulary can play an important role in research.[50] Additionally, gathering measurements of vocabulary abilities in the L1 and L2 is a common procedure in studies on bilingualism in individuals with DS.[51]

Next, VSTM is a weakness in individuals with DS and may correlate to L1 development.[52] Additionally, VSTM has been shown to correlate in TD populations with

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Language;" Peker and Regalla, "Making Exemption the Exception."

[49] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2 Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50; Larry Vandergrift and Susan Baker, "Learner Variables in Second Language Listening Comprehension: An Exploratory Path Analysis," *Language Learning* 65, no. 2 (2015): 407, 410; Nicolay and Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition," 664; Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 6–7; Sparks et al., "Long-Term Crosslinguistic Transfer," 222–24; Tong Li et al., "Longitudinal Predictors of Spelling and Reading Comprehension in Chinese as an L1 and English as an L2 in Hong Kong Chinese Children," *Journal of Educational Psychology* 104, no. 2 (2012): 295**–**99; C. Patrick Proctor et al., "The Intriguing Role of Spanish Language Vocabulary Knowledge in Predicting English Reading Comprehension," *Journal of Educational Psychology* 98, no. 1 (2006): 165–67.

[50] Inge Zoutenbier and Rob Zwitserlood, "Exploring the Relationship between Native Language Skills and Foreign Language Learning in Children with Developmental Language Disorders," *Clinical Linguistics & Phonetics* (February 2019): 1–13; Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language;" Ludo Verhoeven et al., "Assessment of Second Language Proficiency in Bilingual Children with Specific Language Impairment: A Clinical Perspective." *Research in Developmental Disabilities* 32, no. 5 (2011): 1798–807.

[51] Ward, "Profiling the Language Abilities," 106; Feltmate and Bird, "Language Learning," 9; Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 1–7; Trudeau et al., "Développement lexical chez les enfants," 392.

[52] Glynis Laws, "Contributions of Phonological Memory, Language Comprehension and Hearing to the Expressive Language of Adolescents and Young Adults with Down Syndrome," *Journal of Child Psychology and Psychiatry* 45, no. 6 (2004): 1090; Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 333–35.

L2 acquisition.[53] Thus, VSTM may serve as a useful predictor for FL vocabulary acquisition in children with DS. Due to a lack of research among children with DS and populations with other memory impairments this claim has yet to be substantiated.[54] Analysis based upon the data collected in this study helps fill this gap in the research. VSTM is often measured by nonword repetition tasks, which will be administered in this study.[55]

Finally, this study investigated the impact of participation in a six-week FL class on L1 vocabulary development in children with DS. For this purpose, participants with DS were compared to a control group of children with DS not participating in the Spanish class. Initial measurements of English vocabulary were compared to measurements of English vocabulary at the end of the intervention to measure any change in L1 vocabulary. Analysis of the data gathered investigated the correlation between L1 vocabulary and L2 vocabulary acquisition in the FL context for children with DS.

KBIT-2. The Visual Matrices of the *Kaufman Brief Intelligence Test, Second Edition* (KBIT-2) was utilized to measure the NVC of all intervention participants. The Visual Matrices sub-test of the KBIT-2 has been used to determine NVC in studies of

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[53] Unsworth et al., "An Investigation of Factors," 543; Nicolay and Poncelet, "Cognitive Abilities," 664–67; Pascale M. J. Engel de Abreu and Susan E. Gathercole, "Executive and Phonological Processes in Second-Language Acquisition," *Journal of Educational Psychology* 104, no. 4 (2012): 974–86; Elvira V. Masoura and Susan E. Gathercole, "Contrasting Contributions of Phonological Short-term Memory and Long-term Knowledge to Vocabulary Learning in a Foreign Language," *Memory* 13, no. 3–4 (2005): 422–29; Josje Verhagen and Paul Leseman, "How do Verbal Short-Term Memory and Working Memory Relate to the Acquisition of Vocabulary and Grammar? A Comparison between First and Second Language Learners," *Journal of Experimental Child Psychology* 141 (2016): 65–82.

[54] Verhagen and Leseman, "Verbal Short-Term Memory and Working Memory," 79.

[55] Tessel Boerma et al., "A Quasi-Universal Nonword Repetition Task as a Diagnostic Tool for Bilingual Children Learning Dutch as a Second Language," *Journal of Speech, Language, and Hearing Research* 58, no. 6 (2015): 1748; Leif Michael French, *Phonological Working Memory and Second Language Acquisition: A Developmental Study of Francophone Children Learning English in Quebec* (Lewiston, N.Y.: Edwin Mellen Press, 2006), 33.

children with DS, including studies of language acquisition and/or bilingualism.[56] In the development of a cognitive test battery designed specifically for individuals with DS, the KBIT-2 was one "neuropsychological measure" used "to establish concurrent validity of the test battery measures."[57] The Visual Matrices of the KBIT-2 provides a raw score, standard score, percentile rank, descriptive category, and age-equivalent (MA).

The Visual Matrices of the KBIT-2 tests an individual's ability to recognize and establish patterns or analogies of visual stimuli. Initially, the participant is presented with a single picture and must choose from a selection of five pictures which one best corresponds to the single picture. As the items progressively increase in complexity, the participant is presented with a group of pictures and must choose from a selection of six pictures which one completes the analogy or pattern represented by the group of pictures. Starting point is usually based on age and a basal is established with three consecutive correct answers. The test is terminated after four consecutive incorrect answers. Participants receive one point for every item answered correctly, including all items prior to their basal. The Visual Matrices require less than 20 minutes to administer. The KBIT-2 was administered in accordance with the manual guidelines, with one exception: students with DS began on item one rather than their age-related started point to avoid the need to drop back to an earlier starting point or unnecessary frustration for the participant.[58] The Visual Matrices were administered to all intervention participants as well as L1 control group participants.

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[56] Deborah J. Fidler, David E. Most, and Mark M. Guiberson, "Neuropsychological Correlates of Word Identification in Down Syndrome," *Research in Developmental Disabilities* 26, no. 5 (2005): 490; Jennifer Breslin et al., "Obstructive Sleep Apnea Syndrome and Cognition in Down Syndrome," *Developmental Medicine & Child Neurology* 56, no. 7 (2014): 662; Ward and Sanoudaki, "Language Profiles," 6.

[57] Jamie O. Edgin et al., "Development and Validation of the Arizona Cognitive Test Battery for Down Syndrome," *Journal of Neurodevelopmental Disorders* 2, no. 3 (2010): 160.

[58] Alan S. Kaufman and Nadeen L. Kaufman, *Kaufman Brief Intelligence Test Manual*, 2nd ed. (Circle Pines, MN: Pearson, 2004), 11.

PPVT-4. The *Peabody Picture Vocabulary Test, Fourth Edition* (PPVT-4) is a widely used measure of English receptive vocabulary in studies of individuals with DS.[59] Normed on 3,540 English-proficient individuals ranging from two years and six months to ninety years residing in the United States, it received reliability coefficients of higher than .90 for all age groups in the TD population.[60] It has also been shown to be a valid instrument for measurement of receptive vocabulary in individuals with DS.[61] The test consists of 228 items, divided into nineteen sets of twelve items each, with each item (page) containing four brightly-colored pictures of verbs, adjectives, or nouns. In this individually administered assessment, the examiner says a word and the examinee indicates which picture represents said word either nonverbally by pointing to the picture or verbally by stating the number which corresponds to the picture. Items progressively increase in difficulty, beginning with more frequent words, progressing to less frequent words. Starting point for the assessment depends on the examinees age, with a basal of no more than one incorrect item in a set. If more than one item is missed in a set, the examiner must regress to the previous set until a basal is established. Upon establishing a

[59] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test*, 4th ed. (Minneapolis: NCS Pearson, 2007). See for example Kay-Raining Bird et al., "The Language Abilities of Bilingual Children;" Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down Syndrome: Hierarchical Linear Modeling," *Journal of Speech, Language, and Hearing Research* 45 (2002): 902–15; Susan J. Loveall et al., "Receptive Vocabulary Analysis in Down Syndrome," *Research in Developmental Disabilities* 55 (2016): 1–23; Sari Alony and Alex Kozulin, "Dynamic Assessment of Receptive Language in Children with Down Syndrome," *Advances in Speech Language Pathology* 9, no. 4 (2007): 323–31.

[60] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 32; Community-University Partnership for the Study of Children, Youth, and Families, "Review of the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4)," Edmonton, Alberta, Canada, 2011, 3. https://www.ualberta.ca/community-university-partnership/media-library/community-university-partnership/resources/tools---assessment/ppvt-4may-2012.pdf.

[61] Neneng Tati Sumiati, Frieda Mangunsong, and Guritnaningsih Guritnaningsih, "Validitas Konstruk Peabody Picture Vocabulary Test-Edisi Keempat (PPVT-4) pada Anak dengan Sindrom Down," *Psikologika: Jurnal Pemikiran dan Penelitian Psikologi* 26, no. 1 (2021): 169–94.

basal, the exam continues until the examinee misses more than seven items in a single set. The assessment generally takes between ten to fifteen minutes to complete.

The PPVT-4 was administered according to the manual guidelines with one exception: starting point for participants with DS. Since MA for individuals with DS typically lags behind their CA, using item one as a basal eliminated the possibility of needing to return to a prior starting point and reduce the likelihood of participants with DS experiencing feelings of failure from the start of the assessment.[62] The PPVT-4 was administered to all intervention participants as well as L1 control group participants.

EVT-2. The *Expressive Vocabulary Test, Second Edition* (EVT-2) is the co-normed companion of the PPVT-4 and measures an individual's ability to name single-word nouns, verbs, or adjectives.[63] Since the EVT-2 and the PPVT-4 were normed on the same population, a "meaningful comparison of receptive and expressive vocabulary abilities" can be made.[64] The EVT-2 is often used in studies of children with DS.[65]

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[62] For precedent see Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 496. I recognize that this may have resulted in a long testing time for more capable students. However, as I had no previous information about the capabilities of the participants, I had no way of knowing which students would have benefitted from a different starting point. Additionally, post-test starting points were adjusted based off of pre-test results in order to reduce testing time in post-test administration.

[63] Kathleen T. Williams, *The Expressive Vocabulary Test*, 2nd ed. (Minneapolis: NCS Pearson, 2007).

[64] Christopher Jarrold, Annabel S. C. Thorn, and Emma Stephens, "The Relationships among Verbal Short-Term Memory, Phonological Awareness, and New Word Learning: Evidence from Typical Development and Down Syndrome," *Journal of Experimental Child Psychology* 102, no. 2 (2009): 204; Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 60.

[65] See for example Rachel F. Hick, Nicola Botting, and Gina Conti-Ramsden, "Short-Term Memory and Vocabulary Development in Children with Down Syndrome and Children with Specific Language Impairment," *Developmental Medicine and Child Neurology* 47, no. 8 (2005): 532–38. Jarrold, Thorn, and Stephens, "Relationships among Verbal Short-term Memory;" Emily K. Schworer, Emily K. Hoffman, and Anna J. Esbensen, "Psychometric Evaluation of Social Cognition and Behavior Measures in Children and Adolescents with Down Syndrome," *Brain Sciences* 11, no. 7 (2021): 3; Lauren B. Adamson et al., "Joint Engagement and the Emergence of Language in Children with Autism and Down Syndrome," *Journal of Autism and Developmental Disorders* 39, no. 1 (2009): 6. More variation is found in the literature regarding the types of assessments used to measure expressive vocabulary in children with

Though it has not yet been validated for children with DS, it has been deemed an appropriate measure of expressive vocabulary for individuals with DS.[66] The EVT-2 is an individually administered test in which the administrator shows the examinee a picture and prompts the examinee to give a one-word description of the picture or a one-word synonym. The assessment progresses in difficulty: initially the child is shown a picture and asked to name it. Difficulty increases when the child is presented with a picture and a spoken word, and the child is asked to provide a synonym. Starting point for the EVT-2 is based upon age and five consecutive correct items are required to establish a basal. The assessment is terminated when the examinee gives five consecutive incorrect answers. The EVT-2 takes ten to fifteen minutes to administer.

The EVT-2 was administered according to the manual guidelines with the following exception: students with DS did not begin at the age-related starting point but rather with the first item. Since MA of children with DS is typically below CA, this will prevent the examiner from needing to return to a previous starting point. The EVT-2 was administered to all intervention participants as well as L1 control group participants.

Nonword repetition task. A nonword repetition task measures an individual's ability to correctly repeat nonwords of increasing length and serves as a measure of verbal (phonological) short-term memory.[67] Nonword repetition tasks are often used in

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DS as opposed to receptive, since expressive development is delayed children with DS. Thus, language assessments designed for preschool-aged children, or alternative assessments such as questionnaires for parental reporting or language samples are sometimes utilized. These alternative methods are especially prevalent in studies examining young children. See Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 191; Trudeau et al., "Développement lexical chez les enfants," 390; Danielle te Kaat-van den Os et al., "Expressive Vocabulary Development in Children with Down Syndrome: A Longitudinal Study," *Journal of Policy and Practice in Intellectual Disabilities* 14, no. 4 (2017): 313. However, for the sake of consistency among both groups of participants in this study (TD and DS), and since all participants are school age, the EVT was deemed appropriate.

[66] Anna J. Esbensen et al., "Outcome Measures for Clinical Trials in Down Syndrome," *American Journal on Intellectual and Developmental Disabilities* 122, no. 3 (2017): 6.

[67] Boerma et al., "A Quasi-Universal Nonword Repetition Task," 1748.

studies of children with DS, and have been found to be a reliable measure of phonological short-term memory in individuals with DS.[68] The nonword repetition task used for this study was adapted from a quasi-universal nonword repetition task developed by Shula Chiat which has been used in various studies of bilingualism and second language learners.[69] The version which was utilized for this study, adapted for English speakers, was shared with me by Elizabeth Kay-Raining Bird, leading scholar of bilingualism in children with DS. She and her colleagues modified and utilized this version for a study, currently in press.[70] In the nonword repetition task used for this study, participants listen to a recording of someone saying a nonword, which they must repeat. Participants listen to sixteen words of increasing length, one at a time, and repeat each one immediately after they hear it. Items are recorded and played only once unless there is an interruption or distraction. Items are scored on the spot, as either correct or incorrect and are considered correct if all segments of the word are present and in the correct order. Answers are recorded by hand and audio recording of the participant responses is made to later confirm correct scoring. The nonword repetition task was administered only to intervention participants and was administered according to instructions.[71]

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[68] Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology & Psychiatry & Allied Disciplines* 39, no. 8 (1998): 1119–30.

[69] Shula Chiat, "Nonword Repetition," in *Methods for Assessing Multilingual Children: Disentangling Bilingualism from Language Impairment*, ed. Sharon Armon-Lotem, Jan de Jong, and Natalia Meir (Bristol, UK: Multilingual Matters, 2015), 125–50. For examples of studies which utilize this assessment for learners of a second language see Boerma et al., "A Quasi-Universal Nonword Repetition Task," 1747–60; Enni Vaahtoranta et al., "Language Exposure and Phonological Short-Term Memory as Predictors of Majority Language Vocabulary and Phonological Awareness in Dual Language Learning," *Bilingualism: Language and Cognition* 24, no. 2 (2021): 319–32.

[70] A. Sutton et al., "Developmental Patterns of Non-Word Repetition by Monolingual and Bilingual School-Aged Children," *Journal of Language and Communication Disorders*, Article in Press (2022): 1–23.

[71] In the scoring of the NWRT, consistent errors of the participants (i.e., consistent phonological substitutions made in conversation) were not taken into account.

Phase Two

No assessments were administered to intervention participants during phase two of the study for the purpose of data collection. Rather, instrumentation was developed to assess the Spanish vocabulary acquisition of participants based on the content of the Spanish course. Two instruments were developed during phase two: one to assess receptive lexical acquisition of Spanish and one to assess the expressive lexical acquisition of Spanish. As previously described, both assessments were based off of standardized assessments in format and administration but used vocabulary from the Spanish intervention curriculum for content. In line with the general trends of assessing receptive vocabulary, the assessment I developed for receptive lexical acquisition were "(tests) of word-picture matching" based off of one of the most commonly used standardized assessments of receptive vocabulary, the *Peabody Picture Vocabulary Test* (PPVT).[72] The same pattern was followed for the assessment which I developed for expressive lexical acquisition in which children must name a picture.[73]

Items for both assessments developed came from the stories, TPR, music, games, and classroom procedures used in the Spanish intervention. In order to be included, items had to be used in multiple or repeated contexts in the classroom curriculum, and able to be pictured by an illustration. Any vocabulary item included in the standardized Spanish assessments (EOWPVT-B and ROWPVT-B) were not included in the content-based assessments so that there was no overlap of items. All items are

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[72] Laws et al., "Receptive Vocabulary and Semantic Knowledge," 491. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) is nearly identical to the PPVT in format and administration. Since the ROWPVT-B is the standardized test I will use to assess Spanish receptive acquisition, I will also model my assessment after the ROWPVT-B. Nicolay and Poncelet followed a similar pattern in their content-based L2 vocabulary assessments Nicolay and Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition," 661–62.

[73] Picture identification and naming are the most common ways of assessing vocabulary in children and are especially useful for non-literate populations, making them an ideal form of vocabulary assessment for children with DS. Ewa Haman, Magedalena Łuniewska, and Barbara Pomiechowska, "Designing Cross-Linguistic Lexical Tasks (CLTs) for Bilingual Preschool Children," in Armon-Lotem, de Jong, and Meir, *Methods for Assessing Multilingual Children*, 203–4.

hand-drawn black and white illustrations representing one word, action, noun, or attribute. I drew the pictures myself. The format and administration of these assessments are described in further detail in the phase three instrumentation section. The EVCBT pilot test form and the RVCBT pilot test form can be found in appendices thirteen and fourteen, respectively.

After the initial development of the instrumentation, the assessments were piloted with two groups of elementary-aged students: a group of TD students (N=13) and a group of students with DS (N=5). Basic demographic information about the pilot test participants can be viewed in table A5 in appendix 19. The students who participated in the piloting of the Spanish vocabulary assessments were not participants in the intervention study, though one student with DS was also part of the L1 vocabulary control group. All children received parental permission to participate in the pilot test. The purpose of the pilot test was to establish that the drawings accurately represented the intended word/concept. Children that are native English speakers were given the assessments in English. Though these assessments were administered in Spanish in phase three, the purpose of the pilot group was to establish that the drawings accurately represented the intended word/concept, not to test Spanish language skills. This could be accomplished in English or Spanish. The participant whose L1 was Spanish was given the assessment in Spanish.[74] Testing the assessments in Spanish on L2 learners of Spanish would not be effective for the purposes of the pilot testing, since they may not have the necessary vocabulary to successfully complete the assessments and thus establish whether or not the drawings accurately represent the intended word/concept.

Any item which was not recognized one hundred percent of the time by the TD group as representing the word spoken was not included in the final version of the

[74] One child with DS whose native language was Spanish participated in the pilot test. He was nonverbal and thus only was only administered the receptive vocabulary pilot test.

receptive assessment. Any drawing which did not solicit the correct spoken word or its synonym one hundred percent of the time by the TD group was not included in the final expressive assessment. Because children with DS lag behind their TD peers in their vocabulary development it could not be assumed that they would correctly identify or name every item in the assessment, especially considering it could not be assured that they had previously been exposed to the words in the assessment. However, their participation in the pilot testing was valuable to ensure that the test was suitable for their abilities. If an item was missed by participants in the group of children with DS fifty percent of the time or more, it was eliminated from the final assessment.

The final number of items in each assessment depended upon curriculum content and reliability of drawings as indicated by the pilot test. All drawings included in the pilot test which did not meet the stipulated requirements were disregarded for the final version of the assessments. Additionally, items which were included in the pilot test but by the end of the intervention were not sufficiently represented in the curriculum through multiple or repeated contexts were excluded from the final version of the assessments. After exclusion of items based upon stipulated requirements of the pilot test and frequency of use in the curriculum, the final expressive assessment consisted of thirty-five items and the final receptive assessment consisted of forty-five items. The final versions of the EVCBT and RVCBT assessment forms along with a sample item of each can be found in appendices sixteen through eighteen.

Phase Three

In phase three of the study, students were administered two tests to assess English vocabulary and four tests to assess Spanish vocabulary.

PPVT-4. Students were administered a parallel version (Form B) of the *Peabody Picture Vocabulary Test, Fourth Edition* (PPVT-4) as a post-intervention measurement of English receptive vocabulary. This parallel version is an equivalent form

of the PPVT-4 with a distinct set of vocabulary items. It allowed for a comparison of L1 receptive vocabulary levels between the pre-intervention and post-intervention assessments while ensuring that any increase in vocabulary score was not due to previous exposure or "learning" the test. PPVT-4 test items were normed on a sample of 3,540 individuals residing in the United States and proficient in English ranging from ages two years and six months to ninety years and older, and 533 examinees were tested on both forms A and B.[75] When tested on measures of alternate-form reliability, the PPVT-4 received reliability coefficients between .87 and .93, considered to be "very reliable."[76] The administration of the post-intervention PPVT-4 followed the same guidelines used in the administration of the pre-test, with one major exception: starting point. In the pre-intervention assessment, all participants began at item one. Based upon the results of the pre-intervention assessment, a basal was established for every participant. This basal was used in the post-intervention as the starting point to reduce the amount of time required to administer the assessment and to avoid administration of unnecessary items. The PPVT-4 Form B was administered to all intervention participants as well as the L1 control group participants.

EVT-2. Students were administered a parallel version (Form B) of the *Expressive Vocabulary Test, Second Edition* (EVT-2) as a post-intervention measurement of English expressive vocabulary. This parallel version is an equivalent form of the EVT-2 with a distinct set of vocabulary items. It allowed for a comparison of L1 expressive vocabulary levels between the pre-intervention and post-intervention assessments while ensuring that any increase in vocabulary score was not due to previous exposure or "learning" the test. EVT-2 items were normed on a sample of 3,450 individuals residing

[75] Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 32, 45.

[76] Community-University Partnership for the Study of Children, Youth, and Families, "Review of the Peabody Picture Vocabulary Test," 3.

in the United States and proficient in English, ranging from ages two years six months to ninety years and older, with 507 examinees receiving both forms A and B.[77] When tested on measures of alternate-form reliability, the EVT-2 received reliability coefficients between .83 and .91, considered to be "very reliable."[78] The administration of the post-intervention EVT-2 followed the same guidelines used in the administration of the pre-test, with one major exception: starting point. Based upon the results of the pre-intervention assessment, a basal was established for every participant. This basal was used in the post-intervention as the starting point to reduce the amount of time required to administer the assessment and to avoid administration of unnecessary items. The EVT-2 Form B was administered to all intervention participants as well as the L1 control group participants.

ROWPVT-B. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) is the standardized assessment which was used to measure receptive Spanish vocabulary acquisition of all intervention participants.[79] The ROWPVT-B, and its counterpart, the *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EPWPVT-B) have been used in studies of bilingualism and FL acquisition, including for individuals with special needs and DLD.[80] The ROWPVT-B

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[77] Williams, *The Expressive Vocabulary Test Manual*, 44, 57.

[78] Community-University Partnership for the Study of Children, Youth, and Families, "Review of the Expressive Vocabulary Test, Second Edition (EVT-2)," Edmonton, Alberta, Canada, 2011, 3. https://www.ualberta.ca/community-university-partnership/media-library/community-university-partnership/resources/tools---assessment/evt-2--may-2012.pdf.

[79] Nancy A. Martin, *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy Publications, 2013).

[80] Studies investigating bilingualism and individuals with DLD employing both the ROWPVT-B and the EOWPVT-B include: Giang Pham, Kerry Danahy Ebert, and Kathryn Kohnert, "Bilingual Children with Primary Language Impairment: 3 Months after Treatment," *International Journal of Language and Communication Disorders* 50, no. 1 (2015):1–19; Kerry Danahy Ebert, Jill Rentmeester-Disher, and Kathryn Kohnert, "Nonlinguistic Cognitive Treatment for Bilingual Children with Primary Language Impairment," *Clinical Linguistics and Phonetics* 26, no. 6 (2012):1–22; The original English

was normed on 1,260 bilingual Spanish/English speaking individuals residing in the United States ranging from two to seventy-plus years old and measures an individual's ability to correctly identify spoken words for objects, actions, or concepts in Spanish or English.[81] The ROWPVT-B has a median reliability measure of 0.95 across all ages and content validity of .60 when standard scores of the second edition are compared to the first.[82]

The assessment includes 180 brightly colored test items. Each item is presented on a page with three other items. The examiner says a word in Spanish or English and the examinee must indicate verbally or nonverbally the picture which represents the stated word. Starting point is based on age and a basal is established after eight consecutive correct answers. If the examinee fails to establish a basal at the corresponding age-based starting point, the examiner must fall back to the previous age-based starting point until a basal is established. The test continues until a ceiling of four incorrect responses within six items is reached and takes approximately fifteen to twenty-five minutes to administer.[83]

The ROWPVT-B was administered according to the manual guidelines with the following exceptions: basal, ceiling, and language of administration. First, the assessment did not begin based on the age-indicated starting point, but rather, all

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versions were used in the study of children with special needs in the FL classroom to assess their L1. Peker and Regalla, "Making Exemption the Exception," 81. The Finnish versions were used in a study for L2 acquisition in children with DLD. Smolander et al., "L2 Vocabulary Acquisition," 78. Studies which employ only the EOWPVT-B and investigate bilingualism and individuals with DLD include: Christine E. Fiestas et al., "Spanish Language and Literacy Intervention for Bilingual Children at Risk for Developmental Language Disorder: A Pilot Study," *Topics in Language Disorders* 41, no. 4 (2021): 309–21; Stephanie M. Grasso et al., "Cross-Linguistic Cognate Production in Spanish–English Bilingual Children with and without Specific Language Impairment," *Journal of Speech, Language, and Hearing Research* 61, no. 3 (2018): 619–33.

[81] Martin, *Receptive One Word*, 5.

[82] Martin, *Receptive One Word*, 51, 57.

[83] Martin, *Receptive One Word*, 23–25.

participants began from the first item. The ROWPVT-B was normed on bilingual individuals, and as incipient L2 learners with minimal language exposure, participants likely would not have been able to establish a basal at the age-related starting point. Thus, the first item was automatically considered the basal for all participants. Second, the assessment continued beyond the ceiling of six consecutive incorrect responses and continued through item number thirty-four for all participants. As novice language learners, participants reached a ceiling very quickly. Extending beyond the ceiling allowed participants the opportunity to demonstrate their knowledge more fully. Item number thirty-four was chosen as it clearly marks the end of a section and includes items which participants will likely to be exposed to during the course of the intervention. Items markedly increase in difficulty after item number thirty-four, and it was highly unlikely that any participant would correctly identify any item after this point based on their knowledge. If any participant still had not reached the ceiling at item number thirty-four, the assessment would have continued until a ceiling was reached. However, all participants reached a ceiling before item number thirty-four. Finally, items were stated by the examiner only in Spanish. The ROWPVT-B is intended to measure bilinguals' collective vocabulary in Spanish and English. One method of administration is to state a word in Spanish, and if the examinee cannot identify it in Spanish, to state the word in English. Since the purpose of the ROWPVT-B in this study was to assess the Spanish acquisition of participants, items were stated exclusively in Spanish.

EOWPVT-B. The *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EOWPVT-B) is the standardized assessment which was used to measure expressive Spanish vocabulary acquisition of all intervention participants.[84] It was normed on the same group of individuals as its counterpart ROWPVT-B, and thus

[84] Nancy A. Martin, *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy Publications, 2013).

serves as an accurate comparison. The EOWPVT-B has median reliability measure of 0.95 across all ages and content validity of .67 when standard scores of the second edition are compared to the first.[85] The EOWPVT-B consists of 180 items and tests an individual's ability to name a word, object, action, or concept in English or Spanish. The examinee is presented with a colored picture and must verbally name the picture. Starting point is based on age and a basal is established with eight consecutive correct answers. If the examinee fails to establish a basal at the age-related starting point, the examiner must return to the previous starting point until a basal is established. Items increase in difficulty, and the test continues until a ceiling of six consecutive incorrect responses is reached.[86] The EOWPVT-B takes between fifteen and twenty-five minutes to administer.

EOWPVT-B was administered according to the manual guidelines with the following exceptions: basal, ceiling, and acceptable response language. First, the basal for all participants was the first item. Since students were incipient L2 learners and the EOWPVT-2 was normed on a bilingual population, participants were not likely to be able to establish a basal of eight consecutive correct answers at their age-related starting point. Thus, all participants began with item number one. Second, the EOWPVT-B was administered beyond the participants' ceiling through item number thirty-four. Item number thirty-four was chosen as it clearly marks the end of a section and includes items which participants were likely to have been exposed to during the intervention. Items markedly increase in difficulty after item number thirty-four, and it was highly unlikely that any participant would correctly name any item after this point. If any participant still had not reached the ceiling at item number thirty-four, the assessment would have continued until a ceiling was reached. However, this was not the case for any participant. Finally, correct answers were only be accepted in Spanish. Since the EOWPVT-B is

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[85] Martin, *Expressive One Word*, 59, 65.

[86] Martin, *Expressive One Word*, 23–25.

intended to measure bilinguals' collective vocabulary in Spanish and English, answers are generally accepted in English or Spanish. However, in this study the EOWPVT-B was intended to measure Spanish vocabulary and thus credit was only received for correct answers in Spanish.

RVCBT. The receptive vocabulary content-based test (RVCBT) is the instrument which was developed in phase two to measure receptive acquisition of Spanish vocabulary from the intervention curriculum. The RVCBT assessed a participant's ability to recognize a spoken word in Spanish. The RVCBT was modeled after the ROWPVT-B in format and administration but assessed vocabulary taken directly from the curriculum used in the Spanish class intervention. The RVCBT consisted of forty-five hand-drawn black and white illustrations each representing one word, action, noun, or attribute. Each item in the RVCBT was presented to the participant on a sheet of paper along with three foils. The examiner said the item in Spanish and the participant was instructed to verbally or nonverbally indicate which drawing represented the stated word.

Unlike the ROWPVT-B, the RVCBT did not progressively increase in difficulty. Items in the RVCBT were not rated for difficulty but were included in the test if the students were consistently exposed to the word in class and it met the requirements of the pilot test. All participants began on item one and took the entirety of the test; there was no basal, ceiling, or age-related starting point. The test was expected to take no more than ten minutes to administer.[87]

EVCBT. The expressive vocabulary content-based test (EVCBT) is the instrumentation which was developed in phase two to measure expressive acquisition of

[87] Due to the difficulty of some students to concentrate, the test took longer for some participants.

Spanish vocabulary from the intervention curriculum. The EVCBT was modeled after the EOWPVT-B in format and administration but assessed vocabulary taken directly from the curriculum used in the Spanish class intervention. The EVCBT assessed a participant's ability to verbally name in Spanish a word, action, noun, or attribute represented by a hand-drawn black and white illustration. The examiner presented the participant with a picture and the participant was instructed to name the item in Spanish.

Unlike the EOWPVT-B, the EVCBT did not progressively increase in difficulty. Items in the EVCBT were not rated for difficulty but were included in the test if the students were consistently exposed to the word in class and it met the requirements of the pilot test. All participants began on item one and took the entirety of the test; there was no basal, ceiling, or age-related starting point. The test consisted of thirty-five items and was expected to take no more than ten minutes to administer.[88]

Procedures

The research design was implemented through the following steps: (1) recruit students and confirm qualifications to participate in the study, (2) orient assistants (3) administer pre-tests (4) implement intervention and gather data for the case studies, (5) develop instrumentation, recruit participants for the pilot test, and implement pilot test, (6) administer and score post-tests, gather surveys, and conduct interviews for case studies (7) analyze the data of the pre- and post-tests, (8) evaluate findings, draw conclusions, and finalize case studies.

Recruit Study Participants

The research sample of children with DS was recruited through Down Syndrome of Louisville (DSL). Several weeks before the start of the summer camp DSL sent an email with a Google Form survey to inform parents of the opportunity for their

[88] Due to the difficulty to concentrate, the assessment took longer for some participants.

child to participate in the study and to request that they fill out a survey of interest. Very little feedback was received from the initial emails. Upon full ethics approval, follow up emails were sent which included an informational video that I made to give parents more information about the study as well as a Google Form through which parents could indicate whether or not they desired for their child to participate in the study. After minimal feedback was received from the follow up emails, I began to personally call from DSL the parents of students participating in the camp for the full six weeks. The majority of parents whom I contacted by phone were willing for their child to participate in the study.

In addition to recruiting intervention participants, I recruited children with DS for the L1 control group as well as children with DS and TD children for the pilot vocabulary test. Recruitment for the L1 control group was primarily through contacts given me from DSL. They provided me with names and numbers of the parents of elementary-aged students with DS whom they thought may be willing for their child to participate in the control group. I called these individuals from DSL and experienced some success in connecting with the contacts I was given. Contacts at local churches and homeschool communities were used to recruit students for the pilot vocabulary test. I made posts on various Facebook pages and multiple emails were sent to members of my church for this purpose.

Parents of intervention participants filled out an Agreement to Participate form (consent form), as well as a questionnaire with background information (both participant and parental). Parents of students with DS confirmed a diagnosis of DS from a medical professional for their child. Additionally, parents of all intervention participants confirmed that their child met the criterion of normal hearing to moderate hearing loss after correction and indicated whether or not their child had been diagnosed with autism spectrum disorder or suffered a traumatic brain injury, both of which can affect language learning. Absence of a diagnosis of autism spectrum disorder and previous traumatic

brain injury were requirements of inclusion in the present data analysis.[89]

Upon agreement to participate in the class, parents were informed of the opportunity for their child to participate in a case study through their participation in the Spanish intervention. They were provided with an information sheet which outlines what would be required of them and their child for the child to participate in the case study, and those that agreed for their child to participate filled out an Agreement to Participate form specifically for the case study. This form included permission to be video recorded for the purposes of gathering data. Additionally, parents of students attending the class due to their participation in the summer camp at DSL but who did not take part in data collection filled out an Agreement to Participate form specifying their intent to participate in the class but not data collection. These parents were also given the option for their child to participate in an alternative activity during Spanish class, but all parents of students attending the camp chose for their child to participate in Spanish class. Parents of intervention participants as well as all students attending the class but not participating in the study were informed that their child may be video-recorded during the course of the study for data-gathering purposes, and parental permission was sought. Parents were given the opportunity to exempt their child from being recorded and informed that accommodations would be made so that their child would not be recorded, but all parents consented.[90]

Orient Assistants

Classroom teachers for the summer academic enrichment camp served as the

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[89] Any student diagnosed with autism who agreed to participate in the study participated in the intervention and underwent the same battery of tests as their peers without autism. However, their data was excluded from this study and will be analyzed in an upcoming study.

[90] The recording was for purposes of the case studies, and any child not participating in the case study was only be recorded due to proximity to the child/children being recorded for the case studies. All Agreement to Participate forms and the Participant Background Information Form can be found in appendices two through seven.

assistants in Spanish class.[91] Before classes began, assistants underwent an orientation to prepare them for assisting in the Spanish classroom. This orientation provided information regarding individuals with DS, classroom curriculum and protocol, the role of assistants in the FL classroom, and data gathering procedures for case studies. I lead this orientation regarding specifics of the Spanish class, and assistants received an orientation on educating and working with children with DS from the staff at DSL as part of their training to serve as teachers at the camp.

First, the training provided by DSL provided a general overview of the developmental profile of children with DS, including physical, medical, cognitive, communicative, and behavioral elements. Additionally, teachers were equipped with appropriate teaching and behavioral intervention strategies to utilize with children with DS, such as the use of visuals, signs and gestures, verbal cueing such as "first, then," scaffolding, and praise. Secondly, I gave assistants orientation to the type of curriculum to be used in the class, classroom protocol, and general expectations of student participation. Thirdly, teachers were oriented to their duties as assistants, guidelines for interaction with students with DS in the Spanish class, and specific strategies to support students with DS in the FL classroom. For example, assistants should not translate into English for students or force them to participate, but rather facilitate understanding and encourage and/or facilitate participation. Assistants could help facilitate understanding by modeling for students, using gestures, providing visual aids, or when necessary, use English.[92] Assistants were provided with visual supports to aid the students with DS, and

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[91] Due to their role as classroom teachers, the title "assistant" and "teacher" may be used interchangeably when referring to the classroom teachers who served as assistants during Spanish class.

[92] Assistants were encouraged not to use English with students unless necessary, i.e., when other methods of facilitating understanding did not succeed, or for behavioral support. However, assistants were discouraged from translating for students, that is, providing the direct English translation for students when I was telling a story, giving instructions, etc., so that students could first have an opportunity to try and comprehend without translation.

during the orientation they were instructed on how to use these supports in class. Finally, assistants received an orientation to the journal prompts which they filled out to provide daily observations of the case study participants' class participation and evidence of acquisition. The orientation took place at DSL the week before classes began.

Administer Pre-Tests

The two weeks before the intervention began all participants took the initial portion of the pre-intervention assessments, in the following order: PPVT-4, EVT-4, and nonword repetition task. Tests were administered in a quiet location at DSL.[93] Children were tested individually, and parents were not in the room with the students during the time of the testing.[94] A few minutes were spent talking or playing with the student until they were comfortable and ready to take the tests. All assessments were given in one setting, with short breaks between assessments as needed. The initial battery of pre-tests administered together took approximately forty-five minutes to an hour to administer.

During the first or second day of the camp participants were administered the KBIT-2 by a qualified staff member of DSL. Students were removed from their class and sat at a table with the staff member in the hallway. The KBIT-2 took about 10 minutes to administer. Finally, participants in the L1 control group were also administered a battery of tests during these two weeks in the following order: KBIT-2, PPVT-4, and EVT-4. However, with the difficulty experienced recruiting L1 control group participants, two L1 control group participants were administered the battery of assessments during the first or second week of the camp in their home.

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[93] Those assessments which took place on the weekends were held in a conference room at a local institution of higher learning.

[94] On one occasion a mother joined the child for a limited amount of time because the child needed extra support sustaining their attention to complete the assessments. However, the mother did not interfere with the child's responses in any way.

Intervention Implementation

The intervention consisted of six weeks of Spanish classes in two three-week sessions, with a one week break in between. Classes met Monday through Friday for forty-five minutes from June thirteenth to July first, and from July eleventh to July twenty-ninth. Classes were part of the curriculum of the academic summer camp held at DSL, and all students attending the camp attended Spanish class, even if they were not a part of the data collection for the study. Attendance was taken by the assistants so that class attendance could be examined as a variable which may correlate with language acquisition. At the conclusion of the intervention parents of all participants completed a short survey regarding outside exposure to Spanish during the course of the intervention.[95]

Throughout the six weeks of the Spanish intervention, observational data was collected for the students participating in the case studies. This data was collected daily through video recording, observation, and journaling. Classes were recorded with an iPhone and/or iPad. During each class one assistant was assigned to observe a student participating in a case study. The assistant would answer questions in the provided journal regarding the student's participation and evidence of acquisition during class and/or shortly after class. I also recorded my thoughts and observations after class either on my phone or on a document on my computer. After the first three weeks of class and again at the end of the course assistants completed a survey regarding the case study participants' evidence of language acquisition and class participation. They also provided feedback in an interview at the end of the intervention. All interviews were conducted via FaceTime on an iPhone within a week of the course ending. Finally, parents provided feedback concerning their child's attitude and use of Spanish outside of the classroom through a survey after the end of the course.

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[95] A copy of the survey can be found in appendix 12.

Instrumentation Development

The RVCBT and the EVCBT were developed using vocabulary drawn from the intervention curriculum. Once an initial version was complete it was piloted on a group of TD elementary students and a group of elementary students with DS. Students for the pilot testing were recruited through community contacts. Parents of all pilot testing participants filled out an Agreement to Participate form. Pilot testing took place in a quiet room in DSL or at another quiet location convenient for the participant. The pilot testing took between fifteen to thirty minutes. The final version of the RVCBT and the EVCBT were completed by the last week of the intervention so that students could be assessed shortly after the intervention was complete.

Administer Post-Tests

Upon completion of the Spanish class intervention, students were given a batter of tests in the following order: PPVT-4, EVT-2, EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT. All testing took place within a week and a half of the last day of the intervention. Tests were administered in a quiet location at DSL or in a conference room at a local institution of higher education.[96] Children were tested individually, and parents were not able to be in the room with the students during the time of the testing.[97] All assessments but a few were given in one setting, with short breaks between assessments as needed.[98] English language assessments were administered first, followed by Spanish language assessments. The battery of post-tests should take approximately

[96] A few of the assessments were administered in a quiet location in the child's home because they were unable to complete them in the allotted time or in the case of several L1 control group participants, parents preferred that I come to their home due to the difficulty of bringing their child to DSL.

[97] One student's mother joined him for a while because he needed assistance focusing his attention. However, she did not interfere with his answering of questions.

[98] It was intended that all students follow the same pattern and complete the assessments in one session. However, two students were unable to maintain their attention and could not complete the full battery of assessments in one session.

and hour and a half to complete. Participants in the L1 control group were also be administered the PPVT-4 and EVT-2 during the two weeks immediately following the end of the intervention. Since some L1 control group participants were not administered their pre-intervention assessments until a week or two after the intervention began, their post-intervention assessments were adjusted accordingly so that the time frame from pre- to post-intervention assessments was the same as that for intervention participants.

The Spanish language assessments were administered in the following order: EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT. The expressive assessment for each set was administered first, as recommended by the EOWPVT-B manual, so that students were required to state the vocabulary before hearing it in the administration of the receptive assessments, thus ensuring that they could not draw from their recent exposure to correctly name an item.[99] Since students were likely to experience the most success on the RVCBT, it was administered last, leaving students with a sense of success and accomplishment.

Analyze Data

To answer research question one, observational data from the various sources was gathered, reviewed, and compared. A statistician conducted the majority of the statistical analysis of the quantitative data collected using Microsoft Excel 2016 with the Analysis ToolPak Add-in. No statistical analysis was needed to answer research question two regarding evidence for L2 acquisition, as the raw data from the post-intervention Spanish vocabulary tests were sufficient to answer that question. However, two independent two-tailed *t*-tests were utilized to compare performance on the standardized assessments to performance on the curriculum-based assessments. An independent two-tailed *t*-test was conducted to answer research question three to determine the difference

[99] Martin, *Expressive One Word*, 31.

between expressive and receptive L2 acquisition. Pearson product-moment *r*-correlation coefficients were computed to answer research question four and determine the relationship between L2 acquisition and specific variables. Finally, to answer research question five, two independent two-tailed *t*-tests were conducted to compare performance on the pre- and post-intervention English vocabulary assessments and the mean and standard deviation of the GSV (growth scale value) difference of the English vocabulary pre- and post-tests were calculated.[100]

Evaluate Findings

I used results of the data and statistical analysis to draw conclusions to answer the research questions. Additionally, I compiled the qualitative and quantitative data on the multiple case study participants to describe the language acquisition and class participation of each participant. Strengths and weaknesses of the study were described and recommendations for practice and future studies were given.

[100] Growth scale value "is an indicator of the absolute level of performance" and is "designed (to measure) change over time." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221.

CHAPTER 4

ANALYSIS OF FINDINGS

The purpose of this study was to examine the participation of children with DS in a six-week FL class and to measure the receptive and expressive lexical acquisition of Spanish as a FL in students with DS. To fulfill this purpose I utilized an exploratory mixed methods multiple case study design. This involved recruiting participants, administering pre-intervention assessments, teaching a six-week Spanish intervention to elementary-aged students with DS and recording student participation, developing and piloting Spanish vocabulary assessments, and administering post-intervention assessments.[1] The research questions explored two major categories: participation of students with DS in the FL classroom and the initial stages of L2 acquisition in children with DS. This chapter will present a brief summary of the compilation protocols followed by an analysis of the findings to answer the research questions. I used an alpha level of .05 for all statistical tests.

Compilation Protocols

Both quantitative and qualitative data was gathered for this exploratory mixed methods multiple case study research. I will briefly overview the data collection methodology for each phase and refer the reader to chapter three for an in-depth description.

[1] As outlined in chapter three, more steps than this were involved, but the steps listed here were the main steps in the study.

Phase One

Phase one consisted of recruiting intervention participants as well as participants for the L1 control group and the pilot vocabulary test. Intervention participants and some L1 control group participants were recruited through DSL and pilot vocabulary test participants and remaining L1 control group participants were recruited through community contacts. Pre-intervention assessments were administered to intervention participants and L1 control group participants during the two weeks prior to the Spanish intervention, as well as the first two days of the intervention. Intervention participants were administered the KBIT-2, nonword repetition task, PPVT-4, and EVT-4. L1 control group participants were administered the KBIT-2, PPVT-4, and EVT-4. Additionally, parents filled out a background information form (participant and parental) which provided important demographic information. Finally, data for the case studies was gathered via video recording, observation, journaling, and assistant surveys during the six-week Spanish intervention.

Phase Two

Phase two consisted of developing the RVCBT and the EVCBT based upon the curriculum of the Spanish intervention and modeled after standardized vocabulary assessments. Pilot tests were administered to TD children and children with DS and the protocols outlined in chapter three were followed to determine the final contents of the RVCBT and the EVCBT.

Phase Three

Phase three took place upon the completion of the Spanish intervention. Post-intervention assessments were administered to intervention participants and L1 control group participants. Intervention participants were administered the PPVT-4, EVT-2, EOWPVT-B, ROWPVT-B, EVCBT, and RVCBT within a week and a half of the completion of the Spanish intervention. L1 control group participants were administered

the PPVT-4 and EVT-2 within a week and a half of the completion of the Spanish intervention or within a comparable time frame from their pre-intervention to post-intervention assessments as the intervention participants. Additionally, parents of all intervention participants filled out a brief survey regarding their student's out of class exposure to Spanish. Finally, data for the case studies was gathered via parental surveys, assistant surveys, and assistant interviews.

Synthesis of Data

Both qualitative and quantitative data were gathered in this study to answer the research questions. Qualitative data gathered primarily in phase one, but also in phase three, was used to form the case studies and answer research question one. Quantitative data gathered in phase three was used to answer research questions two and three. Next, quantitative and demographic data gathered in phases one and three were combined to answer research question four. Finally, quantitative data gathered in phases one and three was used to answer research question five. An analysis of the findings is presented below beginning with a presentation of the case studies.

Research Question Synopsis

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?
    e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?

2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?

3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which of the following variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome? The variables of interest are chronological age, nonverbal cognition, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education.

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Case Studies

The first research question and its sub-questions examine the participation of elementary aged students with DS in the FL classroom. The primary means of answering this qualitative research question is through case studies, though some observational data from whole class participation is used as well. I will first present each case study, with special attention given in the description to addressing the sub-questions of research question one. I will then synthesize and summarize the descriptive data from the case studies and observations from the classes to directly answer research question one and its sub-questions.

Case Study Participants

Five children with DS from the intervention participants were originally recruited to participate in a case study based upon class enrollment and cognitive and linguistic profiles. However, one of those five withdrew from the summer camp program after only a few days. Another child was recruited in his place as she demonstrated exceptional engagement and comprehension the first few days of class, and I recognized the need to document her participation in-depth. The fifth child originally recruited for a case study had a dual diagnosis of autism spectrum disorder and will be included in a

subsequent study.[2] Thus, the final number of case studies was four. At least one participant from each of the three classes participated in a case study. An overview of case study participant demographics is presented in table 1 below. All names used are pseudonyms. Participant language profiles with pre- and post-intervention English and Spanish language assessment results are presented in table A6 in appendix 20.

Table 1. Case study participant demographics

	Allen	Sammy	Rusty	Rosie
Age	7:5	9:6	11:6	12:0
Gender	Male	Male	Male	Female
Grade Completed	1	2	4	5
Summer camp Class	Lower	Middle	Upper	Upper
NVMA	<4:0	<4:0	5:8	4:8
NVC raw score	9	4	18	13
Hearing Status	Normal	ML–NC	Normal	ML–NC

NOTE: Age (years:months); NVMA = Nonverbal mental age (years:months); NVC = Nonverbal cognition (out of 46); ML–NC = mild loss, no correction

Case Study One: Allen

At the start of the Spanish intervention, Allen was seven years and five months old and had completed first grade. He had a developmental age of below four years old, yet his age-equivalent English vocabulary scores exceeded four years of age. Allen's receptive vocabulary age-equivalent was four years and seven months, and his expressive

[2] The absence of a diagnosis of autism spectrum disorder was a requirement for this study as autism is a confounding factor in language acquisition.

vocabulary age-equivalent was five years and two months. These results were surprising given that children with DS often score below MA-matched peers on measurements of language, and expressive language usually lags behind receptive. His post-intervention English vocabulary age-equivalent scores presented the same pattern of a higher expressive age-equivalent than receptive. Allen seemed to have unusually advanced language skills for a young child with DS and could express himself verbally better than most children in the camp, even those much older than himself. He could read quite well and would attempt to read almost any text that was in front of him.

Allen's affinity for reading was apparent in Spanish class. English captions would often appear automatically for many of the Spanish music videos which were played in class. When this was the case, Allen would often sing along in English by reading the captions. After I noticed this tendency, I began to change the captions to Spanish whenever possible and toward the end of the six weeks, Allen began to prefer the Spanish captions. At one point when the English captions popped up automatically, he began to yell, "Spanish! Spanish!" As soon as I changed the captions to Spanish, he was satisfied and stopped yelling.

Despite his unusually high language skills, Allen struggled behaviorally. Transitions from preferred activities to non-preferred activities were especially difficult for Allen and could often cause him to scream, cry, kick, hit, and sometimes even bite. Allen's teachers struggled with how to respond to these meltdowns and the easiest way to appease him and keep the meltdown from reoccurring was to give him a phone or tablet on which to watch videos. The behavioral difficulties that Allen experienced in Spanish class presented themselves in other contexts of the camp as well. His teachers noted that, no matter the topic or subject, if he was not interested, he would refuse to engage. One teacher commented, "If he didn't want to do it, he wasn't going to do it, and would ensure that no one got in his way."

Spanish class occurred directly after two preferred activities for Allen:

lunchtime and videos. During the transition between lunch and Spanish Allen's class would often watch a video of some sort. Videos are a highly preferred activity for Allen, and the transition from lunchtime and video watching to Spanish class was often unbearable for Allen, resulting in a major meltdown. On many occasions when I entered the classroom Allen already had a tablet or phone in hand and was engaged in independently watching a video on the device. Once Allen had a device in his possession, he was very unlikely to attend to the activities of Spanish class, and though present in the classroom, was often almost completely disengaged from the lesson and the language. Occasionally, however, even with the device in hand, he would turn his attention to the Spanish lesson if a video which he liked was playing.

At times Allen's meltdowns necessitated that he be removed from the classroom. His behavior was often extremely disruptive for the other students and at times potentially harmful to himself, other students, or teachers. A classroom teacher, camp support staff, or a behavioral interventionist would sometimes wait with him outside the classroom, take him for a walk, or bring him to the sensory room until he was able or willing to calmly join the class again. As a result of his behavioral challenges Allen received much less Spanish input than the other intervention participants, and his behavioral challenges were by far his greatest barrier to participation in class and thus language acquisition

Allen's disengagement in Spanish class may have indicated a negative attitude toward Spanish. Sometimes when transitioning from lunch to Spanish he would express a negative attitude toward Spanish by yelling, "No Spanish!" and a meltdown would often ensue. The teachers noticed that his behavior began to decline every day after lunch and were unable to discern if this was an attempt to escape Spanish due to a true dislike toward the language and the class or the fact that he was being required to transition from a highly preferred activity to a less preferred activity. However, he was generally very positive in his interactions with me and once he was engaged in Spanish class seemed to

enjoy it. His mother reported a positive attitude toward Spanish at home, noting that he had an increased desire to speak Spanish and would spontaneously recall words in Spanish at home without prompting. She also noted that he was more interested in watching videos and listening to music in Spanish and seemed proud of himself for his new skill. His mother also reported that they were once at a park playing when a family nearby did not speak English. Allen took the initiative and greeted them by saying, "*hola*" (hello), indicating a positive attitude toward Spanish and a willingness to use it in contexts outside of the classroom.

Allen's engagement in Spanish class was largely dependent upon his mood before class began and his ability to transition successfully, and fluctuated widely day to day. He was able to best engage in Spanish class when a successful transition was made before I entered the classroom and quiet music was playing on the screen (as opposed to a preferred video). If the transition was not made before I entered the room, he would likely not engage well in Spanish class. While his disengagement was often due to his possession of the iPad or iPhone, he would also demonstrate disengagement by crying, wandering around the room or playing with any object he could get his hands on. However, even when Allen seemed disengaged by watching a video on a personal device or was sitting in another part of the room seemingly refusing to participate, he would sometimes say words in Spanish or sing along to the song. Thus, it seems that even when he was not participating with the other students in the activities of the class, his mind may have been at least partially engaged or attuned to the language. Sometimes he would become interested in a song or activity and on his own initiative leave the device in favor of the Spanish activity, at which time a teacher would put away the device so that he could continue to participate in class undistracted. However, if a teacher tried to take away the device against his will, he would have difficulty regulating his emotions and a meltdown would ensue.

Allen was most engaged when a preferred music video was playing, especially

if he was able to choose the video. To facilitate him choosing which video we would watch next I would put a list of the song titles on the screen, and he would choose which song he wanted to listen to. By the end of the six weeks, he was able to read independently several of the song titles in Spanish, for example, *Los animales* (The Animals). He would also sometimes express which song he wanted without the help of the list by saying the name of the song or a word related to the song. For example, he might express that he wanted to watch the *Camina con Cosmo* (Walk with Cosmo) by saying a word or phrase from the song such as *corre* (run) or *con Cosmo* (with Cosmo). Allen would demonstrate his engagement by sitting and watching the video intently or by dancing and acting out the motions to the music and often singing along. Conversely, he especially struggled to participate if he was not allowed to choose the activity or if he had to wait and give someone else a turn to participate in an activity or choose a song. Allen occasionally enjoyed interactive activities such as throwing the dice and counting in Spanish, but this fluctuated widely from day to day, and if he was not interested in the activity he could resort to some kind of destructive behavior.

Allen was able to participate independently in all of the activities in Spanish class, but often chose not to participate and thus often needed support to stay involved in non-preferred activities. One teacher commented, "I think he could understand almost anything that you put in front of him, it's just if he's willing to or not." Allen demonstrated his understanding of the language by acting out the verbs that were spoken or in a song, such as *duerme* (sleeps), *corre* (runs), or *salta* (jumps). He used spoken language to express his desires, likes, and dislikes. From the first day Allen was making an effort to speak in Spanish. On the first day of class without prompting he said the words, *sí* (yes), *siéntate* (sit), and *minuto* (minute). By the middle of the six-week course he was saying a variety of words in Spanish class such as numbers, body parts, colors, and action verbs and by the end of the six weeks was also saying the names of various animals and other descriptive and social words such as *rápido* (fast) and *gracias* (thank

you).

Sometimes Allen was merely repeating the words that he heard but other times he was using the language to communicate. For example, he would sometimes say the words *corre* (runs), *salta* (jumps), or *baila* (dance) if he wanted me or someone else to do them. Other times he would say the word and act it out himself and would get very excited doing so. Allen also used Spanish to express when he did not want to participate in activity or be compliant with instructions. For instance, when instructed to sit in a chair, and given the option of *rojo* (red) or *azul* (blue) he said, "*rojo*, uh-uh" and "*azul*, no, no, no, no, no," and subsequently refused to sit in a chair. He also used Spanish to express when he did not want the class to engage in a particular activity. For example, when I announced that we were going to sing *los colores* (the colors) and Allen did not want to sing that song he exclaimed, "no, no, *los colores*, no *los colores*!"

Allen demonstrated little evidence of non-comprehension of the Spanish being used in class when he was engaged in the lesson. The only times Allen seemed to show evidence of non-comprehension of Spanish was when asked an open-ended question without sufficient scaffolding. For example, at times when the list of songs was on the screen I might ask him, "*¿Qué quieres?*" (What do you want?) or "*¿Cuál canción quieres?*" (Which song do you want?). Though at times he would indicate which song he wanted in response to these questions, other times he would simply look at the screen and not respond. However, when given two specific choices or when provided with other support such as me pointing to the screen, he would generally respond with the song that he wanted to listen to.

Another challenge faced by Allen which may have negatively affected his participation in Spanish class and language acquisition was the discrepancy between his developmental level and that of the other students in his class. While quantitative data is not available for all of the students in his class, Allen was more advanced than the other students in his class cognitively, linguistically, and socially. Though Allen was one of the

most verbally expressive students in the entire camp, all of the other children in his class were either nonverbal or spoke in one- or two-word utterances. Multiple students in his class had either been diagnosed with autism or were in the process of being screened for autism, and with the exception of one other student in the class, the majority of the students preferred to play independently and did not have the social skills to interact constructively with other children.[3]

Due to the multiple severe disabilities experienced by the majority of the students in Allen's class, Spanish lessons in his class differed from the other two classes. Most notably, stories were not part of the curriculum in Allen's class as the students could not focus their attention on a story for even one minute, no matter how it was presented. Capturing the attention of all of the students in Allen's class with the same activity at the same time was almost impossible, though music videos were the most successful in holding the attention of the majority of the students at any given time. As a result of the absence of stories and the related activities, the variety of vocabulary to which Allen and his classmates were exposed was less than that of the students in the other two classes.[4]

Allen likely would have benefitted from being in a class with other students who were similar to him cognitively and linguistically and who had more mature behavior. Aside from his difficulty transitioning from a preferred to a non-preferred activity, many of his disruptive behavioral habits may also have stemmed from being bored or not challenged cognitively. Being in a classroom that could offer him academic support on his level would have helped him cognitively and may have prevented him from becoming bored. Additionally, Allen likely would have benefitted from the example

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[3] I recommended to camp administration that Allen be moved to another class, suggesting that it would help him socially, behaviorally, and academically, but for reasons not disclosed to me, he remained in the lower class for the duration of the camp.

[4] Allen was the only student in his class to participate in the study.

of good behavior of more behaviorally mature students, as this was absent in his class. Just as students with DS benefit academically and behaviorally by being in a class of TD students, Allen likely would have benefitted from being in a class of students at or above his cognitive level. Finally, he likely could have benefitted from being with other students who may have been able to interact with him socially. Though I recommended to the camp administration that he be moved to the next class, he remained in the lowest class for the duration of the camp. His teachers also expressed in the post-intervention interview that he likely would have benefitted in many ways from being placed in a different class. As one teacher said, "I wonder if it would be a different story if he was able to be in a foreign language classroom with typical peers."

Apart from his challenges in class, Allen struggled to complete both the pre- and post-assessments. He needed frequent breaks not only between assessments but also during any given assessment. For example, he was unable to complete the PPVT-4 and the EVT-2 without multiple breaks. This is likely due to a short attention span combined with a large vocabulary which caused the duration of the tests to extend well beyond his capacity for sustained attention. In the post-assessments he did not reach a ceiling in the PPVT-4 until item number 108, and similarly did not reach a ceiling in the EVT-2 until item number 110. As a result of his need for frequent breaks and the longer duration of his assessments, Allen was unable to complete his pre-or post-assessments in one session.[5] Thus, rather than completing the nonword repetition task in the same session as his other L1 vocabulary pre-intervention assessments, he completed it before class on the first day of camp. Additionally, when administered the KBIT-2 the second day of camp

[5] It should be noted here that during the post-assessment, students began the PPVT-4 and the EVT-2 based on the basal set during their pre-intervention assessment not on item number one. Ceiling requirements of eight incorrect items in a set for the PPVT-4 and five consecutive incorrect items for the EVT-2 meant that every time a student was approaching the ceiling requirement but then correctly answered an item, the test had to continue. For many students this was not a problem, but for a student with a large vocabulary like Allen, it caused the test to extend beyond his concentration ability.

by the trained administrator he refused to participate, and I administered the KBIT-2 to him toward the end of camp when he was better able to adjust to a change in his schedule. Allen was also unable to complete the full battery of post-assessments in one session. He completed the PPVT-4 and EVT-2 in an office room at a local institution of higher education and later that day I went to his house and administered the Spanish language assessments. He was sitting at the kitchen table strapped in his seat and eating a snack and seemed able to focus better in a more familiar environment.

Despite the many challenges Allen faced, he still demonstrated considerable Spanish acquisition. His mean number of items correctly answered on the four assessments (*M*=12) fell just below the mean of the rest of the intervention participants (*M*=12.83). The success that Allen experienced in acquiring Spanish is even more evident when considering the words to which he was not exposed in his class. Allen correctly produced fifteen of the items on the EVCBT (42.86 percent). However, if the items to which he was not exposed due to the absence of stories in his class are removed, then he correctly stated 55.56 percent of the items. Similarly, if the same is taken into account for the RVCBT, then the percentage of items correctly identified increases from 48.89 percent (twenty-two items) to 55.56 percent (twenty items). It is likely that if Allen had been in one of the other two classes with richer input and had he not missed so much class due to his absences and behavioral difficulties, he would have demonstrated even more acquisition.[6]

Case Study Two: Sammy

At the start of the Spanish intervention Sammy was nine years and six months old and had completed second grade. He had a developmental age of below four years old and was in the process of being screened for autism. As with most children with DS,

[6] Aside from not being present in class or not attending to the lesson due to behavioral difficulties, Allen was absent five days out of thirty.

Sammy's receptive language abilities exceeded his expressive. Sammy's pre-intervention receptive language age-equivalent score was two years and eleven months, while no age-equivalent was given for his expressive skills, indicating that it was below the lowest age range specified of two years and zero months. Of the intervention participants he was among those with the lowest linguistic abilities, as well as the lowest cognitive abilities, having obtained a raw score of four on the KBIT-2.

Sammy attended one school year of Spanish class with me during his kindergarten year, two years prior to this Spanish intervention. Classes met once a week for forty-five minutes, reaching a total of approximately twenty-six hours of instruction. However, Sammy was often missing from class due to extreme disruptive behavior such as hitting classmates or knocking over furniture, and he struggled to attend to the lessons. From my observations during his initial year of Spanish with me, he had acquired at least one word, *camina* (walk) and could demonstrate it by walking when given the command in English, even outside of the context of Spanish class. Since his year of Spanish class two years prior, Sammy had no meaningful interaction with Spanish. When I met him for his pre-intervention assessments I gave him the command *camina* (walk) and he had no reaction, indicating that what language he may have acquired from his initial exposure to Spanish likely had not been maintained.

Sammy had high sensory needs which were evident throughout the camp day and in Spanish class. These sensory needs were met through extra breaks in the form of walks with a weighted ball and weighted backpack, receiving pressure massages, or sitting with a weighted blanket. As a result of his sensory needs, Sammy required quite a bit of support to stay present and engaged in Spanish class, though the level of support needed lessened as the six weeks progressed. At the beginning of the six weeks, he was often absent from the room for a considerable portion of class or would spend most of the session trying to get out of the classroom, asking to go home, go outside, go for a walk, or go to the restroom. Sometimes when he left the room for a bathroom break or walk,

upon his return to class he would sit by himself on the floor next to the door instead of engaging in the lesson with the rest of the class. However, as he became more comfortable with the language and the routine and activities of Spanish class, these escape behaviors decreased. Though they never ceased completely, by the end of the six weeks he was able to stay in the class for the entire forty-five minutes and his requests to leave were at a minimum. After the first three-week session when he would request to go for a walk, instead of taking him out of the room, a teacher would walk with him around the room. This helped increase his presence in the classroom as well as his engagement in the activities.

In general, Sammy struggled to sustain his attention in Spanish class. He would demonstrate disengagement by staring at the ground and displaying stimming (self-stimulatory) behaviors such as rocking back and forth, swinging his toy shark back and forth and watching it, and in some situations, pushing over chairs or other outburst behaviors. These behaviors were especially prominent during story time, as he often became disengaged and tuned out during at least a portion of story time, though they were likely to occur during any sedentary activity. However, stimming during story time was not always indicative of complete disengagement. It seems he was sometimes still listening to the story and aware of what was happening around him while stimming, because sometimes while stimming during story time he would make a verbal interjection related to the story. Though he initially struggled to pay attention during story time, by the end of the six weeks he was showing increased interest and engagement in the stories, often interrupting the story to act out what was being said. For example, when telling a story about a frog, and I would say *rana* (frog) he would call for my attention, squat and jump like a frog, and say “Bibbit! Bibbit!” Such actions demonstrated not only his engagement with Spanish, but his comprehension of the language. Additionally, his rocking back and forth was often a sign of excitement in response to the activity in which we were engaging, rather than disengagement.

Aside from sensory breaks such as pressure massages or walks, Sammy often needed redirects to sustain attention in class, and wait time after instructions were given in order to follow through with the instructions. Other support that Sammy needed was modeling of instructions, especially when engaging in a more complex activity such as acting out a story with a prop, or help engaging in and completing an activity such as pointing to the colors on the page while listening to the color song. Sammy's requests to leave Spanish class, difficulty concentrating, and need for assistance to complete some tasks or participate in some activities do not necessarily reflect a negative attitude toward Spanish. His teacher reported that his level of engagement and independence in Spanish class exceeded that of his level in other activities at camp, and that he participated in Spanish much more than in any other special area. Additionally, she noted that Sammy "thrives on one-on-one assistance, direct feedback, practicing, reminders" and "what he needed in Spanish is what he needed everywhere." The time of day in which his class had Spanish also likely contributed to his requests to leave class and engagement in self-stimulatory behaviors. Spanish took place in the latter part of the day (1 p.m.) when he was beginning to reach his limit and needed a break from activities and concentration. His teacher reported that he was often overwhelmed and overstimulated by this time of the day, which resulted in his need to leave the room for a walk or have some other kind of sensory break.

Despite his attempts to leave class and his disengagement in class, Sammy's overall disposition toward Spanish was quite positive. His mother reported that when hearing my name or the word "Spanish" he would he get excited and smile and exclaim, "Spanish!" Similarly, his teacher reported that "he would be very excited about Spanish, clap and be smiley and happy," and when reviewing the daily schedule would say, "Yay Spanish!" Sammy was eager to use Spanish inside and outside of Spanish class, especially his favorite song, *la tortuga camina lento* (the turtle walks slowly), which he would sing at home and in various contexts at camp (especially in the bathroom!).

Almost anytime he saw me in the hallway he would stop me to sing the song and act out the motions and would also interrupt class several times throughout a forty-five-minute session to sing the song to me. When particularly engaged in class Sammy would repeat words that I was saying in Spanish, such as body parts, animals, and verbs, or interject his feelings about what was happening in class. For example, when excited about the story and video of a cat eating pizza he repeatedly said, "Cute! Yum!"

Sammy was very eager to express his feelings in Spanish. Often when I would enter the room with my cart, which had a poster on it with emoji emotion faces, he would stop me and point to the emoji of how he felt (happy, sad, or tired). I would say it to him in Spanish, and then he would usually repeat it and make a face demonstrating the feeling. He began to express feelings of happiness or sadness in Spanish spontaneously both during Spanish class and in other contexts as well. For example, during a break during his post-intervention assessments we were in the sensory room, and he was happily swinging on a swing. He looked up at me and with a big smile on his face exclaimed, "*¡Feliz!*" (Happy!). His teacher also reported that he would use the words *feliz* (happy) and *triste* (sad) throughout the day to express how he was feeling. For instance, when denied the opportunity to go outside and play he may respond with *triste* (sad) and make a sad face. Such use of the language demonstrates not only his positive attitude toward the language but understanding and acquisition.

In class, Sammy demonstrated both understanding and non-comprehension of the language. He demonstrated comprehension through responding correctly to simple instructions such as *levántate* (stand up), or *siéntate* (sit down), acting out words that were spoken or part of a song such as *baila* (dance), *duerme* (sleep), or *salta* (jump), correctly identifying animals that were projected on the screen, and saying the name of an animal and acting it out or making the sign for it. For instance, he said, *pez* (fish) and moved his hand like a fish. He showed increased understanding and language acquisition by saying an action such as *camina* (walk) or *duerme* (sleep) and then acting it out.

Sammy could also respond to simple questions directed to him in Spanish, such as when asked if he wanted a turn participating in an activity or if he wanted to listen to a particular song. Though his responses were typically in English, they indicated his comprehension of the question. Sammy would also sometimes repeat in English what was being said in Spanish. For example, after singing a song I said, "*más rápido*" (faster), indicating to the class that we were going to sing it again more quickly, and he exclaimed, "faster!"

Conversely, Sammy demonstrated non-comprehension by incorrectly identifying animals that were projected on the screen, and inability to follow through with instructions or act out what was being said in Spanish. To support Sammy when he did not understand what was being asked of him, I would use gestures, signs, model what was expected, or have someone else, such as a teacher, model for him. For example, if it was his turn to touch an animal on the screen and he touched the wrong animal, I would make the sign for the animal I was asking him to touch while simultaneously saying the word until he was able to touch the correct animal. Sammy especially struggled to act out the stories with manipulatives as I narrated, likely due in part to non-comprehension. However, due to his regular disengagement, it was sometimes difficult to distinguish if Sammy was struggling with comprehension or attention and compliance. His low cognitive skills may also have contributed to the difficulties he experienced in carrying out more complex tasks such as acting out a story with manipulatives.

Sammy especially enjoyed activities which involved music or gave him a turn to show off his skills, and flourished when he received praise for his success. When experiencing success and receiving praise he would often become overcome with happiness and run to his teacher to hug her enthusiastically. Some of Sammy's favorite activities included having a turn to guess which box the monster puppet was sleeping in, saying hello to monster, using props to act out some of his favorite songs, and having a turn to identify the animals on the screen. Though he often struggled to correctly identify

the animal solicited, his turn always ended in success, and he was thus always excited to have a turn. Two of the video songs which we sang became favorites for Sammy, and he began to request them every class. He would generally request the song by acting out part of the song.

As Sammy became more confident in his Spanish skills he began to interrupt during class and make specific requests more often. I generally tried to acknowledge his interjections to demonstrate that I was listening to him and to keep him engaged in class. His interjections were sometimes related to what was happening in class. For example, during a story about a cat he would constantly interrupt and make a cat noise and do the gesture for cat. However, his interjections were not always on topic. For example, he would often get my attention and begin singing his favorite song, *la tortuga camina lento* (the turtle walks slowly) and act out the motions. Though his interjections were sometimes off topic, they were generally interjections in Spanish or related to some topic that we had recently been covering in class. However, it got to a point where Sammy's interjections were becoming overly disruptive and inhibiting the class from progressing in the lesson.

To balance maintaining his engagement and praising him for using Spanish on the one hand and continuing with the lesson on the other, I began to use strategies such as telling him, *un momento* (one moment) and holding up my finger to indicate that he needed to wait, or tell him that first we would complete what we were doing, and then we would watch him or engage in the activity he wanted to do. Other times I would incorporate his interjections into the lesson and use them as an opportunity to offer more input in Spanish. For instance, during the story about a cat, when he would interrupt and wanted everyone to watch him while he acted like a cat I would say, "*Sammy es un gato*" (Sammy is a cat). When the cat cried in the story and he stopped us to demonstrate crying, I said, "*Sammy llora*" (Sammy is crying). His teacher noted that learning how to initiate conversations or appropriately express his wants and needs is a general skill that

he is working on, and he did improve in learning to wait to be heard toward the end of the six weeks.

Most of the acquisition Sammy demonstrated on the post-intervention assessments was receptive. This is not surprising given his limited expressive abilities in English. Of the expressive words solicited on the EWOPVT-B and EVCBT he only produced one word, *feliz* (happy). During the expressive assessments he would generally respond in English. When I would ask him to tell me the word in Spanish he would respond, "Spanish." By the time we arrived to the RVCBT, the last of six assessments, Sammy had been participating in the assessments (with regular breaks) for an hour, and it was extremely difficult for him to concentrate. Sammy likely would have benefitted from multiple assessment sessions, or alternative forms of assessment. His frequent use of Spanish in class, in other contexts at camp, and at home demonstrate that he likely acquired much more Spanish than what his assessments reflect.

It is also worth noting that Sammy's English vocabulary skills, as measured by the PPVT-4 and EVT-2, increased from pre- to post-intervention assessments. Sammy's receptive GSV (growth scale value) increased by seven points and his expressive GSV increased by eighteen points, a statistically significant improvement.[7] His receptive age level equivalent increased from two years, eleven months to three years, four months, and his expressive age level equivalent increased from below two years old to two years, four months. Though it cannot be claimed that exposure to a FL helped improve his L1 vocabulary skills, it does not appear to have harmed his L1 skills, as they were able to grow in only six weeks while being exposed to and acquiring a FL.

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[7] Growth scale value "is an indicator of the absolute level of performance" and is "designed (to measure) change over time." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221. An increase in expressive GSV for a person Sammy's age reaches statistical significance after an increase of seven points. Sammy's expressive GSV increased by eighteen points, over double that required for statistical significance, indicating a highly significant increase in expressive English vocabulary.

Sammy's teacher not only saw him at camp, but also babysat for him periodically at home. Her words sum up his experience well:

> He uses it (Spanish) throughout the day at (camp) and he says things at home. I feel like he might not say it all, but I do truly think he learned Spanish, and he understands it, everything you talked about in class. If we could find different ways to assess him – assessment depends on his mood. If he were to be assessed over a number of days, everything you taught him he would be able to demonstrate. He went from very passive and not saying anything to being very engaged and frequently using Spanish. He doesn't talk a lot in general, so the fact that he used so many Spanish words was very impressive to me.

Case Study Three: Rusty

At the start of the Spanish intervention Rusty was eleven years and six months old and had completed fourth grade. He had a developmental age of five years and eight months. Rusty's English language profile is typical of that of a child with DS in that his receptive language exceeds that of expressive. At the start of the Spanish intervention Rusty had a receptive age-equivalent of six years, four months, and an expressive age-equivalent of five years, four months. Among intervention participants, Rusty had the highest L1 receptive scores, both pre- and post-intervention.

Rusty showed high engagement and experienced success in Spanish class from the very beginning. Initial engagement was demonstrated by mimicking gestures, attempting to sing along with songs, acting out the motions to songs and stories, and interaction during stories. For example, on the second day of class when I said, "*rápido*" (quickly) he moved his hands quickly as I had modeled previously. When telling a story about a horse I said, "*el caballo se despierta*" (the horse wakes up) and stretched my arms out like I was waking up. Rusty mimicked the motions and pretended to be waking up. Later in the story when the horse was eating, he suggested that the horse eat a hamburger, demonstrating not only true engagement with the story but understanding of what was happening in the story. When watching a video with the actions *camina* (walk), *baila* (dance), *salta* (jump), and *duerme* (sleep), Rusty engaged in all the actions.

Rusty also demonstrated understanding early on by responding to questions

asked of the class. He used English and signs or gestures to communicate when he did not have the verbal skills to respond in Spanish. For instance, on the second day of class when we were looking for the puppet monster and I asked, "*¿Monstruo duerme en el uno?*" (Is Monster sleeping in number one?), Rusty nodded his head and said, "yeah." He would also use the signs which I had modeled for *sí* (yes) and *no* (no) to demonstrate his agreement or disagreement with a number someone else in the class had guessed and hold up his fingers to indicate which number box he thought Monster was sleeping in. When I displayed a picture of a horse on the screen and asked the class, "*¿Es un elefante?*" (Is it an elephant?) and made an elephant noise, he made the sign for *caballo* (horse). Rusty demonstrated understanding not only by responding to questions but by responding correctly to instructions and was often one of the first students in the class to do so. For example, when I would say, "*la clase se levanta*" (the class stands up), Rusty was generally ones of the first students to stand up.

Despite his general high level of engagement, the first three weeks of class Rusty sometimes showed a hesitancy to participate in activities. This was usually if the activity involved standing or lots of movement. He also sometimes struggled to maintain attention and occasionally needed a reminder to look forward or listen. However, this seemed due not to a lack of desire to participate in Spanish but rather from being tired. Spanish class was the last activity of the day (2 p.m.) and most of the students in his class were tired by that time. The second term of the camp class was moved to 10:45 a.m. and this increased participation and energy on the part of all the students, including Rusty.

During the second term Rusty maintained a high level of engagement, though not without occasional challenges. When having difficulty focusing Rusty may become fidgety and benefit from sensory support such as a fidget toy or sensory tile (to stand or

step on).[8] Another significant factor which at times affected Rusty's engagement and focus during class was disruptive behaviors by classmates. At times he was able to ignore these distractions with the help of a teacher but at other times the disruption was too great to ignore.[9] Additionally, if he was struggling with attention during the rest of the day, he was likely to struggle with it in Spanish as well. Changes in the camp schedule, lack of sleep, and disagreements with friends also adversely affected his attention and participation in class.

As Rusty's acquisition of the language increased, he began to mimic not only signs, but words, and soon was using words along with signs and gestures to communicate in class. By the second week of class Rusty began to repeat some words in Spanish, with the number of words he spoke each class steadily increasing. By the fourth week of class Rusty was beginning not only to repeat words but to produce some words correctly in context. For example, when I asked the class, "*¿Qué color es el caballo?*" (What color is the horse?), Rusty responded confidently, "*café*" (brown), indicating his ability to understand the question and respond in Spanish. Likewise, when listening to a song which asks what color the animals are, Rusty was able to correctly answer most of the questions in Spanish before the color was said in the song. He correctly responded with: *rojo, rosa, gris, morado, negro, blanco,* and *café* (red, pink, grey, purple, black, white, and brown).

However, even when incorporating more speaking in Spanish in class, Rusty often relied on gestures to communicate. When singing the song "Head and Shoulders"

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[8] Rusty's need for sensory support was quite minimal, especially when compared to many other students in the class. Generally, a reminder from a teacher to pay attention or participate would suffice to get him back on track or keep him focused.

[9] When the disruption was too loud or distracting for me to talk over or for the students to concentrate, I would generally wait until it was finished to the continue with the lesson. On at least one occasion when the disruption was exceptionally loud and lengthy and hindering the class from engaging in the lesson I took the class outside and continued with class on the playground.

we would successively get faster, and after each round I would say, "*más rápido*" (faster). Rusty wanted to go more slowly and repeatedly made the action for *lento* (slow) until I saw him and acknowledged his request. He repeated the sign and said, "like this." When I responded, "*¿lento*?" (slowly) he nodded and said, "yes." Throughout the duration of the course Rusty preferred to use the signs for yes and no rather than say *sí* (yes) and *no* (no) in Spanish. Similarly, he generally preferred to use his fingers to indicate his choice of number rather than say the number in Spanish when looking for the monster puppet.

Additionally, Rusty quickly gained the ability to respond to simple instructions without scaffolding such as the support of signs. By the fifth class when told *siéntate* (sit down) he sat down without me using the sign in tandem with the verbal command. His ability to respond to instructions without scaffolding increased throughout the course so that by the middle of week four he was able to successfully respond in the following situation: Students had laminated cards of various colors which had been used in a previous activity. I was instructing the students to stack them up in a certain order and would say something like, "*encima del negro pongan anaranjado*" (on top of black put orange). Rusty was able to choose the correct color without seeing me demonstrate about half of the time. Rusty's comprehension improved so that in certain circumstances he was able to anticipate when it was time to stand up to participate in an activity. For example, I might say "*Monstruo quiere bailar*" (Monster wants to dance), and before I had the opportunity to tell the class to stand up, Rusty was standing up in preparation to dance.

By the last week of class Rusty could read simple sentences in Spanish such as, *Hay cuatro monos cafés. Los monos comen.* (There are four brown monkeys. The monkeys eat). Though it was evident he mostly understood what the sentences meant by his ability to answer questions about them, he was generally unable to translate them

from Spanish to English when reading it himself.[10] However, if a teacher read the sentence to him, he was more likely to be able to say its meaning in English. Rusty was also able to predict some things that I was going to say. For example, to announce it's story time I always said, "*Es tiempo para el cuento*" (It's time for the story/It's story time). During the last week of class I began, "*Es tiempo…*" (it's time) and he said, "story time."

While Rusty participated well and enthusiastically in all activities, his favorite activities included music and dancing, acting out stories, looking for and interacting with the monster puppet, and pointing to the colors on a sheet while listening to the color song. He also expressed a like for story time, because on the few occasions when there was not a story, he asked when we were going to have the story. Rusty was generally the first person in class to volunteer for any activity, whether acting out a story or coming to the screen to point to an animal. His high understanding of the language allowed him to set an example for other students in how to participate in class, especially when the activity was more complicated, such as acting out a story. During the last week, when acting as a dog in a story and instructed to sit in his seat until he heard mention of his character, he stood up from his seat and began to run behind the cat when I said, "*el perro corre detrás del gato*" (the dog runs behind the cat). When the cat escaped from the dog and I said, "*el perro está triste*," (the dog is sad) he laid down on the floor and acted sad. Rusty generally needed less prompting than other students to correctly act out the details of a story as they were being narrated.

Though Rusty generally understood well, he did not always clearly

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[10] Students were never taught how to read in Spanish but were exposed to text through the books that were sent home and the occasional word that I would write on the board when telling the story. Additionally, some of the videos that we watched included text or closed captions in Spanish. The last week of class as part of a cumulative project students colored sheets which would be compiled into a book and sent home on the last day of class. Rusty would read these sentences to his teacher, and she would ask him questions about what the sentences meant.

comprehend the language being used. This was especially true if an activity was new and unfamiliar, if instructions were complicated, an open-ended question was asked to the entire class, or if he needed to understand more complex sentences. For example, when following instructions in Spanish to illustrate the different body parts on the characters in a book, he sometimes got confused about which body part he was supposed to be drawing and may have been drawing a nose when the instructions were to draw eyes. During such instances he needed extra scaffolding such as gestures or signs or someone modeling the correct action, or occasional support in English. Rusty's lack of comprehension was sometimes evident by a confused look on his face. More directly, sometimes Rusty demonstrated lack of comprehension by asking in English, "what's that mean?" However, this happened only a few times, likely indicating that though he was able and willing to ask for comprehension help, he was generally able to understand sufficiently to not feel the need to ask for clarification. Rusty would sometimes answer a question under his breath, either in English or Spanish. Though he was not always brave enough to say the answer out loud he likely understood even more than he openly demonstrated. Encouragement from a teacher sometimes gave him the support he needed to say the answer out loud.

Rusty's overall attitude toward Spanish was positive. He struggled a bit at the beginning of the six weeks since it was challenging to be exposed to something that was new and confusing at the end of the day when he was tired. However, once his comprehension increased and classes were moved to the morning session, he began to be excited about the prospect of Spanish class. Once he was able to say some words in Spanish, Rusty began using his language outside of Spanish class at camp and at home. His mother reported that he "would frequently use Spanish words. While playing 'Eye Spy' he would use the Spanish words for the colors. He started calling our dog *perro*. When bowling I said we were going kind of slow. He responded, 'You mean *lento*?'"

Rusty even used his Spanish in the post-intervention assessments when

completing his English vocabulary assessments. During the English expressive assessment Rusty responded several times with the correct word in Spanish such as *rosa* (pink), *lento* (slowly), and *perro* (dog). Though he only correctly stated one item in Spanish on the EWOPVT-B, he would often say the color of the object in Spanish if he did not know the word. Additionally, Rusty correctly identified thirteen out of thirty-four items on the ROWPVT-B and thirty-four out of forty-five on the RVCBT, and correctly stated fifteen out of thirty-five items on the EVCBT. Finally, Rusty experienced no significant change in his English vocabulary from pre- to post-intervention. His receptive GSV dropped by one point. Though this is a decrease, it does not approach significance and while it could represent an actual decrease in vocabulary, it more likely is a reflection of inconsistent performance on a standardized assessment, or reflective of the difference between forms A and B of the PPVT-4. Rusty's expressive GSV increased by four points. Though this does demonstrate some growth, it is not a statistically significant amount, and it may be concluded that exposure to a FL likely had no significant impact on his L1 vocabulary development.

Case Study Four: Rosie

At the start of the Spanish intervention Rosie was twelve years old, had completed fifth grade, and had a developmental age of four years and eight months. Unlike the typical language profile of children with DS, Rosie's expressive language skills exceed her receptive language skills as measured by the standardized assessments. At the start of the Spanish intervention, she had a receptive age-equivalent of five years and five months and an expressive age-equivalent of five years and six months. Her post-intervention assessments also revealed higher expressive than receptive L1 skills.

Rosie's ability to use expressive language likely contributed to her desire to speak in Spanish and ultimate success in acquiring a large amount of expressive vocabulary. From the first day of class Rosie consistently used gestures to communicate

in Spanish class, though once she was able to say a word in Spanish, she generally chose to say the word along with the gesture. For example, when asked, "*¿Dónde duerme monstruo?*" (Where is monster sleeping?) she said, "*cinco*" (five) and held up five fingers. Similarly, once she was able to produce the word for yes, she would respond affirmatively to a question by saying *si* (yes) and simultaneously use the sign for yes. Even after she was able to say the colors in Spanish, she would generally use the sign for them in tandem with the speaking the word in Spanish.

By the second day Rosie was repeating words in Spanish to demonstrate her understanding. For example, I pointed to a picture of a large horse and said, "*No es un caballo pequeño*" (It's not a small horse) and made a motion indicating small by bringing my hands close together, and continued, "*Es un caballo grande*" (It's a big horse) and spread my hands out far apart to indicate big, at which time Rosie interjected, "*grande*" (big). Rosie consistently looked for any opportunity to use the language she knew, be it by answering questions, making interjections, interacting during the story, or commenting on topics unrelated to the class. For example, if she had a horse on her shirt, she may point to it and say, "*caballo*" (horse). By the fourth week Rosie could correctly answer a question in Spanish when given two choices. For example, I made the monster puppet sing, "la, la, la, la, la," then asked Rosie, "¿M*onstruo canta o baila?*" (Does Monster sing or dance?), to which she responded, "*canta*" (sing). Similarly at the end of the story when asked, "*¿La rana está triste o feliz?*" (Is the frog happy or sad?), Rosie responded, "*feliz*" (happy).

Rosie eventually was able to express a wide variety of things in Spanish without prompting or being given a choice. The last week of class when the students were taking turns hugging the crying baby doll, I said, "*El bebé llora. Waawaa. El bebé está triste*" (The baby is crying. Waawaa. The baby is sad), to which Rosie responded, "*feliz*" (happy), indicating that the baby should be happy now that everyone has given it a hug. Even when Rosie didn´t have the precise vocabulary to express what she wanted to say

she was able to circumlocute and use the vocabulary she did know to communicate. For instance, when Monster was eating both of his hands she yelled, "*¡uno, dos!*" (one, two!) and when he was eating his hands and his feet she yelled, "*¡cuatro!*" (four!) to indicate that he was eating both of his hands and then his hands and feet. By the last couple of weeks of class Rosie was consistently making relevant interjections. For example, as I was reading the title of a book, "*El gato y el perro*" (The cat and the dog) she exclaimed, "*¡negro!*" (black!) because the dog was black.

Toward the end of the six weeks Rosie often completed my sentences for me. When I began to read the book about a cat and a dog I showed them the first picture of a cat and said, "*Había una vez un…*" (Once upon a time there was…) and she said, "*gato*" (cat). On another occasion when telling a story I said, "*el mono baila y está…*" (the monkey dances and is…) and without a pause Rosie finished the sentence with "*feliz*" (happy). Additionally, by the last week of class she was beginning to produce some basic sentences in Spanish. When I took the horse out of its box and made a neighing sound, Rosie exclaimed, "*¡El caballo es café!*" (The horse is brown!) and made the sign for *caballo* and *café* as she said the words. Similarly, when I took Monster out of his box he sang, "*¡Hooolaaaaa clase!*" (hellooooooo class!), and holding her hand up to her mouth as if holding a microphone she said, "*Monstruo canta*" (Monster sings). Though she generally used the language correctly, she occasionally made a mistake, even with words she had previously demonstrated that she knew. After demonstrating on multiple occasions that she knew her colors, she once pointed to her blue shirt and said, "I have *rojo*" (I have red). However, Rosie did not make such mistakes often.

Rosie demonstrated comprehension and acquisition of the language not only through speech but through her facial expressions, body language, and actions. She demonstrated comprehension by reacting appropriately toward what was happening in class, for example laughing when something funny happened, looks of excitement when something exciting happened or she was anticipating that it would happen, or responding

appropriately to verbal instructions. When watching a video of a race between a horse and a turtle she used the gestures for *rápido* (quickly) and *lento* (slowly) when the words were narrated on the video. When she heard, *la clase baila* (the class dances) she began to dance, and when I said, "*para*" (stop), she stopped. Before she was able to produce the names of the animals she could successfully point to the animal on the screen when instructed. By the beginning of the third week Rosie was able to point to the colors on the page during the color song without looking at the screen and before the color was sung in English. She also demonstrated a clear understanding of the language when she was able to act out details of a story. This is best demonstrated by a story she acted out during the last week of class. As I narrated and provided support with gestures Rosie successfully acted out sentences such as *el gato duerme* (the cat sleeps), *el gato corre* (the cat runs), *el gato sube un árbol* (the cat climbs a tree), and *el gato está feliz* (the cat is happy).

Rosie truly seemed to enjoy most any activity in Spanish class, but especially enjoyed the songs and any activity which involved movement. One of her favorite activities was to hold the horse face on a stick and run quickly in place as the class sang "*El caballo corre rápido*" (The horse runs quickly). Rosie initially participated in the songs by mimicking the gestures or doing the actions, and after only a few exposures to any song began to attempt to sing along. By the end of the term, she was able to sing the majority of the words to most of the songs in class. Even after learning the words, she continued to do all the motions and gestures to the songs while singing. For example, during one of the songs with animals she would sing the name of the animal while also doing the sign for the animal.

Rosie was very independent in Spanish class and was able to complete nearly every activity without support from a teacher and often served as a model to the other students for how to participate or complete an activity. She was generally one of the first students to respond to instructions and to volunteer to participate in an activity. She was very encouraging of her classmates when it was their turn to participate and would

sometimes even prompt them in English or Spanish to tell them what to do. For example, when it was a classmate's turn to act out the story and I narrated, "*Susie corre*" (Susie runs) and Susie did not run, Rosie said emphatically, "*¡Susie, corre!*"

Aside from the occasional reminder to pay attention, Rosie independently maintained engagement in Spanish class. She periodically became distracted by her friend sitting at the table with her or with a toy she brought from home. If she was tired, she may lay her head down, but this generally only occurred between activities. Additionally, changes in the camp schedule sometimes affected her attention, though at other times she was able to maintain high engagement despite significant changes to the schedule. The most significant barrier to her engagement was disruptive behavior from classmates which at times could become very distracting for the entire class. Her teacher noted that Rosie needed fewer reminders to pay attention and less support to participate fully in Spanish class than in most other subjects and activities at camp, especially other academic subjects.

Rosie loved to use her Spanish outside of Spanish class. By the middle of the second week her teachers reported that she was repeating some of the words she had learned during snack time. As camp progressed and her vocabulary increased, she used Spanish more frequently in a variety of contexts, and her teachers consistently told me stories of how she was using her Spanish outside of Spanish class. For example, one day an ocean scene with relaxing music was projected on the screen in her class. When Rosie saw a shark on the screen, she made the shark sign and said, "*tiburón*" (shark). Likewise, when she saw a fish she said, "*pez*" (fish) and made the fish sign with her hands. During the last week of camp, I saw Rosie on the playground. As soon as she saw me, she began to run and exclaimed, "I *corre*!" (I runs!).

Rosie also used her Spanish at home. After only one week of Spanish class her parents, who knew no Spanish, reported resorting to looking through the story books that had been sent home to decipher what she was saying. They eventually contacted me and

requested that I share with them the music videos we used in class because she was constantly singing songs in Spanish at home. Toward the end of the six weeks Rosie was speaking Spanish in class, in various contexts at camp, at home, and even outside of the home. Her mom reported that they went out to eat with another family and the subject of Spanish class came up. Rosie proceeded to speak in Spanish, naming the colors of the clothing that people were wearing. Concerning her attitude toward and use of Spanish, Rosie's teacher said, "She's out in the community speaking Spanish. Proving people wrong. People don't expect kids with Down syndrome to speak another language. She is out there showing her understanding of a second language."

Rosie was able to demonstrate a considerable amount of Spanish acquisition in her post-intervention assessments, though the scores do not demonstrate the full extent of her acquisition. She correctly answered five out of thirty-four items on the EWOPVT-B. However, she demonstrated the ability to express beyond what was measured by the assessment and sometimes used Spanish to answer the question by responding with a related word when she did not know the precise word for the item. For example, when presented with a food item she responded with *come* (eats), and when the item was an ear, she responded with *escucha* (listens). Additionally, she often said the color of the item if she did not know the word in Spanish. Rosie correctly identified thirteen out of thirty-four items in the ROWPVT-B and forty-one out of forty-five items on the RVCBT. Finally, she correctly stated twenty-seven out of thirty-five items on the EVCBT.

While Rosie's L1 receptive GSV remained constant from pre- to post-intervention, her L1 expressive GSV increased by nine points, a statistically significant amount. Even while being exposed to a FL and gaining a considerable amount of expressive vocabulary in that language, she was able to demonstrate a significant increase in her L1 expressive vocabulary, indicating that exposure to a FL likely had no detrimental effect on her L1 vocabulary development. Reflecting on Rosie's experience in Spanish class and acquisition of the language her teacher stated, "I am very impressed

with her and how much she learned. Not only the Spanish she used in Spanish class but how she used it in other contexts too. I feel like she could and should continue to learn Spanish. I think it would be beneficial for her to continue learning. She learned so much in 6 weeks." Rosie's mom expressed that she desired for Rosie to continue learning Spanish and requested that her school incorporate goals for learning Spanish into her Individualized Education Program.

Research Question One

Research question one asks, "How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?" I will answer the sub-questions to research question one based upon the information presented in the case studies and the various sources of data gathered for the case studies, as well as general observations from the intervention.

The first sub-question asks, "How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?"

Students may demonstrate non-comprehension in the FL classroom in a variety of ways varying from very subtle hints to direct statements of non-comprehension. First, children may demonstrate non-comprehension with facial expressions or body language. When students do not understand the language being spoken, they may have a look of confusion on their faces. Similarly, they may express hesitancy in responding to instructions. For example, before students clearly understood the command *levántate* (stand up) they would often halfway stand up and then sit back down or stand up very slowly as if trying to decipher if they were doing the right thing. Similarly, if a student is confused, they may look at the teacher intently, waiting for clarification. For example, when instructing students to touch a certain animal on the screen, I generally also made the sign for the animal. I would occasionally not give a gesture to see if the child could answer without support. In the case that they could not identify the correct animal

without the support of the gesture, they would often continue looking at me intently until I repeated the word with the scaffolding of a gesture. In more extreme instances non-comprehension may cause some students to feel extra stress and thus trigger behavioral outbursts or destructive behavior such as knocking over furniture. However, it is sometimes difficult to discern if such behavior is truly from a lack of understanding or general stress and fatigue and a need for a break. It was likely often a combination of the two.

Further, non-comprehension may be demonstrated by a lack of response to a question or instructions. If a student does not understand the question that is being asked, rather than respond incorrectly, they may simply not respond to the question. Likewise, if a student is given instructions and does not follow through with those instructions, this may indicate a lack of understanding of the instructions. This is most likely when the instructions are complex and move beyond simple commands. In the same manner, refusal to participate in an activity could reflect that the child does not understand what is being asked of them or the language being used to narrate the activity. For example, if I was narrating a story and it was a student's turn to act out the story, yet they did not move, it often indicated that they did not understand what they were supposed to be acting out or did not understand the language indicating that it was their character's turn to act. In such cases they needed the support of gestures or modeling to comprehend what was being narrated. However, a lack of response to instructions and refusal to participate in an activity does not always indicate lack of comprehension but may indicate simple unwillingness to participate.

Similarly, students may respond to a question or prompt incorrectly. An incorrect response to a question may imply that the child does not understand the question. However, if the child is answering the question in the L2 it may simply reveal that they do not have the proper expressive vocabulary to answer the question correctly in the L2. Likewise, when a student responds to a prompt incorrectly it likely demonstrates

lack of understanding. For example, if a child is prompted to touch the shark on the screen and instead touches the monkey, it is likely that they did not understand the word for shark. However, sometimes the child simply wanted to touch a different animal and would continue touching it until I said the name for that animal in Spanish. Once I acknowledged the animal they wanted to touch, they would often touch the animal they were being instructed to touch.

Finally, students may demonstrate that they do not understand by making direct statements of non-comprehension. For example, a student may say, "what does that mean?" or "I don't understand." Though the most direct, this was the least common of the indicators of non-comprehension and was generally used by the older students. Overall, when given ample support and scaffolding in the form of simple language, gestures and signs, pictures, or modeling, students with DS are able to understand much of the L2 in a novice FL class.

The second sub-questions asks, "How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?"

Students demonstrate understanding of the L2 in the FL classroom through a wide variety of responses, both verbal and nonverbal. Nonverbal indications of comprehension will be addressed first since these are most common and generally appear before verbal. First, students may express understanding through appropriate facial expressions and other body language. For example, when listening to a story and something funny happens, the student may laugh, or if the character is sad, the student may reflect a sad face as well. If something exciting happens, students may have a look of excitement on their faces or show excitement with some type of body language, such as putting their fists in the air in an expression of excitement.

Furthermore, students may use signs and gestures to indicate their comprehension of the language. Students may use signs or gestures to respond to questions, such as the signs for yes and no. They may also use signs for vocabulary, such

as animals, colors, fast and slow, or any other sign or gesture that has been used in class. Students may use these signs to answer questions, show comprehension as they are listening to a story, or to express their desires. For instance, when listening to a story and the student hears the word *tortuga* (turtle) and proceeds to make the sign for *tortuga* they are indicating their comprehension. Similarly, if a student wants to sing a song quickly, they make the sign for *rápido* (quickly) to express their desire to sing the song faster.

Other nonverbal indicators of comprehension in the FL classroom by children with DS include following instructions, responding correctly to prompts, responding with the proper actions, and acting out what is being narrated. Students show comprehension by following instructions given in the target language. For instance, if the teacher says *levántate* (stand up) and the student stands up, this is a clear indicator of comprehension. In a like manner, students demonstrate comprehension by responding correctly to prompts. If the student is prompted to touch the horse on the screen and they do so, they have understood not only the instructions but the word for horse. Additionally, students may indicate understanding by performing the proper actions. For instance, if a song says *salta* (jump), and the student jumps, they demonstrate understanding of the action being sung in the song. If we are singing a song about a fish swimming and the student acts out swimming, they demonstrate understanding of the word for swimming. Finally, students nonverbally demonstrate comprehension of the language by acting out what is being narrated. This is especially true if the student is able to act out what is being narrated without the support of gestures. Students may demonstrate understanding in this way by acting out with their own bodies what is being narrated, for example by running when their character is supposed to run, or acting out what is being narrated with manipulatives, such as making the horse run when I say "*el caballo corre*" (the horse runs).

In addition to nonverbal indicators, students with DS may indicate their comprehension of the L2 verbally. Verbal indicators of comprehension include

interacting in the L1, answering questions verbally in the L1 or L2, and singing along to songs. First students may demonstrate understanding by interacting in the L1. For example, students may make relevant interjections in the L1 during a story or other activity. This could be in the form of translating what is being said or adding their ideas to the story. For instance, when I said, "*el caballo come*" (the horse eats), and a student interjected "hamburger," they indicated their understanding of what was happening in the story. More commonly, students will state in English what is being said in Spanish. For example, if I say, "*corre"* (runs), the student may say, "running!" or if I say, "*el mono está triste*," (the monkey is sad) the student may say, "he's sad." Additionally, students demonstrate understanding by answering questions in the L1 or the L2. If I ask, "*¿Qué color es el caballo?*" (What color is the horse?), the student may indicate understanding by responding in Spanish, "*café*" or in English, "brown."

Finally, students may demonstrate comprehension by singing along to songs. This is especially an indicator of comprehension when the student acts out the actions or does the appropriate gestures along with singing the words. For example, if the student sings *duerme* (sleeps) and then pretends to sleep, they are indicating their comprehension of what they are singing. Additionally, students demonstrate comprehension when they sing or say the lyrics before they arrive in the song. If the song asks, "*¿Delfín, ¿de qué color eres?*" (Dolphin, what color are you?) and the student responds in English, "blue" or in Spanish, "*azul*" before the song, they demonstrate their comprehension of what the question asks.

The third sub-questions asks, "What barriers exist to their participation in the foreign language classroom?"

Barriers to the participation of children with DS in the FL classroom may be divided into internal and external barriers, though the delineation between the two is not always clearcut. First, internal factors may act as barriers to a student's full engagement or participation in a FL class. Internal barriers include short attention span, sensory needs,

mood and energy level, and behavior. A short attention span, common among children with DS, may make it challenging for a student to stay engaged in class. This is especially salient when an activity requires sustained attention, such as during story time. Children may also struggle to sustain attention during an activity in which every student gets a turn. However, children generally seemed engaged watching their classmates perform. Students with high sensory needs may face greater barriers to staying engaged in the FL classroom. They may need more frequent breaks or may become disengaged stimming or looking for some other kind of stimulation. Additionally, a student's mood and energy level may affect their engagement and participation. If a student is extra tired or in a negative mood, they may be less likely to engage fully in the activities in class.

Finally, the internal factor which acts as the greatest barrier to a child's participation in the FL classroom is that child's own behavior. While this factor was not necessarily the most widespread among the children with DS who participated in this intervention, it was the most severe barrier for those who struggled to regulate their behavior in a positive way. Those students that struggled with regulating emotions, switching from preferred to non-preferred activities, or relinquishing control struggled more than their peers with DS to participate in the FL class. Behaviors such as outbursts, emotional meltdowns, and destructive behaviors such as throwing objects or knocking down furniture may prevent a child from participating fully in the class. Similarly, a child's own unwillingness to participate may prevent them from participating in class. This unwillingness may be caused by any number of internal factors, and it is often difficult to uncover the underlying reason. While an unwillingness to participate could be triggered from an external factor such as lack of comprehension, that did not seem to usually be the case.

External barriers include changes in schedules, distraction from a preferred object, difficulty understanding instructions or complex language and activities, and distracting or disruptive behavior from other students. Children with DS thrive on

consistency and schedules, so when a child experiences a change in their schedule, this may affect their mood and thus their ability to participate in the FL class without distraction. This is an instance where an external factor may spur an interior barrier as the child may become internally distracted by the external change of schedule. Students may also be prevented from participating fully in the FL classroom if they have in their possession a preferred object such as an iPhone of iPad. The only case in which this was a barrier for any child in this intervention was for Allen, who had difficulty regulating his emotions and transitioning from a preferred activity to a non-preferred activity. He was sometimes given an iPhone or iPad to help him regulate his emotions and calm down. However, when the device would stay in his possession during Spanish class, it served as a barrier to his engagement and participation. This is an example of an internal factor (difficulty regulating emotions and transitions) which resulted in an external barrier (the distraction caused by a device).

Additionally, students with DS may experience barriers if the L2 being spoken in the class is beyond their comprehension. This may cause them to have trouble following instructions and thus participating in an activity, or they may not be able to understand the content being presented, for example, follow the plot of the story. Activities which involve a higher coordination between understanding and acting out details, such as acting out a story with manipulatives, may be challenging for some students with DS to complete independently. Finally, distracting or disruptive behavior from other students may prevent students with DS from participating fully in the FL class. For those students who were able to participate fully and independently, this was the one external factor which would sometimes prevent them from attending to the lesson and thus affect their participation. It is important to note that many of these barriers can easily be avoided or lessened by providing the proper scaffolding and support to students and thus in some sense should not be considered barriers but challenges.

The fourth sub-questions asks, “What type of support do children with Down

syndrome need to successfully participate in the foreign language classroom?"

The amount of support needed to successfully participate in the FL classroom varies widely among students with DS and may be divided into two broad categories: behavioral support and content support. Behavioral support is generally unrelated to the content or L2 and pertains to the child's behavior and emotions while content support is any support needed to properly understand or respond to the L2 input in order to complete the activities in class. Behavioral support may be needed by children with DS in any classroom context, whereas content support is a bit more specific to the FL context.

Behavioral support needed to participate in the Fl classroom may vary from basic support such as verbal reminders, to more in-depth support such as proximity control, sensory support, and support properly expressing needs or desires. Verbal reminders are reminders to pay attention, disengage from a distracting activity such as talking with a friend, or to follow instructions. A verbal reminder in this context, especially a reminder to follow instructions, is not related to the child's inability to understand the instructions in the L2, but rather an unwillingness to comply with what is being asked of them. For example, even after clearly demonstrating comprehension of the command *levántate* (stand up), students may be tired and not want to stand up or have some other reason for not wanting to participate and would thus need additional prompts from myself or the assistants to comply and stand up. These additional prompts could be done in the L2, though sometimes extra support was needed from the L1 to ensure compliance.

Proximity control may be needed for those students who need extra support paying attention or who may occasionally engage in activities such as knocking down chairs. Such children needed an adult nearby to help redirect them when necessary or prevent them from engaging in disruptive or destructive behavior. Additionally, sensory support such as pressure massages, some kind of fidget, or going for walks may be needed for those children who need extra stimulation to stay engaged or need additional

breaks. Finally, students may need help properly expressing their needs or desires in class. For example, one student would often interrupt with “No, no, no! Wait, wait, wait!” and would need reminders of how to address me by name to get my attention and express his desires.

Content support is needed when students do not understand the L2 being used in class well enough to follow instructions, respond properly, or engage in an activity in class. Content support consists of signs or gestures, modeling, pauses and repetition, occasional use of the L1, and hands on help completing difficult tasks. One of the most effective forms of content support for students with DS in the FL classroom is the use of signs and gestures. When students do not understand the use of verbal input alone, the addition of the sign, especially when it has been presented and used previously in tandem with the verbal input, is often sufficient to help the student understand. For example, when being told to touch the turtle on the screen if the student does not understand the verbal input alone, the addition of the sign for turtle will add meaning to the verbal input and help them understand. Modeling is helpful when introducing a word or concept for the first time or when giving instructions to students. For example, when instructing students to stand up, the action can be modeled in tandem with the verbal input. When giving instructions, especially more complex instructions, modeling is often needed for the students to be able to comprehend what is required of them. Modeling is also helpful to help students complete complex tasks such as acting out a story with manipulatives. For example, more students experienced success in acting out the story with manipulatives when I had my own set of manipulatives and modeled while narrating the story as opposed to narration alone or narration coupled with pointing to pictures.

Sometimes students simply need extra time to process, and a pause or repetition is sufficient scaffolding to aid them in understanding. A pause gives them additional processing time, and repetition allows them to hear the word again for further processing. At times, however, the use of gestures, modeling, or repetition may not be

sufficient to ensure understanding, and the L1 may be necessary to clarify the meaning of more complicated language. Finally, some students needed hands on help to complete difficult or complex tasks. For example, some children needed support to point to the color on the page while listening to the color song. Another complex task which some students consistently needed hands on support completing was acting out the story with manipulatives. Some students needed a teacher to help them move the manipulatives in a way which reflected the narration of the story. For example, if I narrated "*el mono se pone el sombrero*," (the monkey puts on the hat), a student may need assistance helping their monkey put on the hat. However, it was not always clear if support for these tasks was needed due to non-comprehension of the language, the complexity of the task, difficulty attending to the task, or a dislike for the activity. It should be noted that many of these content support strategies do not differ from what would benefit a TD child in the FL classroom, though students with DS may need support with more frequency. However, no data is available as to the amount of support needed by a child with DS compared to a TD child since no TD children participated in the study.

The fifth sub-question asks, "What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?"

Children with DS seem to enjoy a wide variety of activities in the FL classroom. Activities which involved movement, interaction, or taking a turn were favorites of most students. Additionally, many students enjoyed story time. Though some students struggled to maintain attention for the duration of the story, many students expressed a positive attitude toward story time and would interact verbally during the story. Students especially enjoyed story time when it incorporated physical movement. For example, if a character in the story would run, students could move their feet quickly as if they were running and thus participate in the story. Students enjoyed a variety of activities which allowed them to have their own turn, such as acting out a song or simple story with a prop such as a mask on a stick or coming to the board to point to an animal.

Students seemed to enjoy having a turn because it gave them the opportunity not only to participate and move but to show off their skill and receive praise and attention.

Another favorite activity of students was interacting with the monster puppet. Each class began with taking turns guessing which box Monster was sleeping in. After he was found, I would count to three in Spanish and the students would say, "*Hola, Monstruo*" (Hello, Monster). Monster would then proceed to greet every child in the room by name, giving high-fives and hugs. The routine of looking for Monster and greeting Monster quickly became a favorite activity of all the children and the routine became longer and longer as new elements were added to the routine. For example, in the older class, Monster began to eat people's hands and drink their water. The students were constantly coming up with new things for Monster to do, and these new things would then become part of the daily routine. All students were actively engaged in any activity with Monster, even if it was not their turn to greet him, and Monster became an engaging source of rich input in the L2.

The most widely loved activity seemed to be music, especially with a video. Students highly enjoyed the combination of music with movement and benefitted from the visual support given by music videos. Many students had favorite songs and would become visibly excited when a song they liked began to play. Other students expressed their excitement for music by requesting specific songs. Most students were highly engaged during songs with videos which incorporated movement, and many began to sing along to the songs as well.

Research Question Two

The second research question asks, "To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?"

To answer this research question students were administered four post-

intervention measures of Spanish vocabulary. Participants were first administered two standardized assessments, followed by two content-based assessments. One of each measured expressive vocabulary and one of each measured receptive vocabulary. The results of the four quantitative assessments will be discussed below. Additionally, the results of the standardized assessments will be compared to those of the content-based assessments.

EOWPVT-B. The *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (EOWPVT-B) was the standardized assessment used to measure the expressive Spanish vocabulary of intervention participants.[11] Of the eleven intervention participants, only ten participants were administered the EOWPVT-B. The participant who was not administered the EOWPVT-B was also not administered expressive assessments in English due to having unintelligible speech and was given a score of zero. Participants were administered thirty-four items, and scores were calculated as total number correct out of thirty-four. While some participants scored zero, the majority of participants were able to correctly state at least one item in Spanish, with two students achieving five items correct (M=1.7; SD=2.0). The results for EOWPVT-B can be found on table A3 in appendix 18.

ROWPVT-B. The *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (ROWPVT-B) was the standardized assessment used to measure receptive Spanish vocabulary acquisition of all intervention participants.[12] Thirty-four items were administered, and scores were calculated as total number correct out of thirty-four. All participants correctly identified at least a few items. The minimum number of

[11] Nancy A. Martin, *Expressive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy Publications, 2013).

[12] Nancy A. Martin, *Receptive One Word Picture Vocabulary Test, Spanish-Bilingual Edition* (Novato, CA: Academic Therapy Publications, 2013).

items correctly identified was four, and the maximum was thirteen (*M*=10.27; *SD*=3.0). The results for ROWPVT-B can be found on table A3 in appendix 18.

EVCBT. The expressive vocabulary content-based test (EVCBT) was the instrumentation developed in phase two to measure the expressive Spanish vocabulary of participants based off of the curriculum used in the Spanish class intervention. The EVCBT was administered to ten of the eleven intervention participants. The one participant who was not administered the EVCBT was also not administered expressive assessments in English due to having unintelligible speech and was given a score of zero. The EVCBT consisted of thirty-five items and scores were calculated as total number correct out of thirty-five. All but two participants correctly produced at least one item in Spanish while the maximum number correctly produced was twenty-seven (*M*=11.5; *SD*=9.6).[13] The results for the EVCBT can be found on table A3 in appendix 18.

RVCBT. The receptive vocabulary content-based test (RVCBT) was the instrumentation developed in phase two to measure receptive acquisition of Spanish vocabulary from the intervention curriculum. The RVCBT was administered to all intervention participants and consisted of forty-five items. Scores were calculated as total number correct out of forty-five. All participants correctly identified some items in the RVCBT, with the minimum number of items identified being nine, and the maximum forty-one (*M*=26.6; *SD*=9.77). The results for the RVCBT can be found on table A3 in appendix 18.

Standardized vs. content-based. Two two-tailed *t*-tests were conducted to determine the difference in performance between the standardized assessments

[13] Of the two participants who failed to answer at least one item correctly, one was the student who was not administered the assessment. Thus, of those participants administered the assessment, only one was unable to produce at least one word expressively.

(EOWPVT-B and ROWPVT-B) and the content-based assessments (EVCBT and RVCBT). One *t*-test compared the mean percentage correct of the EOWPVT-B to the mean percentage correct of the EVCBT. Performance on the EVCBT (*M*=32.99; *SD*=27.5) exceeded performance on the EOWPVT (*M*=5.08; *SD*=5.9); *t*(20)=3.3115, *p*=.00348. The second *t*-test compared the mean percentage correct of the ROWPVT-B to the mean percentage correct of the RVCBT. Performance on the RVCBT (*M*=59.19; *SD*=27.71) exceeded performance on the ROWPVT (*M*=30.22; *SD*=8.83); *t*(20)=5.3098, *p*<.001.

Research Question Three

Research question three asks, "Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?"

To answer this question results of the EOWPVT-B were compared to results of the ROWPVT-B, and results of the EVCBT were compared to the results of the RVCBT. For the purposes of the analysis between EOWPVT-B and ROWPVT-B raw scores (total correct out of thirty-four) were utilized while percentages of total correct were used for the analysis between EVBCT and RVCBT due to the discrepancy between the number of total assessment items. A two-tailed *t*-test was utilized in both analyses to test the null hypothesis that no significant difference would be found between receptive and expressive acquisition. The results of each comparison are presented below.

EOWPVT-B vs. ROWPVT-B. An independent two-tailed *t*-test was conducted using raw scores to determine if there was a difference between the expressive and receptive scores on the standardized assessments. Receptive scores (*M*=10.27; *SD*=3.00) were found to be significantly higher than expressive scores (*M*=1.727; *SD*=2.00); *t*(17.4)=7.8, *p*=.000.

EVCBT vs. RVCBT. An independent two-tailed *t*-test was conducted to determine if there was a difference between the expressive and receptive scores on the content-based assessments. Due to the discrepancy in item numbers, percentages are reported. Receptive scores (M=59.19; SD=21.7) were found to be significantly higher than expressive scores (M=32.99; SD=27.5); $t(18.98)=2.48$, $p=.0227$.

Research Question Four

Research question four asks, "which of the following variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome? The variables of interest are chronological age, nonverbal cognition, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education." Chronological age was determined as the age in months at the start of the intervention. Nonverbal cognition was calculated as the raw score on the KBIT-2 administered pre-intervention. L1 abilities were calculated as raw scores on the PPVT-4 and EVT-2 at pre-intervention. Performance on a NWRT was determined by total number correct. Class attendance was total number of classes attended out of total number of classes (thirty). Outside exposure was based on the outside exposure survey and was calculated on a scale from zero (none) to three (high). Finally, maternal education was calculated on a scale of one to five. Means and standard deviations for each variable can be found on table A7 in appendix 21.

Pearson product-moment *r*-correlation coefficients were computed to determine the relationship between L2 acquisition and each variable. Pearson *r*-correlations were computed for each of the four assessments. However, due to the lack of variation in the standardized test scores, only *r*-correlations for the EVCBT and RVCBT will be discussed. Statistically significant results, as well as those approaching significance will be discussed. Results of all Pearson *r*-correlations can be seen on table

A8 in appendix 22.

The following variables did not have a statistically significant relationship to FL lexical acquisition: CA, NVC, class attendance, and outside exposure. The following variables were found to have a statistically significant relationship to at least one measurement of FL lexical acquisition: L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, and maternal education. L1 expressive lexical ability was found to be strongly positively correlated to FL expressive acquisition, $r(9)=.79$, $p=.002$ and moderately positively correlated to FL receptive acquisition, approaching significance, $r(09)=.51$, $p=.056$. The relationship between L1 expressive lexical ability and FL lexical acquisition is such that as L1 expressive ability increases, FL acquisition also increases, with the relationship between L1 expressive and FL expressive stronger than that of L1 expressive and FL receptive.

L1 receptive lexical ability was found to be moderately positively correlated to FL expressive acquisition, $r(9)=.59$, $p=.027$ and moderately positively correlated to FL receptive acquisition $r(9)=.51$, $p=.05$. The relationship between L1 receptive lexical ability and FL lexical acquisition is such that as L1 receptive ability increases, FL lexical acquisition also increases, with the relationship between L1 receptive and FL expressive only marginally stronger than that of L1 receptive and FL receptive.

Performance on a nonword repetition task was found to be strongly positively correlated to both FL expressive acquisition, $r(9)=.64$, $p=.017$ and FL receptive acquisition, $r(9)=.61$, $p=.024$. The relationship between performance on a nonword repetition task and FL lexical acquisition is such that as performance on the task increases, FL lexical acquisition also increases, with the relationship between performance on a nonword repetition task and expressive FL acquisition marginally stronger than that of performance on a nonword repetition task and receptive FL acquisition.

Maternal education was found to be significantly related to expressive FL

acquisition $r(9)=.64$ $p=.016$, while receptive was only moderately positively related maternal education, almost approaching significance, $r(9)=.47$ $p=.07$. The relationship between maternal education and FL lexical acquisition is such that as maternal education increases, so does FL acquisition, with a significantly stronger relationship between maternal education and expressive FL lexical acquisition than between maternal education and receptive FL lexical acquisition.

Research Question Five

Research question five seeks to determine if L1 vocabulary levels of children with DS change after participation in a six-week FL class as measured by a standardized assessment. The pre- and post-intervention English vocabulary tests were analyzed in two different ways to answer this question. First, the means of the English vocabulary pre- and post-tests were compared using a two-tailed *t*-test. PPVT-4 scores at time one ($M=64.73$; $SD=26.37$) did not differ significantly from PPVT-4 scores at time two ($M=68.82$; $SD=28.21$); $t(20)=0.3514$, $p=.729$. Likewise, EVT-2 scores at time one ($M=46.18$; $SD=28.12$) did not differ significantly from EVT-2 scores at time two ($M=50.55$; $SD=31.06$); $t(20)=.3454$, $p=.733$.

Secondly, to determine the change in L1 vocabulary from pre-intervention to post-intervention, the growth scale value (GSV) of each intervention participant was calculated for the PPVT-4, Forms A and B, and EVT-2, Forms A and B. The GSV from Form A was then subtracted from Form B to determine the change. The GSV is "an indicator of the absolute level of performance" and is "designed for measuring change over time," and thus is the most useful measurement of change for L1 vocabulary from pre-intervention to post-intervention.[14] The GSV change of the PPVT-4 ($M=3$;

[14] Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 205.

SD=11.14) did not reach significance.[15] Likewise, the GSV change of the EVT-2 (*M*=3.5; *SD*=8.09) did not reach significance.[16]

Evaluation of Research Design

The following section offers a brief summary of the strengths and weaknesses of this exploratory mixed methods multiple case study design. This study offered many valuable contributions to the study of second language acquisition in children with DS even though the final design was not precisely as originally intended.[17]

Strengths of the Research Design

This study was the first to document the L2 acquisition of children with DS in the FL context and their participation in the FL classroom and as such is an important contribution to the fields of second language acquisition and language development in children with DS. The first strength of this study is the variety of abilities represented among the intervention participants. Though it is not possible to claim that the entire spectrum of abilities represented in individuals with DS was represented in this sample, a wide variety of cognitive and linguistic abilities were represented among the intervention participants. Additionally, the multiple case study design was a strength for this study as it provided a rich description of the participation of children with DS in the FL

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[15] For the age range of the intervention participants, a GSV change of 8 points is needed to reach significance ($p<.10$). The EVT-2 and PPVT-4 manuals each supply a chart which lists statistically significant difference sizes by age group ($p<.10$), and state that "a statistically significant difference is one that is large enough to be unlikely to have occurred by chance (i.e., because of measurement error) . . . (though) statistically significant differences are not necessary for demonstrating growth in vocabulary." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221 and Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 205.

[16] For the age range of the intervention participants, a GSV change of 7 points is needed to reach significance ($p<.10$). Williams, *The Expressive Vocabulary Test Manual*, 221.

[17] More details regarding the original design of the study and the obstacles faced to complete the study can be found in chapter five under the heading "Obstacles to Conducting the Research." Many of the strengths and weaknesses mentioned in this present section are discussed in more detail in said section in chapter five.

classroom. The multiple case studies presented represent children with a wide spectrum of cognitive and linguistic abilities with varying experiences in the FL classroom.

The unique setting of the intervention at the summer enrichment camp at DSL contributed to various strengths of the study. First, as a result of the six-week setting, the frequency of exposure to the L2 was greater than would have been in another setting, such as in an elementary school classroom. The daily exposure to the L2 was likely advantageous for the acquisition of intervention participants. Secondly, the unique setting in a camp exclusively for children with DS allowed many children with DS to be exposed to the same L2 input at the same time. A different design that gathered data from distinct sources or contexts would not provide a consistent base of L2 input for which to compare the acquisition of participants.

Next, the exploratory design of this study allowed for the development of instrumentation specific to the L2 input received by the students. This provided a more accurate representation of the L2 acquisition of the intervention participants which would not have been possible if relying solely upon standardized assessments. Finally, the mixed methods design of this study which combined both quantitative and qualitative data on the L2 acquisition of children with DS in the FL context provides a much richer and fuller understanding of initial stages of FL acquisition in children with DS than either source could have provided independently.

Weaknesses of the Research Design

Despite the uniqueness of this research, the design had some notable weaknesses, the first of which is the lack of a TD control group. Though efforts were made to recruit TD students to participate in the Spanish intervention, none committed to participating. As a result, the acquisition of the children with DS cannot be compared to TD students who received the same or comparable input. While the data collected from the children with DS is valuable in and of itself, more would be understood about their

acquisition if it could be compared to that of TD children. Another weakness of the study is the small L1 control group, which consisted of only three individuals. As a result of the small control group, the data gathered was not utilized in the final analysis. The conclusions drawn regarding the impact of exposure to a FL on L1 vocabulary could be considered more reliable if compared to a control group. The conclusions drawn regarding change in L1 vocabulary may also be more reliable had the same form of the PPVT-4 and the EVT-2 been used in the pre- and post-intervention assessments.

Additionally, most participants would have benefitted from multiple pre- and post-intervention assessment sessions, but this was not feasible due to scheduling and time constraints. Had participants been able to complete their assessments over a span of two sessions rather than one, they may have demonstrated more acquisition. Finally, the length of exposure to the L2 was quite limited, totaling about twenty-two and a half hours of exposure. Due to the short nature of this study students had limited contact with the L2, and a more long-term study with a greater amount of exposure to the L2 would reveal more about the initial stages of L2 acquisition in the FL context among children with DS.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Research Purpose

The purpose of this study was to describe the participation of elementary-aged children with DS in a six-week FL class and to measure the receptive and expressive lexical acquisition of Spanish as a FL in students with DS. This study also examined the variables which correlate with FL lexical acquisition in children with DS and the effect of FL exposure upon L1 vocabulary of children with DS.

Research Questions

The following questions were addressed by this study:

1. How do students with Down syndrome demonstrate their acquisition of the Spanish language in a six-week foreign language classroom based upon observations?
    a. How do students with Down syndrome demonstrate that they do not understand the L2 in the foreign language classroom?
    b. How do students with Down syndrome demonstrate that they do understand the L2 in the foreign language classroom?
    c. What barriers exist to their participation in the foreign language classroom?
    d. What type of support do children with Down syndrome need to successfully participate in the foreign language classroom?
    e. What activities do children with Down syndrome seem to enjoy the most in the foreign language classroom?
2. To what extent do children with Down syndrome acquire second language vocabulary in a six-week foreign language classroom?
3. Do the post-intervention L2 expressive lexical abilities of children with Down syndrome differ from that of their post-intervention L2 receptive lexical abilities?

4. Which of the following variables, if any, correlate with receptive and/or expressive lexical foreign language acquisition in children with Down syndrome? The variables of interest are chronological age, nonverbal cognition, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education.

5. Do L1 vocabulary levels of children with Down syndrome change over the course of a six-week FL class as measured by a standardized assessment?

Discussion of Findings

The analysis of findings for each research question was presented in chapter four. The below section will discuss the significance of the findings for each research question. Special attention will be given to those findings with statistical significance and will interact with relevant precedent literature.

Research Question One

The first research question drew upon qualitative data to explore how students with DS demonstrate their acquisition of the Spanish language in a six-week FL classroom. The sub-questions examined how students with DS demonstrate comprehension and non-comprehension of the L2, what barriers exist to their participation in class and accordingly, what type of support they need to successfully participate in the class, and finally, what activities they seem to enjoy the most in the FL classroom. The answers to these questions are valuable for any teacher wishing to teach a FL to children with DS, whether in a segregated context, similar to that of this study, or in the inclusive context alongside TD peers.

Students with DS demonstrate non-comprehension of the L2 through facial expressions and body language, hesitancy in responding to instructions or non-response to instructions or questions, incorrect responses, and direct statements of non-comprehension. Students with DS demonstrate comprehension of the L2 in the FL classroom through a variety of responses, both nonverbal and verbal. Nonverbal responses which demonstrate understanding of the L2 include appropriate facial

expressions and body language, the use of signs and gestures, following instructions, responding correctly to prompts, responding with the proper actions, and acting out what is being narrated. Verbal indicators of comprehension of the L2 include interacting in the L1, answering questions verbally in the L1 or L2, and singing along to songs. These indicators of non-comprehension and comprehension demonstrate that children with DS can comprehend the L2 in the Fl classroom, though they may need some support to understand. Overall, when given ample support and scaffolding in the form of simple language, gestures and signs, pictures, or modeling, students with DS are able to understand much of the L2 in a novice FL class. Teachers of children with DS should be aware of the signs of comprehension and non-comprehension so that they can adequately adjust their language and delivery of the L2 and make it comprehensible for students with DS.

While students with DS can successfully participate in the FL classroom, some barriers do exist to their participation, and as a result they may need the support of an assistant or the teacher to be fully integrated into the classroom. Barriers to the participation of children with DS in the FL classroom may be divided into internal and external barriers, though the delineation between the two is not always clearcut and the two often intermingle or feed off of each other. Internal barriers include short attention span, sensory needs, mood and energy level, and behavior. External barriers include changes in schedules, distraction from a preferred object, difficulty understanding instructions or complex language and activities, and distracting or disruptive behavior from other students. The extent to which a child with DS may be affected by any one of these barriers varies greatly among individuals. The most widespread and formidable barrier seemed to be behavior, whether the child's own behavior or the disruptive behavior of another child. It is important to note that many of these barriers can easily be avoided or lessened by providing the proper scaffolding and support to students and thus in some sense should not be considered barriers but challenges. That is to say that the

vast majority of these challenges can be overcome and children with DS can indeed successfully participate in the FL classroom.

As a result of these challenges, some children with DS may need support from an assistant of the teacher to fully participate in the FL classroom. The amount of support needed to successfully participate in the FL classroom varies widely among students with DS and may be divided into two broad categories: behavioral support and content support. Behavioral support needed to participate in the FL classroom includes verbal reminders, proximity control, sensory support, and support properly expressing needs or desires. Behavioral support is more closely related to child internal factors and thus may be needed by children with DS in any classroom context. Content support is related to the child's ability to understand the L2 and participate in activities involving the L2 in the FL classroom and consists of signs or gestures, modeling, pauses and repetition, occasional use of the L1, and hands on help completing difficult tasks.

It should be noted that many of these content support strategies do not differ from what would benefit a TD child in the FL classroom, though students with DS may need support with more frequency. However, no data is available as to the amount of support needed by a child with DS as compared to a TD child since no TD children participated in the study. While some students with DS require fairly consistent support from an assistant to participate fully in the FL classroom, other students with DS are able to participate independently without extra support from an assistant. Additionally, most students increased in their ability to participate independently in the FL classroom throughout the duration of the course.

Finally, children with DS seemed to enjoy a wide variety of activities in the FL classroom. Activities which involved movement, interaction, or taking a turn were favorites of most students. Though sustaining attention through the duration of story time was challenging for some students, many seemed to enjoy story time. Students especially enjoyed looking for the monster puppet every class and the accompanying greeting

routine. Finally, most students truly enjoyed any activity involving music, especially when accompanied by movement and a video. There is no shortage of input rich activities which may be used to facilitate L2 learning by children with DS in the FL classroom.

Research Question Two

The second research question examined to what extent children with DS could acquire L2 vocabulary in the FL classroom. The results of the quantitative assessments clearly demonstrate that children with DS can acquire L2 vocabulary in a six-week FL classroom. All children who participated in the intervention showed evidence of vocabulary acquisition as measured by a quantitative assessment. Four quantitative measures were administered to intervention participants, with varying results.

As expected, participants performed significantly higher on the content-based assessments (EVCBT and RVCBT) than the standardized assessments (EOWPVT-B and ROWPVT-B). The disparity between the standardized assessments and the content-based assessments is evident when comparing the percentage of total items correctly answered. While participants correctly answered 23.99 percent of the items on the EVCBT (*SD*=27.5), they only correctly answered 5.08 percent of the items on the EOWPVT-B (*SD*=5.9); $t(20)=3.3115$, $p=.00348$. Similarly, while participants correctly answered 59.19 percent of items on the RVCBT (*SD*=27.71), they only correctly answered 30.22 percent of the items on the ROWPVT-B (*SD*=8.83); $t(20)=5.3098$, $p<.001$. Despite the sizable gaps in performance between the content-based assessments and the standardized assessments, many participants were able to demonstrate a small amount of acquisition as measured by the standardized assessments. All students demonstrated receptive L2 vocabulary acquisition as measured by the standardized assessment (*M*=10.27; *SD*=3.00) and by the content-based assessment (*M*=26.63; *SD*=9.77). Eight students correctly identified at least half of the items on the RVCBT and one student correctly identified thirty-five items (77.78 percent), demonstrating that many students were able to achieve a

considerable level of success acquiring receptive vocabulary after only six weeks of instruction.

Given the distinct expressive deficit experienced by children with DS, the slow nature of L2 acquisition, and the limited contact with the L2, skepticism was expressed as to the possibility of participants acquiring expressive L2 vocabulary. Despite these various factors, the majority of participants (81.82 percent) acquired at least some expressive L2 vocabulary as measured by the EOWPVT-B (M=1.73, SD=2.0) and by the EVCBT (M=11.55; SD=9.63). Four students correctly stated at least half of the items on the EVCBT, and one student correctly stated twenty-seven items (77.14 percent), demonstrating that some children with DS can successfully acquire a considerable amount of expressive FL vocabulary in a relatively brief amount of time.

When presented with the question, "Can individuals with Down syndrome become second language learners?" in 2009 Kay-Raining Bird responded, "The answer is probably. There are currently no studies of bilingualism in children with DS that have focused specifically upon second language learners."[1] Since that time, a small amount research has been conducted on L2 learning in children with DS, though not in the FL context.[2] This research demonstrates that children with DS can indeed acquire both receptive and expressive L2 vocabulary in a six-week FL class to varying degrees of success.

Research Question Three

The third research question asked whether the post-intervention L2 expressive

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[1] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 93.

[2] Sarah Martin and colleagues conducted a single case study of L2 learning in a child with DS in the immersion context. Sarah Martin et al., "Bilingual Outcomes for a Student with Down Syndrome in French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 1–29. To date no other studies on L2 learning in children with DS have been published.

vocabulary skills differed from post-intervention L2 receptive vocabulary skills. The raw data demonstrates that the post-intervention Spanish expressive and receptive lexical abilities of all intervention participants differ, with L2 receptive abilities exceeding expressive for every participant. This difference was found to be statistically significant. As a group participants scored higher on measurements of receptive vocabulary than measurements of expressive vocabulary ($t(19.4)=4.21$, $p=.0005$), though the difference between expressive and receptive abilities was more salient on the standardized assessments ($t(17.4)=7.8$, $p=.000$) than the content-based assessments ($t(18.98)=2.48$, $p=.0227$).

These results conform to what would be expected given that individuals with DS have a marked delay in expressive abilities when compared to receptive abilities.[3] The receptive vocabulary of individuals with DS generally surpasses that of their expressive vocabulary so that they tend to understand more words than they can speak, and receptive vocabulary is considered a relative strength for individuals with DS.[4] This holds true for monolinguals as well as for bilinguals in both their dominant and non-dominant language.[5] Additionally, research on novel word acquisition demonstrates that

[3] Julie Grieco et al., "Down Syndrome: Cognitive and Behavioral Functioning across the Lifespan," *American Journal of Medical Genetics Part C: Seminars in Medical Genetics*, 169, no. 2 (2015): 136; Leonard Abbeduto, Steven F. Warren, and Frances A. Conners, "Language Development in Down Syndrome: From the Prelinguistic Period to the Acquisition of Literacy," *Mental Retardation and Developmental Disabilities Research Reviews* 13, no. 3 (2007): 250; Gary E. Martin et al., "Language Characteristics of Individuals with Down Syndrome," *Topics in Language Disorders* 29, no. 2 (2009): 5; Glynis Laws and Dorothy V. M. Bishop, "A Comparison of Language Abilities in Adolescents with Down Syndrome and Children with Specific Language Impairment," *Journal of Speech, Language, and Hearing Research* 46 (2003): 1335; Robin S. Chapman et al., "Language Skills of Children and Adolescents with Down Syndrome: II. Production Deficits," *Journal of Speech, Language, and Hearing Research* 41, no. 4 (1998): 9.

[4] For receptive vocabulary as a relative strength in individuals with DS see Glynis Laws et al., "Receptive Vocabulary and Semantic Knowledge in Children with SLI and Children with Down Syndrome," *Child Neuropsychology* 21, no. 4 (2015): 498,502; Miguel Galeote et al., "The Development of Vocabulary in Spanish Children with Down Syndrome: Comprehension, Production, and Gestures." *Journal of Intellectual and Developmental Disability* 36, no. 3 (2011): 191–93.

[5] For bilinguals see Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English

when exposed to new words individuals with DS are able to comprehend much more than they can produce.[6] Thus, it seems reasonable to conclude that FL acquisition in children with DS may follow the same general pattern of language abilities in individuals with DS in that receptive abilities precede expressive abilities. When learning a FL, as with an L1, receptive vocabulary may be considered a relative strength for individuals with DS.

Research Question Four

Research question four sought to determine which factors relate to FL vocabulary acquisition. The variables examined were CA, NVC, L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, class attendance, outside exposure to the L2, and maternal education. Four variables were found to be significantly related to some aspect of FL acquisition. These variables in order of strength are maternal education, L1 receptive ability, performance on a nonword repetition task, and L1 expressive ability. These variables and the pertinent literature will be discussed below. Due to their link to each other in the literature, L1 receptive and expressive abilities will be discussed simultaneously.

Maternal education was strongly positively correlated to expressive FL vocabulary acquisition and approached significance to receptive FL vocabulary acquisition, such that as maternal education increased, FL vocabulary increased. The expected relationship of maternal education to vocabulary acquisition in L2 learners with

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Bilingual Children with Down Syndrome," *Journal of Communication Disorders* 93 (2021):10–11; Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Langage Learning and Education* 16, no. 3 (2009): 92; Krista Feltmate and Elizabeth Kay-Raining Bird, "Language Learning in Four Bilingual Children with Down Syndrome: A Detailed Analysis of Vocabulary and Morphosyntax," *Canadian Journal of Speech-Language Pathology and Audiology* 32, no. 1, (2008): 15–16; Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *American Journal of Speech-Language Pathology* (2005): 295–96.

[6] See for example Elizabeth Kay-Raining Bird et al., "Novel Word Acquisition in Children with Down Syndrome: Does Modality Make a Difference?," *Journal of Communication Disorders* 33, no. 3 (2000): 258.

DS is not completely clear from the literature. While maternal education seems to be a significant factor in receptive and expressive vocabulary acquisition for TD bilingual and L2 learners, the relationship between maternal education and vocabulary development for children with DS is more ambiguous.[7] In their studies on boys with DS, Price and colleagues found that maternal education predicts receptive language and Roberts and colleagues found that higher maternal education resulted in higher vocabulary abilities.[8] However, Cuskelly and colleagues did not find an influence of maternal education on receptive vocabulary in monolingual children with DS and posit that the "cognitive and language deficits associated with the condition may overwhelm (the) external influence" of maternal education typically found in TD children.[9] Additionally, studies in language

[7] For TD children see Johanne Paradis, "Oral Language Development in French and English and the Role of Home Input Factors" (report presented at the Conseil scolaire Centre-Nord Edmonton, Alberta, Canada, April, 2009); Heather Golberg, Johanne Paradis, and Martha Crago, "Lexical Acquisition over Time in Minority First Language Children Learning English as a Second Language," *Applied Psycholinguistics* 29, no. 1 (2008): 59. In another study, Paradis found maternal education to be a marginally significant factor, as opposed to a highly significant factor, in L2 vocabulary acquisition. Johanne Paradis, "Individual Differences in Child English Second Language Acquisition: Comparing Child-Internal and Child-External Factors," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 225–28. However, Rydland and colleagues found maternal education to be the sole factor in the rate of L2 growth in the elementary years of Turkish immigrants in Norway. Veslemøy Rydland, Vibeke Grøver, and Joshua Lawrence, "The Second-Language Vocabulary Trajectories of Turkish Immigrant Children in Norway from Ages Five to Ten: The Role of Preschool Talk Exposure, Maternal Education, and Co-Ethnic Concentration in the Neighborhood," *Journal of Child Language* 41, no. 2 (2014): 352–81.

[8] J. Price et al., "Language Comprehension in Boys with Fragile X Syndrome and Boys with Down Syndrome," *Journal of Intellectual Disability Research* 51, no. 4 (2007): 322; Joanne Roberts et al., "Receptive Vocabulary, Expressive Vocabulary, and Speech Production of Boys with Fragile X Syndrome in Comparison to Boys with Down Syndrome," *American Journal on Mental Retardation* 112, no. 3 (2007): 186–89.

[9] Monica Cuskelly, Jenny Povey, and Anne Jobling, "Trajectories of Development of Receptive Vocabulary in Individuals with Down Syndrome," *Journal of Policy and Practice in Intellectual Disabilities* 13, no. 2 (2016): 117. Expressive vocabulary was not examined in this study, thus no claims can be made off of this study as to the effect of maternal education on expressive vocabulary in individuals with DS. For no relationship between language development in children or infants with DS and maternal education see Robin S. Chapman et al., "Predicting Language Production in Children and Adolescents with Down Syndrome: The Role of Comprehension," *Journal of Speech, Language, and Hearing Research* 43, no. 2 (2000): 340–50; Peter Mundy et al., "Nonverbal Communication and Early Language Acquisition in Children with Down Syndrome and in Normally Developing Children," *Journal of Speech, Language, and Hearing Research* 38, no. 1 (1995): 160.

development in bilingual children with DS have yet to find a link between maternal education and language development.[10] However, Kay-Raining Bird mentions that mothers with higher education tend to have children with more exposure to the L2 and thus greater gains in L2 acquisition, suggesting a mediated effect of maternal education on L2 acquisition in children with DS via exposure to the L2.[11] Such a mediated effect is doubtful in this study, however, since outside exposure to the language was not a significant factor in FL vocabulary acquisition.

Despite a lack of clear evidence for a connection between maternal education and lexical abilities in children with DS, this study demonstrated a connection between expressive lexical L2 abilities in the FL context and maternal education. This link may be due to the small size of the study sample, the limited amount of time of the study, or the extreme sensitivity of expressive abilities in children with DS. The lack of mention or ambiguity of the role of maternal education as a significant factor in vocabulary acquisition of children in DS may indicate the need for further research in this area.[12] The

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[10] Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3 (2011): 392. Ward and Sanoudaki found no relationship between socioeconomic status (of which maternal education was one factor) and language abilities in bilingual children with DS. Ward and Sanoudaki, "Language Profiles," 10–11. Likewise, Feltmate and Kay-Raining Bird found no connection between parental education and language development in bilingual children with DS. Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 16.

[11] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," *Perspectives on Language Learning and Education* 16, no. 3 (2009): 92.

[12] For example, Katsarou and Andreou did not examine the effect of parental education in their study of language development of bilingual children with DS. Dimitra Katsarou and Georgia Andreou, "Bilingualism in Down Syndrome: A Greek Study," *International Journal of Disability, Development and Education* 68, no. 3 (2021): 5. Kay-Raining Bird and colleagues did not find that parental education was a significant factor in L2 ability among children of DS. However, parental education did not differ between three of the four groups, possibly impacting the outcome of the relationship found between L2 ability and parental education. Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 190. For similar situations see Elena Checa, Miguel Galeote, and Pilar Soto, "The Composition of Early Vocabulary in Spanish Children with Down Syndrome and Their Peers with Typical Development," *American Journal of Speech-Language Pathology* 25, no. 4 (2016): 614 and Leonard Abbeduto et al., "Collaboration in Referential Communication: Comparison of Youth with Down Syndrome or Fragile X Syndrome," *American Journal on Mental Retardation* 111, no. 3 (2006): 172.

findings from this study are in no way conclusive and this factor should continue to be investigated.

Performance on a nonword repetition task was found to be significantly correlated to both receptive and expressive L2 lexical acquisition, with a stronger correlation to expressive acquisition ($r(9)=.64$, $p=.017$) than to receptive acquisition ($r(9)=.61$, $p=.024$). Thus, higher performance on the nonword repetition task correlated to higher L2 vocabulary acquisition. The connection between performance on a nonword repetition task and L2 vocabulary acquisition is not surprising given that there is a robust link between phonological memory, of which nonword repetition task is a measure, and L2 development in TD individuals, as well as L1 development in individuals with DS.[13]

More specifically, phonological memory seems to be a significant predictor of vocabulary acquisition in individuals with DS.[14] Majerus and Barisnikov found a strong relationship in monolinguals with DS between phonological memory and receptive

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[13] For L2 development in TD children see Lia Efstathiadi, "Early Foreign Language Learning: Intensive Exposure, Vocabulary Development and the Cognitive Skills Involved," *Belgrade English Language and Literature Studies* 11, no. 1 (2019): 95–96; Thomai Alexiou, "Young Learners' Cognitive Skills and their Role in Foreign Language Vocabulary Learning," in *Early Learning of Modern Foreign Languages: Processes and Outcomes*, ed. Marianne Nikolov (Bristol, UK: Multilingual Matters, 2009), 55–56; Johanne Paradis, "Individual Differences in Child English Second Language Acquisition: Comparing Child-Internal and Child-External Factors," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 229. For L1 development in individuals with DS see Robin S. Chapman, Linda J. Hesketh, and Doris J. Kistler, "Predicting Longitudinal Change in Language Production and Comprehension in Individuals with Down Syndrome: Hierarchical Linear Modeling," *Journal of Speech, Language, and Hearing Research* 45 (2002): 902–15; Robin S. Chapman and Linda J. Hesketh, "Language, Cognition, and Short-Term Memory in Individuals with Down Syndrome," *Down Syndrome Research and Practice* 7, no. 1 (2001): 3–4; Glynis Laws, "The Use of Nonword Repetition as a Test of Phonological Memory in Children with Down Syndrome," *Journal of Child Psychology and Psychiatry and Allied Disciplines* 39, no. 8 (1998): 1119–30.

[14] Glynis Laws and Deborah Gunn, "Phonological Memory as a Predictor of Language Comprehension in Down Syndrome: A Five-year Follow-up Study," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 333–34. Jarrold and colleagues argue that "verbal short-term memory drives vocabulary acquisition." Christopher Jarrold, Alan D. Baddeley, and Caroline E. Phillips, "Verbal Short-Term Memory in Down Syndrome: A Problem of Memory, Audition, or Speech?," *Journal of Speech, Language, and Hearing Research* 45 (2002): 538. However, Kari-Anne B. Næss and colleagues found no evidence of a longitudinal predictive relationship between VSTM and vocabulary development. Kari-Anne B. Næss et al., "Longitudinal Relationships between Language and Verbal Short-Term Memory Skills in Children with Down Syndrome," *Journal of Experimental Child Psychology* 135 (2015): 52.

vocabulary though no association between phonological memory and expressive vocabulary.[15] Ward and Sanoudaki found phonological memory to be the strongest predictor of receptive language in bilingual children with DS.[16] Similarly, of those factors explored in this study, phonological memory was the factor most strongly correlated to FL receptive vocabulary acquisition. However, unlike the results of Majerus and Barisnikov, this study found a connection between phonological memory as measured by a nonword repetition task and both receptive and expressive FL vocabulary, though the connection was only slightly stronger for receptive vocabulary.

Despite the connection between the performance on the nonword repetition task and FL vocabulary acquisition, even children who were unable to complete the nonword repetition task or scored very low were able to acquire some FL vocabulary. This may suggest, as Mosse and Jarrold posit, that novel word-learning in children with DS is not completely inhibited by deficits in phonological memory and therefore must be supported by some type of domain general capacity.[17] However, this conclusion cannot be fully supported based off of the available data from this study as there was no TD control group. More studies are needed of L2 acquisition in the FL context to clarify the relationship between L2 acquisition and phonological memory in children with DS.

L1 receptive lexical ability as assessed by the PPVT-4 was found to be significantly correlated to both expressive and receptive FL vocabulary acquisition, and the relationship between L1 receptive lexical ability and FL expressive lexical acquisition

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[15] Steve Majerus and Koviljka Barisnikov, "Verbal Short-Term Memory Shows a Specific Association with Receptive but Not Productive Vocabulary Measures in Down Syndrome," *Journal of Intellectual Disability Research* 62, no. 1 (2018): 10–20.

[16] Rebecca Ward and Eirini Sanoudaki, "Language Profiles of Welsh-English Bilingual Children with Down Syndrome," *Journal of Communication Disorders* 93 (2021): 11–12.

[17] Emma K. Mosse and Christopher Jarrold, "Evidence for Preserved Novel Word Learning in Down Syndrome Suggests Multiple Routes to Vocabulary Acquisition," *Journal of Speech, Language and Hearing Research* 54, no. 4 (2011): 1137–52.

($r(9)=.59$, $p=.027$) was stronger than that between L1 receptive lexical ability and FL receptive acquisition ($r(9)=.51$, $p=.05$). L1 expressive lexical ability as assessed by the EVT-2 was also found to be a significant factor in FL acquisition. Its relationship approached significance to FL receptive lexical ability ($r(09)=.51$, $p=.056$) and was robustly correlated to FL expressive lexical acquisition ($r(9)=.79$, $p=.002$). The relationship between FL vocabulary acquisition and L1 lexical ability, particularly L1 expressive lexical ability was highly significant, such that those students with higher L1 lexical abilities acquired more FL vocabulary than those students with lower L1 lexical abilities.

In studies on second language acquisition in TD children, L1 abilities have been shown to be a significant factor in L2 acquisition, so much so that L2 abilities seem to mirror L1 abilities.[18] This same pattern seems to appear in bilingual children with DS, in that the abilities in the weaker language reflect those in the stronger language.[19] The link between L1 vocabulary and L2 abilities is particularly strong and among other skills is related to L2 vocabulary acquisition in TD children.[20] In bilingual children with DS, receptive vocabulary skills in the dominant language strongly correlate to receptive

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[18] Richard L. Sparks, Jon Patton, and Julie Luebbers, "Individual Differences in L2 Achievement Mirror Individual Differences in L1 Skills and L2 Aptitude: Crosslinguistic Transfer of L1 to L2 Skills," *Foreign Language Annals* 52, no. 2 (2019): 255–83; Richard Sparks et al., "Long-Term Crosslinguistic Transfer of Skills from L1 to L2," *Language Learning* 59, no. 1 (2009): 203–43.

[19] Trudeau et al., "Développement lexical chez les enfants," 391; Ward and Sanoudaki, "Language Profiles," 11; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196–97.

[20] Vibeke Grøver, Joshua Lawrence, and Veslemøy Rydland, "Bilingual Preschool Children's Second-Language Vocabulary Development: The Role of First-Language Vocabulary Skills and Second-Language Talk Input," *International Journal of Bilingualism* 22, no. 2 (April 2018): 234–50; Larry Vandergrift and Susan Baker, "Learner Variables in Second Language Listening Comprehension: An Exploratory Path Analysis," *Language Learning* 65, no. 2 (2015): 407, 410; Anne-Catherine Nicolay and Martine Poncelet, "Cognitive Abilities underlying Second-Language Vocabulary Acquisition in an Early Second-Language Immersion Education Context: A Longitudinal Study," *Journal of Experimental Child Psychology* 115, no. 4 (2013): 664; Melissa Koenig and Amanda L. Woodward, "Toddlers Learn Words in a Foreign Language: The Role of Native Vocabulary Knowledge," *Journal of Child Language* 39, no. 2 (2012): 1–13.

vocabulary in the weaker language, as was found in this study of FL acquisition.[21] Among children with DLD, though the relationship between L1 and L2 is not as strong as in TD children, research demonstrates that the relationship between L1 and L2 skills increases as the child increases in proficiency in both languages.[22] To discover whether a similar pattern exists among FL acquisition in children with DS a more long-term study would be needed.

Kay-Raining Bird suggests that stronger language ability may support learning in the weaker language in bilingual children with DS and this is likely the case in L2 learning in the FL context as well.[23] Though it has been suggested that L1 abilities may not play any significant role in L2 acquisition until after a considerable amount of L2 exposure, it appears that it may be a significant factor in FL vocabulary acquisition in children with DS even in the earliest stages of L2 acquisition.[24] This study demonstrated that after only six weeks of L2 instruction, L1 vocabulary ability correlated to L2 vocabulary acquisition, so much so that L1 expressive vocabulary ability was the most significant variable in FL expressive lexical acquisition among children with DS. It should be noted, however, that even those children with low L1 vocabulary were able to acquire L2 vocabulary in the FL context, suggesting that a low L1 vocabulary does not

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[21] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 194.

[22] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14–15. Blom and Paradis found that children with SLI cannot make use of L1 transfer as efficiently as TD children. Elma Blom and Johanne Paradis, "Sources of Individual Differences in the Acquisition of Tense Inflection by English Second Language Learners with and without Specific Language Impairment," *Applied Psycholinguistics* 36, no. 4 (2015): 971–73.

[23] Elizabeth Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in *Multilingual Perspectives on Child Language Disorders*, ed. Janet L. Patterson and Barbara L. Rodriguez (Bristol, UK: Channel View, 2015), 53.

[24] For no relationship between L1 and L2 in early stages of L2 acquisition in TD individuals and individuals with DLD see Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14. Blom and Paradis found 15 months of exposure were needed to activate transfer effect from the L1 to the L2. However, this was for verbal inflection, not vocabulary acquisition. Blom and Paradis, "Sources of Individual Differences," 971.

preclude a child with DS from acquiring L2 vocabulary in the FL context.[25]

Three variables explored which were found to bear no significant relationship to FL vocabulary acquisition warrant discussion considering their importance in the literature: CA, NVC, and outside exposure to the L2. In TD L2 learners, later age of onset has quite consistently resulted in an advantage in L2 acquisition.[26] This advantage is also present in L2 learners with DLD.[27] Among bilingual children with DS, CA has been found to correlate with L2 expressive and receptive abilities.[28] However, Trudeau and colleagues found that CA only correlated to the dominant language in bilingual children with DS, which could help explain why no effect was found for CA in the L2 in this study.[29] Despite the evidence from the literature of a possible positive effect of older age of onset for L2 acquisition, older learners in this study showed no significant advantage over younger learners. This divergence may simply be due to the short nature of the study, as the age advantage could take more time to manifest itself.[30] Additionally, many

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[25] It is important to note that the data gathered in this study only points to correlations, and causality and directionality should be examined in later studies.

[26] He Sun et al., "Individual Differences in Very Young Children's English Acquisition in China: Internal and External Factors," *Bilingualism: Language and Cognition* 19, no. 3 (2016): 561; Vasiliki Chondrogianni and Theodoros Marinis, "Differential Effects of Internal and External Factors on the Development of Vocabulary, Tense Morphology and Morpho-Syntax in Successive Bilingual Children," *Linguistic Approaches to Bilingualism* 1, no. 3 (2011): 337; María del Pilar García Mayo, "Age, Length of Exposure and Grammaticality Judgements in the Acquisition of English as a Foreign Language," in *Age and the Acquisition of English*, ed. María del Pilar García Mayo and María Luisa García Lecumberri (Bristol, UK: Multilingual Matters, 2003), 94–114; Jasone Cenoz, "The Influence of Age on the Acquisition of English: General Proficiency, Attitudes and Code-Mixing," in García Mayo and García Lecumberri, *Age and the Acquisition of English as a Foreign Language*, 89.

[27] Tribushinina, Dubinkina-Elgart, and Rabkina, "Can Children with DLD Acquire a Second Language," 14.

[28] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 194–96; Ward and Sanoudaki, "Language Profiles," 9–12.

[29] Trudeau et al., "Développement lexical chez les enfants," 391.

[30] Nils Jaekel et al., "From Early Starters to Late Finishers? A Longitudinal Study of Early Foreign Language Learning in School," *Language Learning* 67, no. 3 (2017): 645–47. However, while Jaekel and colleagues found that the age effect did not show until later stages of L2 acquisition, Muñoz argues from the literature that older learners have an "initial rate advantage." Carmen Muñoz, "Symmetries

posit that one main reason for an advantage of older age of onset is cognitive maturity.[31] This may be the reason why CA failed to be a factor in FL vocabulary acquisition in the present study, since the cognitive maturity of older learners, though generally higher than the younger learners, was still quite low.

Similarly, NVC did not prove to be a significant factor in FL vocabulary acquisition of participants in this study. Like CA, NVC did not correlate to any measurement of FL vocabulary acquisition. The highest performer on all four measurements of Spanish vocabulary was neither the oldest chronologically nor had the highest NVC. This differs from the results found by Kay-Raining Bird and colleagues in which the participant with the highest MA outperformed the other participants on all language measurements and those found by Feltmate and Kay-Raining Bird in which the child with the highest MA and CA scored the highest of all bilingual participants with DS on all language measurements.[32] As with CA, Trudeau and colleagues found that NVC significantly correlated to expressive abilities in the dominant language, but not in the L2. While NVC seems to be an important factor in language acquisition in bilingual children with DS, the case does not seem quite as straightforward in L2 development in the FL context.[33] As Ward and Sanoudaki conclude, NVC may play a lesser role in language development in (L2 learners) with DS than in TD children.[34] Additionally, many

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and Asymmetries of Age Effects in Naturalistic and Instructed L2 Learning," *Applied Linguistics* 29, no. 4 (2008): 579.

[31] Chondrogianni and Marinis, "Differential Effects of Internal and External Factors," 337; Sun et al., "Individual Differences," 561; Paradis, "Individual Differences in Child English Second Language Acquisition," 229–30; Blom and Paradis, "Sources of Individual Differences," 270–71.

[32] Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

[33] For more evidence of a correlation between NVC and language development in bilingual children with DS see Ward and Sanoudaki, "Language Profiles," 9–12.

[34] Ward and Sanoudaki, "Language Profiles," 10

participants in this study scored quite low on the measure used for NVC (KBIT-2). A different or more sensitive measure of NVC may revealed different results. Further research is needed support or challenge the findings from this study regarding the role of NVC and CA in FL vocabulary acquisition in children with DS.

Finally, outside exposure to the L2 had no significant correlation to FL vocabulary acquisition despite its importance in L2 development in TD children.[35] Though no data is available for the importance of outside exposure to a FL in children with DS, the overall amount and frequency of input to the L2 is very important in the L2 development of bilingual children with DS.[36] In the FL context, one such avenue for input and meaningful exposure to the language could be exposure outside of the classroom. Even though some students were ranked as having received "high" outside exposure to Spanish in this study as measured by a post-intervention parental survey, "high" is relative only to the other students in the study and it should not be considered that they were receiving significant amounts of meaningful exposure to the language outside of class. A typical student who received a rating of "high" outside exposure to Spanish may have read a storybook from class at home multiple times a week, watched, listened, or interacted with some other resource in Spanish (such as a video, game, book, or music) a few times a week, and possibly had someone engage with them in simple conversation in Spanish a few times a week. It stands to reason then that outside exposure did not correlate to FL vocabulary acquisition due to the negligible amount of outside

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[35] Sun et al., "Individual Differences," 560; Eva Lindgren and Carmen Muñoz, "The Influence of Exposure, Parents, and Linguistic Distance on Young European Learners' Foreign Language Comprehension," *International Journal of Multilingualism* 10, no. 1 (2013): 120–21; Carmen Muñoz, "Contrasting Effects of Starting Age and Input on the Oral Performance of Foreign Language Learners," *Applied Linguistics* 35, no. 4 (2014): 14–15.

[36] Trudeau et al., "Développement lexical chez les enfants," 399; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196; Ward and Sanoudaki, "Language Profiles," 12; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 60.

exposure among participants, even those ranked as "high" exposure.

Research Question Five

Given the measurements used, there is no evidence that the L1 abilities of the intervention participants changed over the course of the intervention. Two different types of comparisons were made analyze the change between pre- and post-intervention English vocabulary tests. Neither the *t*-tests nor the GSV difference showed any significant difference in pre- and post-intervention English vocabulary scores, whether receptive or expressive. Thus, there is no clear evidence that exposure to a FL in a six-week FL class had any impact, positive or negative, on the L1 vocabulary development of the intervention participants.

It should be noted that the GSV difference of some students reached statistical significance, both positively and negatively for both the EVT-2 and the PPVT-4.[37] Specific results for each participant can be viewed on table A4 in appendix 18. Viewing the GSV results of each individual student presents mixed results, and it is difficult from the raw data to draw any clear conclusions. However, when viewed as a group, no significant change occurred. The wide individual variation in L1 pre- and post-test results may be due in part to using different forms of the PPVT-4 and EVT-2.[38] It may be cautiously concluded that exposure to a FL had no meaningful impact on the L1 vocabulary development of children with DS. Given that six weeks is a short amount of time for exposure to a FL and for growth in the L1 more long-term studies are needed.

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[37] The EVT-2 and PPVT-4 manuals each supply a chart which lists statistically significant difference sizes by age group ($p<.10$), and state that "a statistically significant difference is one that is large enough to be unlikely to have occurred by chance (i.e., because of measurement error) . . . (though) statistically significant differences are not necessary for demonstrating growth in vocabulary." Kathleen T. Williams, *The Expressive Vocabulary Test Manual*, 2nd ed. (Minneapolis: NCS Pearson, 2007), 221 and Lloyd M. Dunn and Douglass M. Dunn, *Peabody Picture Vocabulary Test Manual*, 4th ed. (Minneapolis: NCS Pearson, 2007), 205.

[38] The EVT-2 has a mean alternate-form of .87 and the PPVT-4 of .89. Williams, *The Expressive Vocabulary Test Manual*, 66; Dunn and Dunn, *Peabody Picture Vocabulary Test Manual*, 54.

It seems reasonable that exposure to a FL language would not affect L1 vocabulary development in children with DS given the evidence from L1 development in bilingual children with DS. Studies of bilingual children with DS have consistently shown that bilingualism has no detrimental effect on L1 development in bilingual children with DS.[39] Additionally, Edgin and colleagues found that exposure to an L2 has no negative impact on cognitive functions in bilingual children with DS.[40] These studies, along with the evidence gathered from this study, should give pause to those professionals who may advise parents against exposing their child with DS to a second language.[41] It seems from the available evidence that children with DS can be exposed to a second language without impeding the development of their first.

Obstacles to Conducting the Research

This research is the first of its kind to document the L2 abilities of children with DS participating in the FL classroom. Though there are many reasons why such research may not have been previously conducted, a large contributing factor is likely the fact that children with DS are not included in the FL classroom at the same rate as their TD peers.[42] Due to the scarcity of their participation, such data would be difficult to

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[39] Katsarou and Andreou, "Bilingualism in Down Syndrome," 4; Ward and Sanoudaki, "Language Profiles," 10; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 196–97; Trudeau et al., "Développement lexical chez les enfants," 400; Feltmate and Kay-Raining Bird, "Language Learning in Four Bilingual Children," 18–19.

[40] Jamie O. Edgin et al., "Neuropsychological Effects of Second Language Exposure in Down Syndrome," *Journal of Intellectual Disability Research* 55, no. 3 (2011): 351–56

[41] Fred Genesee, "French Immersion and At-Risk Students: A Review of Research Evidence," *Canadian Modern Language Review* 63, no. 5 (2007): 656; Elizabeth Kay-Raining Bird et al., "The Language Abilities of Bilingual Children with Down Syndrome," *American Journal of Speech-Language Pathology* (2005): 197; Elizabeth Kay-Raining Bird et al., "Access and Outcomes of Children with Special Education Needs in Early French Immersion," *Journal of Immersion and Content-Based Language Education* 9, no. 2 (2021): 21; Jean Ware, Catrin Bethan Lye, and Fliss Kyffin, "Bilingualism and Students (Learners) with Intellectual Disability: A Review," *Journal of Policy and Practice in Intellectual Disabilities* 12, no. 3 (2015): 226–27.

[42] Stefka H. Marinova-Todd et al., "Professional Practices and Opinions about Services

gather. Conversely, children with DS are likely excluded from the FL classroom due to the lack of research demonstrating their abilities in the FL classroom, and for lack of examples for FL teachers on how to effectively teach and include children with DS in the FL classroom.[43] Such a dilemma is a catch-twenty-two for researchers, teachers, and children with DS. Without children with DS in the FL classroom, research cannot be conducted; without research demonstrating their abilities in the FL classroom, children with DS are not likely to be included.[44]

This research sought to help close this gap, yet faced many obstacles to come to completion, demonstrating the difficulty of carrying out such research. Though all research encounters obstacles, the nature of language acquisition among a special population of children presented unique challenges and intensified the obstacles which may be present in any type of research with human subjects. Obstacles were encountered for intervention location and setting, participant recruitment, participant retention, data collection, and assessment of participants. Each of these obstacles will be discussed below, followed by a summary of notable results of the research obstacles.

Available to Bilingual Children with Developmental Disabilities: An International Study," *Journal of Communication Disorders* 63 (2016): 58; Julia Scherba de Valenzuela et al., "Access to Opportunities for Bilingualism for Individuals with Developmental Disabilities: Key Informant Interviews," *Journal of Communication Disorders* 63 (2016): 32–46; Diane Pesco et al., "A Multi-site Review of Policies Affecting Opportunities for Children with Developmental Disabilities to become Bilingual," *Journal of Communication Disorders* 63 (2016): 15–31.

[43] Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *Journal of Communication Disorders*, Article in Press (2016): 11; Johanne Paradis, "An Agenda for Knowledge-Oriented Research on Bilingualism in Children with Developmental Disorders," *Journal of Communication Disorders* 63 (2016): 80. Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30.

[44] Kay-Raining Bird and colleagues allude to these challenges in their recommendations for policy, practice, and future research for bilingualism among children with developmental disorders. Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *Journal of Communication Disorders*, Article in Press (2016): 11–12

Intervention Location and Setting

My original intention was to conduct the research in my Spanish classes at the elementary school where I taught kindergarten through fifth grade Spanish. The school had a program specifically for children with DS. The children were integrated into the classroom and attended Spanish class with their peers. This setting was seemingly ideal, as it reflected the actual parameters of a FL classroom in the elementary school, and the children with DS were integrated into the classroom with their TD peers. The TD peers would serve as the control group, and the intervention would require no extra commitment from any of the participants, as they were already attending Spanish class once a week as part of their school curriculum. However, before I was able to begin collecting data the school closed its doors. While the program for students with DS was moved to another campus, the integration of the students into a larger student body presented too many confounding factors to provide reliable data.

Through contacts from the school, I was able to connect with Down Syndrome of Louisville and proposed to them the idea of offering after school Spanish classes for an entire school year to their elementary-aged clients. This idea was received enthusiastically, and we agreed together to move ahead with the classes once I was allowed to conduct research, and at the start of a new school year. The classes were intended to be divided by grade level and include both children with DS and TD students. My contacts at DSL agreed to help recruit students with DS as well as provide incentives for families to enroll their child in the class, and I would take full responsibility for recruiting TD children.

Approximately three and a half months before the after-school classes were set to begin I met via Zoom with my two contacts at DSL to discuss recruitment of participants. During this conversation I was informed that my plan to offer after school Spanish classes for an entire school year was not likely to succeed. They informed me that they had struggled with retention of participants in enrichment programs previously

offered to their clients, and even that if I began the school year with a large number of participants with DS, it was highly unlikely that many, if any, would complete the entire school year of Spanish classes. Families of individuals with DS have many extra commitments such as therapies and doctor's appointments that most families with TD children do not have, making an extra long-term commitment for families of children with DS extremely difficult. It was very likely that I would end up without participants and thus without data.

They informed me of a six-week educational enrichment camp for elementary-aged children with DS at DSL that summer and invited me to teach Spanish in conjunction with the camp. I agreed on the condition that they would allow me to teach Spanish every day, since students would need ample hours of exposure to the language to demonstrate any amount of measurable acquisition. As a result, Spanish became part of the curriculum of their six-week camp, and all camp participants attended Spanish class. The summer camp was set to begin in less than six weeks from the time of our conversation, during which time ethics committee approval had to be gained, a revised research plan written, approved, and implemented, participants recruited and assessed, and preparation for teaching and classes finalized.

Participant Recruitment

Less than six weeks is not much time to recruit participants and administer pre-intervention assessments. The original plan was to recruit TD children to attend the daily Spanish classes and serve as a control group. Additionally, though all participants at the camp were to attend Spanish class, it was still necessary to recruit students for the study, as specific parental consent had to be granted for students to participate in the research. Finally, children with DS for the L1 vocabulary control group and pilot vocabulary test needed to be recruited. Recruiting children with DS and TD children both posed their own specific challenges and resulted in divergent outcomes.

Intervention participants with DS were recruited through help with my contacts at DSL. Multiple emails and Google Forms, along with a short informative video, were sent to inform families of the opportunity for their child with DS to participate in Spanish class and a research study. However, very little response was received from the emails and Google forms. Later some parents expressed that they receive so many emails, especially from DSL, that they typically ignore them. Most participants were secured through phone calls made by me from DSL. After a personal conversation with me, most parents of those children already attending Spanish as a result of their participation in summer camp were willing to allow their child to participate in the study. A great number of parents expressed over the phone that they had seen the email but were too busy to respond and appreciated the personal phone call. The phone call also gave parents the opportunity to ask questions and overcome any hesitations they may have had about their child participating in the study. Communication with parents via email proved to be challenging throughout the duration of the study and balancing effective communication while respecting professional boundaries often hindered the progress of the study.

Though many parents of children participating in the summer camp agreed to allow their child with DS to participate in the study, this was not the case for all parents. Though not all parents gave a specific reason, the main hesitation that parents expressed for the participation of their child in the study was their hesitancy for their child to be assessed. Some parents were concerned about the ability of their child to sit through the assessments, others did not want to subject their child to more testing than necessary, and still others always expressed that they always decline any type of cognitive testing for their child. Conversely, some parents who were willing for their child to participate in the study were unable to do so because their child was not attending the full six weeks of the camp, thus disqualifying them for participation in the study.

Every possible attempt was made to recruit TD students to participate in the Spanish classes to serve as a control group and to create an integrated environment for FL

learning. Multiple Facebook posts were made on my personal Facebook page as well as on community pages such as homeschool groups and women's groups which reach many families with children. Emails were sent to various contacts in the community and various attempts were made to connect with people from the local public school system, but with no success. In the end, no TD children were recruited for the Spanish intervention. Aside from the limited amount of time for participant recruitment, the main barrier to the participation of TD children in the classes was the time commitment: students would have to commit to a 45-minute class, five days a week for six weeks during the Summer. This would entail not only a commitment on the part of the child, but on the part of the parent to bring them and pick them up every day. While the students with DS were already committed to being at camp for the entirety of the day, families of TD children could not commit to bringing their child every day for only forty-five minutes. By the time I was able to begin recruiting for the study, many families had summer travel plans, and others simply could not commit to bring their child to a certain place for forty-five minutes five days a week for six weeks.

An additional recruitment challenge was that of finding participants for the English vocabulary control group. Many of my personal contacts of children with DS did not qualify for participation in the L1 control group due to their prior or current participation in the FL classroom. The only other option was to recruit students through DSL. However, many of DSL's elementary-aged clients who would typically agree to participate in a study were participating in the summer camp, and thus not eligible to participate in the L1 control group. Additionally, due to the short time frame between the decision to hold the Spanish intervention class at the camp and the start of the camp, priority was given to recruiting students for the intervention group. My contacts at DSL needed to hand pick who I could contact for the L1 control group and provide me with their contact information but were busy with the details of preparing for the camp. Finally, as with the Spanish intervention group, communication with parents was also a

challenge in recruiting students for the English vocabulary control group. All of these confounding factors resulted in a very small L1 control group of only three participants.

Participant Retention

Acquisition of a FL requires a considerable amount of exposure to the language, and thus FL acquisition research cannot be conducted in a short time span. With the increase of time comes an increased risk of participant withdrawal. Anyone considering conducting research in FL acquisition must consider the possibility that they may not retain all of their participants, with this risk increasing as the duration of the study increases. Two students who originally agreed to participate in the study withdrew from the camp after only a few days, and thus were removed from the intervention group.[45] While two participants may seem like a small number, it resulted in a fourteen percent decrease in the number of participants. Moreover, concerns of participant retention were the driving force behind abandoning the plan for after-school Spanish classes. Were it not for the opportunity to teach at the six-week summer camp, the problem of student retention likely would have prevented this research from taking place.

Data Collection

Both quantitative and qualitative data were collected for this study. Challenges to the collection of quantitative data will be discussed below under "Assessment of Participants." Qualitative data for the case studies was collected via recording of the Spanish classes, post-class observation notes by me, daily journal entries by assistants, mid-intervention surveys by the assistants, post-intervention assistant surveys and interviews, and post-intervention parental surveys. The collection of qualitative data

[45] Parents of both children agreed for their student to continue participation in the study by participating in the English vocabulary control group. As they were exposed to a negligible among of Spanish in their couple of days of participation in the intervention group, they qualified to participate in the English vocabulary control group. However, one of these children has a dual diagnosis of autism and thus did not qualify to participate in the L1 control group.

faced one particular challenge: that of recording the Spanish classes. Recordings were made with an iPhone and an iPad. While the majority of the classes were recorded, the first couple of days were not recorded due to missing parental permission from a few class participants (not study participants). Additionally, during the first few days of class all the energy of myself and the assistants was directed toward make sure that the class went smoothly, and sufficient attention could not be given to students while also setting up and monitoring the recording. Moreover, transition time between classes was short, and setting up the device and ensuring that "record" was pressed properly at the start of class sometimes proved to be a challenge. Once class began, the focus of assistants and myself was on the students, and there were a few times that though the device was set up, the record button was not properly pressed.

Another difficulty was finding an appropriate place to place the iPhone or iPad that could effectively record the case study participants and be conspicuous enough to not distract students. This challenge was particularly acute in the classroom with the youngest students. Having an iPhone or iPad set up for recording in the youngest class could pose a potential safety risk for students or teachers, as well as for the device itself, as many students in the room would swipe or grab and throw any device they could get their hands on. After the first week a place was found where the iPhone could be placed and record the majority of the students in the class. However, students in the younger class often moved around, and placing the device in such a way as to capture all the activity in the classroom proved to be very difficult. Additionally, some days Spanish class for the younger class took place outside on the playground. On such days, aside from a few brief recordings of particular activities, no recording was made and observations were recorded post-class in the journal, on my phone, and on my computer. Despite the challenges of recording every class, more than sufficient data was collected via recordings, observations, surveys, and interviews to accurately describe the participation of the selected students in the intervention classes and to answer the

corresponding research questions.

Assessment of Participants

Assessment of participants faced two main obstacles: limited attention span of participants and scheduling of assessments. While these two factors may seem unrelated, they are in fact intricately tied together. Individuals with DS generally have a "significant deficit" in their attention span when compared to their TD peers.[46] As a result of this limited attention span, children with DS may have a difficult time "staying engaged with a task."[47] This difficulty was clearly demonstrated by the difficulty participants experienced in focusing on the assessments. Though breaks were taken between assessments, toward the end of the assessment session, many children could hardly concentrate or give their attention to the assessment. By the final assessment, some children would choose a picture before I had said the word or point to a picture without looking at the other options.

Due to the short attention span of the participants, two separate assessment sessions, especially for the post-intervention assessment, would have been ideal. The post-intervention assessment consisted of six assessments, beyond the capacity of most participants to fully concentrate. However, the difficulty of scheduling assessments made the completion of two separate sessions nearly impossible for the majority of families. All post-intervention assessment session needed to be completed within two weeks of the end of the intervention. However, school started only a week and a half after the

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[46] Susana de Sola et al., "A New Cognitive Evaluation Battery for Down Syndrome and its Relevance for Clinical Trials," *Frontiers in Psychology* 6 (2015): 5. See also Tuomo Määttä et al., "Mental Health, Behaviour and Intellectual Abilities of People with Down Syndrome," *Down Syndrome Research and Practice* 11, no. 1 (2006): 41; Floriana Costanzo et al., "Executive Functions in Intellectual Disabilities: A Comparison between Williams Syndrome and Down Syndrome," *Research in Developmental Disabilities* 34, no. 5 (20S3): 1773; Janice H. Brown et al., "Spatial Representation and Attention in Toddlers with Williams syndrome and Down Syndrome," *Neuropsychologia* 41, no. 8 (2003): 1044.

[47] Grieco et al., "Down Syndrome," 137.

intervention ended, further shortening the available time frame for scheduling post-intervention assessments. Furthermore, families were busy with the details of preparing for a new school year and as a result their schedules were extra busy. Most families struggled to make the time to schedule one assessment session and requiring students to participate in two post-intervention assessments may have resulted in participant withdrawal or incomplete data. As a result, students were required to complete all six post-intervention assessments in one session.[48]

Results of Research Obstacles

The research obstacles encountered, though many and formidable, did not prevent the research from being carried out successfully. However, the results of these obstacles should be noted as the obstacles impacted the research in various ways.

Sample size. Due to the difficulty recruiting and retaining students for the intervention, the result is a relatively small sample size. Though twenty-seven students participated in the Spanish classes for some length of time, only eleven students who qualified and were also granted parental permission to participate remained as part of the intervention group until the end of the study. The recruitment for the L1 control group resulted in an even smaller group of four participants. Though the intervention sample and control group were small, care was taken in all statistical analysis to account for small group size.

Unviability of L1 control group data. My original intention was to compare the change in L1 vocabulary from pre- to post-test in the intervention participants with a

[48] Two children had particular difficulty concentrating, and it was not possible to complete all six assessments in one session. The parents of these children were agreeable to meeting again. One child completed the remaining assessments in one session, while the other child needed two additional sessions to complete the assessments. Even with the additional sessions, the child struggled to concentrate and complete the assessments. Though other students would have benefited from the same, scheduling and time constraints made that impossible to offer to every student.

control group of children with DS that had not participated in the intervention. Due to the various difficulties in recruiting L1 control group participants, the final control group consisted of 3 children. Due to this small number, the control group was not large enough to provide reliable data and was therefore not used in the final analysis for research question five.

No TD participants. One of the most salient effects of recruitment difficulties is the absence of TD participants in the intervention. As a result, there was no TD control group with which to compare the L2 acquisition of the students with DS. Two of the original research questions investigating the L2 acquisition of children with DS were dependent upon TD participants in the Spanish intervention. The research questions were: "Do the post-test receptive lexical abilities of children with Down syndrome differ from that of their typically developing peers following the same amount of Spanish language instruction?" and "Do the post-test expressive lexical abilities of children with Down syndrome differ from that of their typically developing peers following the same amount of Spanish language instruction?"

Due to a lack of a TD control group, these research questions were removed from the study. Likewise, an initial sub-question of research question number one, documenting the participation of children with DS in the integrated FL classroom, was removed: "How do the children with Down syndrome interact with their typically developing peers in the foreign language classroom?"

In addition to serving as a control group, the participation of TD children would have allowed the children with DS to have the experience of learning a FL in an integrated class, possibly increasing their L2 vocabulary acquisition. Sue Buckley and colleagues found that teenagers with DS integrated into the mainstream classroom have

higher expressive language scores than those teenagers in the segregated context.[49] While there is no data for the FL context, it is possible that the same would be true of learning an L2 in the FL context. In an integrated class TD students can serve as a model for children with DS or other disabilities for how to properly participate in class. In the context of a FL class, the response of TD students to L2 input can serve as a sort of scaffolding for children with DS or encourage them to participate in an activity in which they may otherwise choose to not participate. For example, TPR was used on a limited basis in one intervention class. However, the students seemed resistant to participating, so after a few times, I ceased using TPR. In the integrated classroom, elementary-aged TD students are generally very eager to participate in TPR, and thus the children with DS are too. Had TD students been present in the class, TPR may have been a successful method for teaching language.[50] It is possible that the scaffolding and participation of TD students could have bolstered understanding for the participants with DS and facilitated the implementation of a variety of input-rich strategies, thus increasing participant L2 acquisition.

Without the presence of TD students in the class, the assistants often had to serve as the model for students. For example, when instructions were given in Spanish and the students did not understand, the teachers would model the proper response and

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[49] Sue Buckley et al., "A Comparison of Mainstream and Special Education for Teenagers with Down Syndrome: Implications for Parents and Teachers," *Down Syndrome Research and Practice* 9, no. 3 (2006): 56–58. Harold Kleinert and colleagues also found that children with severe cognitive disabilities placed in an integrated classroom have higher expressive abilities than those that are educated in the segregated context. Harold Kleinert et al., "Where Students with the Most Significant Cognitive Disabilities are Taught: Implications for General Curriculum Access," *Exceptional Children* 81, no. 3 (2015): 321–322.

[50] These observations are based on my own experience, having previously taught Spanish to children with DS in the integrated classroom. A clear difference was seen in students' response to instructions and participation in certain activities in the integrated context and the segregated context, with participation and compliance often higher in the integrated context, especially for those activities, such as TPR, which may require sustained attention.

the students were then able to understand the instructions and respond properly.[51] At times, when students were going to participate in an activity which may be a bit complex for them, such as acting out a story, the assistants would complete the activity first, as an example for the students. In an integrated context, this role would be fulfilled by the TD students.

Additionally, Buckley and colleagues found that teenagers with DS have better behavioral outcomes in the integrated context.[52] One of the most prominent barriers to learning and participation in the intervention classes was behavior – either the student's own behavior or the disruptive behavior of another student in the class. It is possible that with the presence of TD students modeling expected behavior, disruptive behaviors may have been reduced, thus increasing the learning of all students.

Finally, the inclusion of TD students in the Spanish intervention would have allowed this study to and serve as an example for FL teachers for how to teach children with DS in an integrated classroom. One of the original purposes of this study was to model for teachers how to effectively include children with DS in the integrated FL classroom. While much valuable data can still be gleaned from this study to be implemented in the integrated FL context, this study cannot serve as a model due to the lack of TD participants.

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[51] Students especially needed the additional scaffolding of the example of the assistants in the beginning of the intervention when they had not yet acquired any language. After a couple of weeks, the students understood basic instructions and learned the routine of the class, and the modeling of the assistants for following instructions was less needed. However, assistant support was often needed to help ensure student compliance, as opposed to ensure understanding.

[52] Buckley et al., "A Comparison of Mainstream and Special Education," 58–60. In a study conducted by Joy and Murphy on the inclusion of sixth grade students with special educational needs (including at least one child with DS) in an intensive five-month French as a second language program, students with special educational needs experienced improved behavioral outcomes as a result of the program. Rhonda Joy and Elizabeth Murphy, "The Inclusion of Children with Special Educational Needs in an Intensive French as a Second-Language Program: From Theory to Practice," *Canadian Journal of Education* 35, no. 1 (2012): 112.

Reduced results on assessments. The difficulties of students to maintain attention during the post-intervention assessment session likely contributed to reduced results on the L2 assessments. Various studies suggest that attention deficits can negatively affect performance on standardized assessments.[53] While this would suggest that the performance of the children of DS was negatively affected for all assessments administered, their performance on the Spanish language assessments, especially the content-based assessments, may have been considerably impacted. To consider the impact of attention difficulties to participant performance on an assessment, consideration should be given to when the assessment was given and how long the children were required to sustain their attention. Faught suggests that difficulties in sustained attention for individuals with DS in the auditory modality could magnify after 7.5 minutes.[54] This effect was observed when assessing the students. As the assessment session progressed, students had a harder time focusing. Their difficulty focusing often exponentially increased the amount of time required to complete an assessment, in turn decreasing focus even further. Thus, the longer sustained attention is required, the lower an individual's performance on a test.

The negative effect of reduced attention on assessment performance may be especially salient when assessing those skills which are predicted by sustained attention,

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[53] Michael I. Posner and Mary K. Rothbart, "Influencing Brain Networks: Implications for Education," *Trends in Cognitive Sciences* 9, no. 3 (2005): 101–02; G. G. Faught et al., "Sustained Attention to Response Task Performance Trajectories in Down Syndrome," *Journal of Intellectual Disability Research* 65, no. 3 (2021): 230. While their research was performed on individuals with cognitive disabilities due to being born preterm, Mahurin-Smith and colleagues found that low attention skills contribute to poor performance on standardized tests of intelligence and language in school-aged children born preterm, "accounting for 15%–20% of the variance in children's scores." Jamie Mahurin-Smith, Laura S. DeThorne, and Stephen A. Petrill, "Longitudinal Associations across Prematurity, Attention, and Language in School-Age Children," *Journal of Speech, Language, and Hearing Research* 60, no. 12 (2017): 3605.

[54] Faught et al., "Sustained Attention," 234.

including vocabulary.[55] Particularly vulnerable to the effects of reduced attention are prolonged assessments involving the auditory modality.[56] The assessments measuring receptive vocabulary, while presenting visual stimuli, also depended upon attention to auditory information, and were thus exceptionally vulnerable to the negative effects of reduced attention. In the post-intervention assessment session, the Spanish assessments were administered after the English assessments. Furthermore, the content-based Spanish assessments were administered at the very end of the session, making them the most susceptible to the effects of reduced attention. Given these factors, it is likely that participant performance on Spanish language assessments, particularly the content-based assessments, did not reflect the full extent of participant L2 acquisition.

Variety of participants with DS. While some of the results of the research obstacles may seem to have negatively affected research outcomes, many positive outcomes resulted as well. The final makeup of the Spanish classes at the summer camp included children with DS with a wide variety of cognitive and linguistic abilities. Several nonverbal children, children with a dual diagnosis of autism, and a child with selective mutism were included in the Spanish classes. Though the children with autism are not included in this study, both quantitative and qualitative data was gathered from these students and will be analyzed in a subsequent study. While it cannot be claimed that children representative of all individuals with DS were included in the classes, the research sample likely represents a larger portion of the population of children with DS than would have been represented had the study taken place in a regular integrated classroom or in after-school classes.

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[55] Faught et al., "Sustained Attention," 234.

[56] Faught and colleagues state, "difficulty maintaining attention over time in the auditory modality could contribute to poor performance on auditory measures that are prolonged." Faught et al., "Sustained Attention," 234.

At the conclusion of the study, some parents, particularly those of children with multiple diagnoses, expressed their initial doubts about their child's ability to learn Spanish and participate in the study. Had the study taken place in after-school Spanish classes, they very likely would not have signed up their child for the class. However, since the Spanish classes were part of the summer camp curriculum, all students, no matter their cognitive or linguistic abilities, participated in the class. Thus, as a result of the obstacle of intervention location and setting, a wider variety of children with DS were able to participate in the classes.

Peer learning. The absence of TD children in the Spanish intervention resulted in various positive outcomes for the children with DS. First, the summer camp was only for students with DS, and it afforded them the opportunity to learn in an environment tailored to them and their specific needs. Spending the day in a classroom full of TD students, in which the child with DS generally lags behind their peers both academically and developmentally, can require a lot of extra effort on the part of the child with DS. It may also be discouraging for children with DS whey they recognize that they are not on the same level as their peers and must put forth extra effort to be included both academically and socially.[57] While students with DS often struggle in the integrated context to be included socially, at the summer camp children were no longer the "special"

[57] Cuckle reports the frustration and humiliation that children with DS and their parents may feel when they are consistently falling behind their peers academically and may even lose friends due to being held back while their classmates advance. He also notes that social inclusion for children with DS takes much more effort than for TD children. Pat Cuckle, "Getting in and Staying There: Children with Down Syndrome in Mainstream Schools," *Down Syndrome Research and Practice* 6, no. 2 (1999): 97–99. Wendelborg and Kvello documented the perceived social acceptance and peer intimacy of children with disabilities and found that isolation increased with the severity of the disability. Christian Wendelborg and Øyvind Kvello, "Perceived Social Acceptance and Peer Intimacy Among Children with Disabilities in Regular Schools in Norway," *Journal of Applied Research in Intellectual Disabilities* 23, no. 2 (March 2010): 149. It is important to note that this documentation was that of the perception of the child, indicating that children with disabilities do indeed perceive that they are isolated from their peers.

student in the class, but among their peers with DS.[58] Spanish class offered a unique opportunity for social engagement and learning at the camp. As opposed to other learning contexts at the summer camp in which students were engaged individually or in small groups, Spanish class was an opportunity for all students to be engaged together learning the same thing at the same time.

Though there is evidence to suggest that the presence of TD peers could bolster the L2 acquisition of the children with DS, there is also reason to believe that it may have been to the benefit of the students to learn an L2 in an environment tailored to the needs and interests of children with DS. During the intervention the needs and interests of the students and the rate of their learning dictated the activities in Spanish class and the rate at which we advanced in the curriculum. The presence of TD children may have necessitated at times that we include other activities which may not have been as preferable for the children with DS, or that we advance more quickly through material to hold the interest of the TD students. For example, older children with DS may enjoy a video that same-aged TD peers would find juvenile and thus not appropriate for an integrated classroom.[59] The absence of TD peers facilitated the use of such videos with the older children and were rich and engaging sources of comprehensible input for the students.

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[58] Various studies document the difficulties of children with DS and other disabilities to be truly socially integrated in the mainstream classroom. Anne-Stine Dolva et al., "Facilitating Peer Interaction–Support to Children with Down Syndrome in Mainstream Schools," *European Journal of Special Needs Education* 26, no. 2 (2011): 205; Christian Wendelborg and Jan Tøssebro, "Educational Arrangements and Social Participation with Peers amongst Children with Disabilities in Regular Schools," *International Journal of Inclusive Education* 15, no. 5 (June 2011): 497–512; Christian Wendelborg and Kvello, "Perceived Social Acceptance," 143–53; Christian Wendelborg and Jan Tøssebro, "School Placement and Classroom Participation among Children with Disabilities in Primary School in Norway: A Longitudinal Study," *European Journal of Special Needs Education* 23, no. 4 (2008): 316–17.

[59] In their qualitative study of social integration of children with DS in the mainstream classroom Dolva and colleagues found that the interests of children with DS often differed from that of their TD peers and report that children with DS were perceived to be more "immature" than their TD peers. Dolva et al., "Facilitating Peer Interaction," 205.

Finally, learning exclusively with students with DS allowed the stronger students to be the example in class. In a very real sense, they fulfilled the role of the model in class that would otherwise be fulfilled by TD students. This reaps benefits not only for the child who is serving as the example, but for all the children in the room who see that a child with DS can be the model and set the example. Students were encouraged to applaud for each other and rejoiced when another student experienced success. Thus, though education in the integrated environment has many strengths, this short-term segregated learning environment tailored to the needs of children with DS may have benefitted student learning and morale.

Daily L2 exposure. Though holding the intervention classes at a six-week summer camp was not the intended setting, it may have served for the benefit of the participants' L2 acquisition. As a result of holding the classes during the six-week summer camp, learners were exposed to the language daily for six weeks.[60] Though the overall hours of exposure were less than if the students had attended class at school or an after-school class, the frequency of exposure was much more often.[61] Frequency is a key factor in L2 acquisition.[62] It is therefore likely that due to daily exposure, students were

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[60] Students were exposed to the language five days a week, Monday through Friday for three weeks with a one-week intermission, followed by another consecutive three weeks.

[61] Had the students attended a one hour once-a-week after school class for the duration of the school year, they would have received thirty-five hours of language instruction. Had they attended a forty-five minute once-a-week after school class for the duration of the school year, they would have received 26.25 hours of language instruction. By attending a six-week class which met for forty-five minutes per session, they received 22.5 hours of instruction. A comparison to an in-school class is much more difficult to make, as elementary FL classes vary widely in duration and frequency of instruction. However, if the study had taken place as originally planned in my classroom, one school year of teaching would have resulted in 26.25 hours of language instruction, as classes met once a week for forty-five minutes.

[62] Natacha Trudeau et al., "Développement lexical chez les enfants bilingues avec Trisomie 21," *Enfance* 3 (2011): 399; Elizabeth Kay-Raining Bird, "The Case for Bilingualism in Children with Down Syndrome," in *Language Disorders from a Developmental Perspective*, ed. Rhea Paul (Mahwah, NJ: Lawrence Erlbaum Associates, 2007), 267; Kay-Raining Bird, "Bilingualism and Children with Down Syndrome," in Patterson and Rodriguez, *Multilingual Perspectives*, 60; Anne Vermeer, "Breadth and Depth of Vocabulary in Relation to L1/L2 Acquisition and Frequency of Input," *Applied Psycholinguistics* 22, no.

able to acquire more language than if they had only been exposed to the language once a week over a longer period of time.

Summary of Research Findings

Below is a succinct summary of the findings of this research, divided by research questions.

Participation and Acquisition in the FL Classroom

Students with DS are able to successfully participate in the FL classroom given the proper support. When provided with sufficient scaffolding children with DS can understand the L2 in the FL classroom and based upon observations, students with DS demonstrate some acquisition of the L2 in the FL classroom. Though some students may need behavioral or content support to participate fully in the FL classroom, other students are able to participate fairly independently. Students with DS demonstrate comprehension and non-comprehension of the language in a variety of ways and enjoy a wide variety of engaging and interactive activities in the FL classroom.

L2 Acquisition

Children with DS are able to acquire both receptive and expressive L2 vocabulary in the FL context as measured by quantitative assessments. While the amount of acquisition demonstrated through quantitative assessments varies widely, some children were able to experience a high degree of success and acquire a considerable amount of both receptive and expressive vocabulary. All children who participated in the intervention demonstrated evidence of receptive L2 acquisition. Students demonstrated more acquisition as measured by the curriculum-based assessments than measured by the standardized assessments.

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2 (2001): 230.

Expressive vs. Receptive L2 Acquisition

Children with DS demonstrated higher levels of receptive acquisition than expressive. This conforms to the general language profile of monolingual and bilingual individuals with DS. While some children achieved substantial amounts of expressive vocabulary acquisition, all students acquired more receptive than expressive vocabulary.

Variables in L2 Acquisition

Of the variables investigated, the following variables had a statistically significant relationship to FL acquisition: L1 expressive lexical ability, L1 receptive lexical ability, performance on a nonword repetition task, and maternal education. Certain variables which have in other contexts been found to correlate to language acquisition in children with DS or L2 acquisition in TD children did not demonstrate a statistically significant relationship to FL acquisition, namely, CA, NVC, and outside exposure to the L2.

L1 Vocabulary Change

There is no evidence that L1 vocabulary changed during the course of the Spanish intervention. Of the two types of comparisons made no significant change was found between pre- and post-test expressive or receptive vocabulary in intervention participants. Given these results, it seems that six weeks of exposure to a FL did not appear to have any meaningful impact on L1 vocabulary development.

Implications and Recommendations for Practice

Children with DS have traditionally not been afforded the same opportunities as their peers to learn or maintain an L2.[63] One of the reasons children with DS have been excluded from the FL classroom is due to lack of examples of children with DS

[63] Marinova-Todd et al., "Professional Practices and Opinions," 58; de Valenzuela et. al, "Access to Opportunities," 32–46; Pesco et al., "A Multi-site Review," 15–31.

participating in the FL classroom. As a result, their capabilities in the FL classroom are unknown, and teachers do not have access to examples of how to effectively include children with DS in the FL classroom.[64] Additionally, teachers, professionals, and parents have expressed hesitancy as to whether or not children with DS are capable of acquiring an L2 or should be exposed to an L2.[65] This research demonstrates that when given the proper support children with DS can successfully participate in the FL classroom and as a result can acquire both receptive and expressive vocabulary in the FL classroom to varying degrees. This research also provides an example for FL teachers of how to facilitate the participation of and FL acquisition of children with DS in the FL classroom.

Is it thus recommended that administrators and FL teachers seek to include children with DS in the FL classroom and provide for them the needed support for them to experience success. This support should come in the form of an assistant for the child with DS if needed, recognizing that not all children with DS may need an assistant to successfully participate in the FL classroom. Additionally, the teacher should ensure that their teaching practices are suitable for children with DS. It is likely that the scaffolding needed by children with DS will also benefit TD children. Additionally, professionals giving guidance to parents of children with DS should present parents with accurate information regarding the L2 abilities of children with DS and evidence that children with DS can successfully participate in the FL classroom.[66] When presented with the

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[64] Elizabeth Kay-Raining Bird, Fred Genesee, and Ludo Verhoeven, "Bilingualism in Children with Developmental Disorders: A Narrative Review," *Journal of Communication Disorders*, Article in Press (2016): 11; Julie Longard and Hélène Deacon, "Bilingualism in Children with Down Syndrome," *Literacy Today* (June 2009): 30.

[65] Paradis, "An Agenda for Knowledge-Oriented Research," 80; de Valenzuela et. al, "Access to Opportunities," 38–40; Genesee, "French Immersion and At-Risk Students," 656; Kay-Raining Bird et al., "The Language Abilities of Bilingual Children," 197; Kay-Raining Bird et al., "Access and Outcomes," 21–22; Ware, Lye, and Kyffin, "Bilingualism and Students," 227–28.

[66] Kay-Raining Bird, Genesee, and Verhoeven, "Bilingualism in Children with Developmental Disorders," 11.

opportunity, parents may consider allowing their child to participate in the FL classroom. While it is not guaranteed that every child with DS will acquire an L2 in the FL classroom, it is likely that they may acquire some amount of FL vocabulary when properly supported in class. Not only might the child benefit from learning another language, but they may highly enjoy participation in the FL classroom.

Furthermore, while various factors contribute to successful FL acquisition, no single factor precludes FL acquisition in children with DS. That is, even those children with low cognition and/or low L1 skills were able to demonstrate evidence of FL acquisition to varying degrees. Teachers, practitioners, administrators, and parents should not assume that a child with low cognition or low L1 skills will not be able to acquire at least some L2. Children with DS of varying abilities should be given the opportunity to participate in the FL classroom. With the proper scaffolding, most children can experience some level of success. While each child's case should be considered carefully, the success experienced by the wide variety of students in this study sets a precedent for children of varying abilities to successfully participate in the FL classroom.

Finally, a prevailing concern among parents, teachers, and professionals regarding L2 exposure among children with DS is the possible negative impact that exposure to an L2 may have on the L1 development of children with DS.[67] This study demonstrates that exposure to a FL does not seem to negatively impact L1 vocabulary development in children with DS. Thus, while L1 vocabulary development did not change during the course of the intervention, L2 acquisition occurred. Professionals giving guidance to parents of children with DS should provide parents with this information so that parents can make rightly informed decisions regarding their child's educational path. While parents may have a variety of reasons for not wanting their child

[67] Marinova-Todd et al., "Professional Practices and Opinions," 48; Rebecca Ward, "Profiling the Language Abilities of Welsh-English Bilingual Children with Down Syndrome" (PhD diss., Bangor University, 2020), 141–42.

to participate in the FL classroom, misinformation, such as the inability of their child to learn a FL or possible harm to L1 development as a result of that participation, should not be a reason.

Though this study only examined FL acquisition among children with DS, these results carry implications for children with other learning and intellectual disabilities. Though every disability is unique, DS is a complex combination of impairments. Despite considerable cognitive and linguistic impairment, participants were able to experience success participating in a FL class and acquiring FL vocabulary. It is possible that children with other intellectual, learning, or cognitive disabilities may also be able to experience some level of success in the FL classroom. Administrators, teachers, and parents should consider these findings when considering if a child with other learning, language, or cognitive disabilities should participate in the FL classroom. It is likely that with the proper scaffolding and support they too can experience success and have a positive experience in the FL classroom.

A Charge to Christian Schools

A special word is warranted for administrators and teachers in Christian schools. While it is likely that most teachers and administrators in Christian schools would not doubt the worth or value of a child with DS, they may doubt their ability to participate in a FL classroom or successfully acquire a FL. This is evident by the attitude of administrators and teachers in the Christian school in which I worked. Though administrators wanted the children with DS to participate in Spanish class, they expressed their low expectations for them to learn the language. Furthermore, one teacher even said it was “stupid” that we would expect them to learn a second language when they have such a hard time with English. Though likely expressed out of a concern for the children, such attitudes are not reflective of a true desire to integrate children with DS nor a belief in their abilities to learn and achieve.

As believers in the doctrine of *imago Dei* and the resulting uniqueness and dignity of every child, Christian schools should lead the way in educating children with DS and other intellectual disabilities. Not only that, but they should intentionally seek to provide them with the same opportunities afforded to TD peers, such as learning a FL, when such services are provided in their school. This study demonstrates that children with DS are capable of successfully participating in the FL classroom and acquiring FL vocabulary and serves as a precedent for Christian schools.

Finally, Christian schools should not only include children with DS and other intellectual disabilities in the FL classroom, but train their teachers, including their FL teachers, to provide the support needed for such children to experience success. It is the duty of the Christian school and teacher to utilize diverse strategies "to match diverse learning outcomes, based on the individual and situation."[68] In his commentary on Titus 2:1–15, scholar of Christian Education James Estep states that the teaching ministry of the church must respond to the needs of the individual and thus "instruction must be tailored to the needs of the specific group or age level . . . (and) take into account the learner and the context in which the instruction will occur."[69] Utilizing teaching strategies which are tailored to the individual, including children with DS, honors the diversity and varying abilities of those whom God has created and entrusted to our care. While not exhaustive, this study provides a starting point for FL teachers seeking to include children with DS in the FL classroom.

Christian teachers and administrators should be advocates and supporters of children with DS in both word and in deed. As such, they must provide children with DS with opportunity and the needed support, all the while believing that they are truly

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[68] James R. Estep, "Biblical Principles for a Theology of Christian Education," in *A Theology for Christian Education*, by James R. Estep, Michael J. Anthony, and Gregg R. Allison (Nashville: B & H Academic, 2008), 55.

[69] Estep, "Biblical Principles," 57.

capable of achieving success. It is our privilege and duty to help children with DS and other disabilities flourish, succeed, and attain the highest fulfillment of their God-given abilities, one of which could be learning a FL.[70]

Further Research

This study is the first to explore FL acquisition of children with DS and their participation in the FL classroom. While the findings of this study are valuable and contribute greatly to the field of second language acquisition in children with DS, further research is needed to more fully understand FL acquisition in children with DS and to facilitate their successful participation in the FL classroom. The following list provides recommendations for future research of FL acquisition in children with DS and the contributions they can make.

1. Studies in which children with DS are exposed to a FL for more substantial lengths of time are needed to understand FL acquisition in children with DS beyond its incipient stages. This would also facilitate the examination of grammatical acquisition of a FL in children with DS since grammatical development is delayed in individuals with DS and likely needs substantial exposure to the language for measurable development to occur.

2. Studies with TD children serving as a control group are needed to understand how FL acquisition in children with DS differs from that of their TD peers.

3. Studies which examine the factors which relate to FL acquisition in DS are needed to build upon the preliminary findings of this study.

4. Longitudinal studies which track the retention of acquired FL vocabulary as compared to a TD control group are needed.

5. Studies with larger control groups for L1 development are needed to more accurately assess the impact of exposure to a FL to the L1 development of children with DS. Studies in which children are exposed to a FL for longer amounts of time and greater quantity would also be useful in this regard, as well as pre- and post-test measurements of L1 vocabulary using the same assessment, rather than alternate forms.

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[70] For a similar reflection see Judy Chesson, "What's Special about Special Education in Christian Schools?," *Christian Teachers Journal* 26, no. 1 (2018): 27. See also Philip Stegink, "Disability to Community: A Journey to Create Inclusive Christian Schools," *Journal of Religion, Disability & Health* 14, no. 4 (2010): 368–81.

6. Studies with languages besides Spanish as a FL are needed to add to our understanding of FL acquisition among children with DS and to determine if linguistic proximity has any bearing on the ability of children with DS to acquire a FL.

7. Studies among other age groups of individuals with DS such as adolescents and adults could not only help answer the question as to whether these age groups are able to acquire a FL but could add more information as to the age effect among individuals with DS.

8. Studies which further examine the relationship between verbal short-term memory and FL acquisition could explore whether exposure to a FL improves verbal short-term memory in individuals with DS.

9. Studies of children with DS participating in the FL class in the school context would be valuable to better understand their participation and acquisition in the context of the school FL classroom with its unique parameters and constraints.

10. Studies which compare the effectiveness of teaching methodologies and strategies for children with DS could aid teachers in more effectively teaching a FL to children with DS.

11. Studies which compare FL acquisition of children with DS in the integrated context and separated context could add to our understanding of which context is more effective for facilitating FL acquisition in children with DS.

12. More case studies of children with DS with a wide range of cognitive and linguistic abilities, as well as confounding factors such as autism, should be conducted to understand more in depth the abilities of children with DS to acquire a FL and their participation in the FL classroom. Case studies which include interviews with the students themselves could also be valuable to consider their perception of participation in the FL classroom and learning a FL.

13. Studies which incorporate alternative methods of assessments may prove valuable to better capturing the full extent of FL acquisition by children with DS. These methods could include allowing students to act out words rather than merely identifying a picture or incorporating play and assessing language via a checklist or questionnaire.

14. Studies which investigate variables in FL acquisition, not only in terms of correlation, but also in terms of causality and directionality would be valuable.

Conclusion

This is the first study of its kind to document the participation of children with DS in the FL classroom and their L2 acquisition in the FL context. This study clearly demonstrates that children with DS are capable of successfully participating in the FL classroom and acquiring FL vocabulary. All children who participated in the study, with a wide spectrum of cognitive and linguistic abilities, demonstrated evidence of FL

acquisition. While all children demonstrated more receptive than expressive acquisition, some children demonstrated a considerable amount of expressive FL vocabulary after only six weeks of instruction. This study also examined the factors which contribute to FL vocabulary acquisition and demonstrates that exposure to a FL does not adversely impact L1 vocabulary development in children with DS. While results from this study need to be confirmed by studies, this study suggests that children with DS should not be excluded from the FL classroom based on diagnosis, nor cognitive or L1 abilities, and should be afforded the same opportunities as their TD peers to acquire a FL.

APPENDIX 1

AGREEMENT TO PARTICIPATE SPANISH
INTERVENTION AND DATA GATHERING

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess their acquisition of Spanish after having participated in a six-week Spanish class. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. The research consists of three parts: 1) pre-intervention assessments 2) intervention – 6-weeks of Spanish class 3) post-intervention assessments.

1. *Pre-Intervention Assessments*
In the pre-intervention research, a person will undergo a series of assessments to determine their cognitive abilities and English vocabulary. They will be required to look at a series of pictures and point to the answer which completes the pattern or represents the word they heard, or verbally describe the picture in one word. They will also listen to a series of non-words (non-sense words) and be asked to repeat them. The non-word task will be audio recorded for the purposes of accurate scoring.

2. *Intervention*
In the intervention phase, a person will participate in a 6-week Spanish course held at Down Syndrome of Louisville. The course will meet every day, Monday through Friday, for 45 minutes. The course will take place for two three-week periods, with a week break in-between. The dates of the course are June 13 to July 1 and July 11 through July 29.

All Spanish classes will be recorded for the purposes of research. The recording *will not be made public* and will *only* be viewed by Emily Ibrahim. Indicate whether or not you grant permission for your child to be recorded by signing your initials next to the corresponding choice below.

____ I agree to allow my child to be recorded in the Spanish class.
____ I do not agree to allow my child to be recorded and request that accommodations be made so that my child will not appear in the recording.

3. *Post-Intervention Assessments*
In this post-intervention research, a person will undergo a series of assessments to determine their Spanish vocabulary acquisition and English vocabulary levels. The person will be required to look at a set of pictures and point to the picture which represents the word they heard, or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor

or member of a vulnerable population to participate in this research if he or she desires.

Participant Name _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 2

AGREEMENT TO PARTICIPATE CASE STUDY

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a case study designed to describe their participation in a six-week Spanish class and their acquisition of Spanish after having participated in the class. This research is being conducted by Emily Ibrahim for purposes of her dissertation research. In this research, a person will be video recorded as they participate in a Spanish class. The recording *will not be made public* and will only be viewed by Emily Ibrahim for research and documentation purposes. The teacher (Emily Ibrahim) will also record observations of the person's participation in a journal after each class. Assistants in the class may also observe the student in the class and supply their observations through a journal, survey, and interview.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses or description. *Participation in this case study is totally voluntary, and the person you are giving approval to participate in this case study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 3

AGREEMENT TO PARTICIPATE
SPANISH INTERVENTION

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess acquisition of Spanish in children with Down syndrome after having participated in a six-week Spanish class. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research.

In the Spanish intervention phase (Spanish class) a person will participate in a 6-week Spanish course held at Down Syndrome of Louisville. The course will meet every day, Monday through Friday, for 45 minutes. The course will take place for two three-week periods, with a week break in-between. The dates of the course are June 13 to July 1 and July 11 through July 29.

All Spanish classes will be recorded for the purposes of research. The recording *will not be made public* and will *only* be viewed by Emily Ibrahim. Indicate whether or not you grant permission for your child to be recorded by signing your initials next to the corresponding choice below.

____ I agree to allow my child to be recorded in the Spanish class.

____ I do not agree to allow my child to be recorded and request that accommodations be made so that my child will not appear in the recording.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in the Spanish intervention (Spanish class) only.

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 4

AGREEMENT TO PARTICIPATE
INSTRUMENTATION
PILOT TEST

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess the validity of a vocabulary test. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. In this research, a person will undergo a series of vocabulary assessments. They will be required to look at a series of pictures and point to picture which represents the word they heard or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 5

AGREEMENT TO PARTICIPATE
L1 CONTROL GROUP

You are being requested to give permission for a minor or member of a vulnerable population under your legal supervision to participate in a study designed to assess their English vocabulary over a period of six-weeks. This research is being conducted by Emily Ibrahim for purposes of her doctoral dissertation research. In the first part of this research, a person will undergo a series of assessments to determine their cognitive abilities and English vocabulary skills. They will be required to look at a series of pictures and point to the answer which completes the pattern or represents the word they heard, or verbally describe the picture in one word. After six weeks, in the second part of this research, a person will undergo a series of assessments to determine their English vocabulary skills. The person will be required to look at a set of pictures and point to the picture which represents the word they heard, or verbally describe the picture in one word.

Any information provided will be held *strictly confidential*, and at no time will a person's name be reported, or a person's name identified with his or her responses. *Participation in this study is totally voluntary, and the person you are giving approval to participate in this study is free to withdraw from the study at any time.*

By signing your name below, you are giving informed consent for the designated minor or member of a vulnerable population to participate in this research if he or she desires.

Participant Name _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 6

PARTICIPANT BACKGROUND
INFORMATION FORM

General Information

Last Name _____ First Name _____

Date of birth _____/_____/_____ Age _____years _____months Sex _____

Race/Ethnicity _____ Grade Entering (2022-23) _____

Medical History

Has your child received a diagnosis of Down syndrome?

____ Yes, my child has received a diagnosis of Down syndrome.

____ No, my child has not received a diagnosis of Down syndrome.

WHO diagnosed your child with Down syndrome?

____ A medical physician diagnosed my child with Down syndrome.

____ A psychologist diagnosed my child with Down syndrome.

____ Other, please specify: _____

WHERE was your child diagnosed with Down syndrome?

____ In a hospital

____ In a Dr.'s office or medical clinic

____ In a school

____ Other, please specify: _____

With which subtype of Down syndrome was your child diagnosed?

____ Trisomy 21

____ Translocation

____ Mosaic

____ I'm not sure

Has your child received a diagnosis of autism spectrum disorder? _____Yes _____No

Has your child ever experienced a traumatic brain injury? _____Yes _____No

Which best describes your child's hearing status as confirmed by a recent audiogram?

___ Normal hearing ___Normal hearing after correction

___ Mild hearing loss with no correction ___ Mild hearing loss after correction

___ Moderate hearing loss with no correction ___ Moderate hearing loss after correction

___ Severe hearing loss with no correction ___ Severe hearing loss after correction

___ I don't have a recent audiogram but have marked the hearing status I believe to be most accurate.

Comments on hearing status: _____

_____

Language Exposure

*Is English your child's first and only language (with exception of sign)?*___Yes ___No

Has your child previously participated in a Spanish class? ____Yes _____No

Has your child had previous significant exposure to the Spanish language? __Yes __No

Has your child ever attended a foreign language class of a language other than Spanish?

____Yes ____No

If so, what language, with what frequency, and for how long? _____

_____

Comments on language exposure: _____

_____

Parental Information

Highest level of father's education:

___High school ___Technical Certificate ___Bachelor ___Masters ___Doctorate

____ other (specify) _____

Highest level of mother's education:

___High school ___Technical Certificate ___Bachelor ___Masters ___Doctorate

_____ other (specify) _____

Parent/Guardian Name _____

Parent/Guardian Signature _____

Date _____

APPENDIX 7

CASE STUDY JOURNAL OBSERVATION QUESTIONS

Date_____ / _____ / _____

Based on your observations of the child in class today, please answer the following questions:

1. Did the child seem especially engaged in a particular activity today? If so, what? How did they demonstrate engagement?

2. Did the child seem especially distracted or disinterested in a particular activity today? If so, which activity? What behaviors did they demonstrate that led you to believe they were distracted or disinterested?

3. Was there any activity today that seemed particularly challenging for the child today? If so, what and why? How did they demonstrate that it was challenging for them?

4. Was there a time in class when the child seemed to really not understand what was happening? When was that and how did they demonstrate that they weren't understanding?

5. Was there a time in class when the child really seemed to understand the Spanish being used in class? How did you notice?

6. Did you hear the child say anything in Spanish today?

7. Did the child need your support today? Is so, what type of support did you offer? Did it appear helpful? How so?

8. What was the child's overall demeanor today in class? Did it change during the duration of the class?

9. Are you aware of anything that happened at home (lack of sleep, changed schedule) or during camp that may have negatively affected the child's engagement or behavior in class today?

APPENDIX 8

MID-INTERVENTION ASSISTANT
SURVEY QUESTIONS

Student Name: _____

Please answer the following questions *based upon your observations* of and interactions with the child in the Spanish class:

1. On a scale of 0 to 5, with zero being consistently unengaged and 5 being consistently engaged, how would you rate the child's overall engagement in the class?

Unengaged ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Engaged
Comments:

2. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards Spanish?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive
Comments:

3. On a scale of 0 to 5, with 0 being completely negative, and 5 being completely positive, how would you rate the child's *experience* in Spanish class?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive
Comments:

4. On a scale of 0 to 5, with 0 being no comprehension and 5 being complete comprehension, how would you rate the child's general comprehension of the Spanish used in the class?

No comprehension ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Full Comprehension
Comments:

5. On a scale of 0 to 5, with 0 being isolated and 5 being completely integrated, how would you rate the child's integration in the class?

Isolated ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Integrated
Comments:

6. On a scale of 0 to 5, with 0 being dependent on assistance and 5 being completely independent, how much support from you as an assistant did the child need to participate in the class?

Dependent ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Independent
Comments:

7. On a scale of 0 to 5, with 0 being no learning and 5 being considerable learning, how would you rate the child's learning of Spanish?

No learning ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Considerable learning
Comments:

8. Ona a scale of 0 to 5, with 0 being completely unbeneficial and 5 being highly beneficial, how would you rate the overall effectiveness of the activities in class for the child's learning?

Unbeneficial ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Beneficial
Comments:

9. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate the child's overall enjoyment of the activities in class?

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed
Comments:

APPENDIX 9

POST-INTERVENTION ASSISTANT SURVEY
AND INTERVIEW QUESTIONS

Assistants were given a survey after the end of the course for those children participating in the case study. This survey consisted of the questions numbered one through 10. The follow up questions were asked in the interview with me.

Please answer the following questions *based upon your observations* of and interactions with the child in the Spanish class:

1. On a scale of 0 to 5, with zero being consistently unengaged and 5 being consistently engaged, how would you rate the child's overall engagement in the class?

Unengaged ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Engaged

Follow up question:
What are the behaviors which demonstrated to you the child's engagement or disengagement?

2. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards Spanish?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

Follow up question:
What indicated to you the child's attitude?

3. On a scale of 0 to 5, with 0 being completely negative, and 5 being completely positive, how would you rate the child's *experience* in Spanish class?

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

Follow up questions:
Why did you rate the child's experience as negative/positive?
What factors did you observe that contributed to this positive/negative experience?

4. On a scale of 0 to 5, with 0 being no comprehension and 5 being complete comprehension, how would you rate the child's general comprehension of the Spanish used in the class?

No comprehension ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Full Comprehension

Follow up questions:
What behaviors signaled to you that the child was not understanding?
What behaviors signaled to you that the child was understanding Spanish?

5. On a scale of 0 to 5, with 0 being isolated and 5 being completely integrated, how would you rate the child's integration in the class?

Isolated ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Integrated

Follow up questions:
What would you identify as the greatest barriers to the child's participation in the class?
What types of things did the teacher to do help facilitate participation of the child in class?

6. On a scale of 0 to 5, with 0 being dependent on assistance and 5 being completely independent, how much support from you as an assistant did the child need to participate in the class?

Dependent ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Independent

Follow up questions:
Did this level of independence evolve throughout the course, or was it fairly consistent?
What kind of support or assistance did the child need from you?
Were there certain activities that the child needed more support from you than others?

7. On a scale of 0 to 5, with 0 being no learning and 5 being considerable learning, how would you rate the child's learning of Spanish?

No learning ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Considerable learning

Follow up question:
What indicated to you the child's learning or lack thereof?

8. On a scale of 0 to 5, with 0 being completely unbeneficial and 5 being highly beneficial, how would you rate the overall effectiveness of the activities in class for the child's learning?

Unbeneficial ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Beneficial

Follow up questions:
Which activities do you think most helped the child learn Spanish?
What activities do you think the child least benefited from in class?

9. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate the child's overall enjoyment of the activities in class?

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed

Follow up questions:
What do you think were the child's favorite activities?
What do you think the child least enjoyed in class?

Final questions:
Do you have any final observations pertaining to the child's participation in class?

Do you have any final observations regarding the child's acquisition of Spanish?

Based upon your observations of the child in class, if you were to give any advice to foreign language teachers seeking to integrate children with DS into the foreign language classroom, what would it be?

Based upon your experience in the class, if you were to give any advice to assistants in the foreign language classroom, what would it be?

APPENDIX 10

POST-INTERVENTION PARENTAL
CASE STUDY SURVEY

Please answer the following questions *based upon your observations* of and interactions with your child and their experience in Spanish class:

1. On a scale of 0 to 5, with zero being completely negative, and 5 being completely positive, how would you rate the child's overall *attitude* towards the Spanish language? If you did not observe, please choose "not observed."

Negative ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Positive

_____ Not observed

What indicated to you your child's attitude?

2. On a scale of 0 to 5, with 0 being dislike and 5 being highly enjoyed, how would you rate your child's overall enjoyment of the Spanish class? If you did not observe, please choose "not observed."

Dislike ____ 0 ____ 1 ____ 2 ____ 3 ____ 4 ____ 5 Enjoyed

_____ Not observed

What indicated to you your child's enjoyment or lack thereof?

Additional questions:

Has your child showed you any evidence of acquisition of Spanish, such as saying words or recognizing words in Spanish?

Do you have any other observations pertaining to your child's participation in class?

Do you have any other observations regarding your child's acquisition of Spanish?

Outside Exposure

During the duration of the Spanish course:

1. On average, how often did you or someone else in the family read with your child the story books in Spanish provided by Ms. Emily? (This includes listening to the recording)

___never ___a few times ___ once a week ___ multiple times a week

2. On average, how often did your child view videos on Maestra Ibrahim's YouTube channel?

___never ___a few times ___ once a week ___ multiple times a week

3. On average, how often did your child watch, listen to, or interact with other resources in Spanish (such as videos, games, books, music, etc.)?

___never ___a few times ___ once a week ___ multiple times a week

4. On average, how often did someone else engage with your child in conversation in Spanish?

___never ___a few times ___ once a week ___ multiple times a week

APPENDIX 11

OUT OF CLASS EXPOSURE PARENTAL SURVEY

Please answer the following questions regarding your child's exposure to Spanish outside of Spanish class during the duration of the course.

Participant's Name: _____

Outside Exposure

During the duration of the Spanish course:

1. On average, how often did you or someone else in the family read with your child the story books in Spanish provided by Ms. Emily? (This includes listening to the recording)

___never ___a few times ___ once a week ___ multiple times a week

2. On average, how often did your child view videos on Maestra Ibrahim's YouTube channel?

___never ___a few times ___ once a week ___ multiple times a week

3. On average, how often did your child watch, listen to, or interact with other resources in Spanish (such as videos, games, books, music, etc.)?

___never ___a few times ___ once a week ___ multiple times a week

4. On average, how often did someone else engage with your child in conversation in Spanish?

___never ___a few times ___ once a week ___ multiple times a week

APPENDIX 12

EVCBT PILOT TEST FORM

Name: _____ **Date:** _____

Administration: Administer all 52 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response. Any form of the solicited word is acceptable.

Say to the examinee: "I am going to show you some pictures and ask you a question about the picture. Answer my questions."

Use the **prompt** below each word.

1. Walking _____
What´s he doing?

2. Jumping _____
What´s he doing?

3. White _____
What color is the circle?

4. Drinking _____
What´s she doing?

5. Crying _____
What´s she doing?

6. Arm _____
What is it? (run your finger along the arm as you ask the question)

7. Two_____
How many circles are there?

8. Sleeping _____
What´s he doing?

9. Brown_____
What color is the circle?

10. Dancing_____
What´s she doing?

11. Turtle_____
What is it?

12. Eating _____
What´s he doing?

13. Grey_____
What color is the circle?

14. Leg_____
What is it? (run your finger up and down the leg)

15. Flower_____
What is it?

16. Head_____
What is it? (point to the head)

17. Five_____
How many circles are there?

18. Listening _____
What´s he doing?

19. Blue _____
What color is the circle?

20. Nose _____
What is it? (point to nose)

21. Flying _____
What´s he doing?

22. One_____
How many circles are there?

23. Singing _____
What´s she doing?

24. House_____
What is it?

25. Hand _____
What is it?

26. Green _____
What color is the circle?

27. Dog _____
What is it?

28. Running_____
What´s he doing?

29. Sad _____
How does he feel?

30. Pink _____
What color is the circle?

31. Horse _____
What is it?

32. Mouse _____
What is it?

33. Fell down_____
What happened?

34. Six_____
How many circles are there?

35. Black_ _____
What color is the circle?

36. Rabbit _____
What is it?

37. Happy_____
How does she feel?

38. Yellow _____
What color is the circle?

39. Dolphin_____
What is it?

40. Sitting _____
What´s she doing?

41. Frog _____
What is it?

42. Red _____
What color is the circle?

43. Four_____
How many circles are there?

44. Shark _____
What is it?

45. Orange_____
What color is the circle?

46. Monkey _____
What is it?

47. Fish _____
What is it?

48. Three_____
How many circles are there?

49. Cat _____
What is it?

50. Monster_____
What is it?

51. Purple_____
What color is the circle?

52. Dancing_____
What is she doing?

Total correct _____

APPENDIX 13

RVCBT PILOT TEST FORM

Name: _____ **Date:** _____

DOB:_____ **Age:** _____ **Grade Completed:** _____

Administration: Administer all 56 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response.

Say to the examinee: "I am going to show you some pictures and say a word in Spanish. You point to the picture of the word that I say or tell me the letter of the word."

1. Sitting– C _____
2. Blue – D _____
3. Elephant – D _____
4. Walking – B _____
5. Arm – B _____
6. Green – B _____
7. Turn around – A _____
8. Monkey – B _____
9. Drinking – D _____
10. Leg – D _____
11. Black – B _____
12. Crying – C _____
13. Octopus – B _____
14. Dancing – C _____
15. White – A _____
16. Sleeping – A _____
17. Clapping – B _____
18. Cat – D _____
19. Purple – C _____
20. Listening – D _____
21. Mouth – A _____
22. Moving – B _____
23. Giraffe – C _____
24. Head – A _____
25. Horse – A _____
26. Stomach – C _____
27. Brown – B _____
28. Foot – B _____
29. Flying – A _____
30. Singing – D _____
31. Big – A _____
32. Running – C _____
33. Pink – A _____
34. Ear – C _____
35. Bird – A _____
36. Eating – B _____

37. Eye – C _____
38. Dog – C _____
39. Grey – D _____
40. Swimming – D _____
41. Scared – B _____
42. Mouse – A _____
43. Small – C _____
44. Fell down – D _____
45. Red – A _____
46. Frog – D _____
47. Sad – D _____
48. Hug – B _____
49. Get up – D _____
50. monster – B ___
51. Yellow – A _____
52. Turtle – B _____
53. Shoulder – D _____
54. Shark – C _____
55. Bicycle – D _____
56. Orange – C _____

TOTAL CORRECT: _____

APPENDIX 14

EVCBT ASSESSMENT FORM

Name: _____ **Date:** _____

Administration: Administer all 35 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response. Any form of the solicited word is acceptable.

Say to the examinee: "I am going to show you some pictures and ask you a question about the picture. I want you to tell respond to my question is *in Spanish.*"

Use the **prompt** below each word. Ask the prompt in Spanish, English and Spanish again.

1.Camina _____
¿Qué hace? / What´s he doing?

2. Bebe _____
¿Qué hace? / What´s she doing?

3. Llora _____
¿Qué hace? / What´s she doing?

4. Dos_____
¿Cuántos círculos hay? / How many circles are there?

5. Duerme _____
¿Qué hace? / What´s he doing?

6. Café_____
¿Qué color es el círculo? / What color is the circle?

7. Tortuga_____
¿Qué es? / What is it?

8. Come _____
¿Qué hace? / What´s he doing?

9. Mano _____
¿Qué es? / What is it?

10. Verde _____
¿Qué color es el círculo? / What color is

11. Perro _____
¿Qué es? / What is it?

12. Cinco_____
¿Cuántos círculos hay? / How many circles are there?

13. Escucha _____
¿Qué hace? / What´s he doing?

14. Azul _____
¿Qué color es el círculo? / What color is the circle?

15. Nariz _____
¿Qué es? / What is it? (point to nose)

16. Uno_____
¿Cuántos círculos hay? / How many circles are there?

17. Canta _____
¿Qué hace? / What´s she doing?

18. Se sienta_____
¿Qué hace? / What´s she doing?

19. Rana_____
¿Qué es? / What is it?

the circle?

20. Rojo _____
¿Qué color es el círculo? / What color is the circle?

21. Cuatro_____
¿Cuántos círculos hay? / How many circles are there?

22. Tiburón_____
¿Qué es? / What is it?

23. Corre_____
¿Qué hace? / What´s he doing?

24. Triste_____
¿Cómo se siente? / How does he feel?

25. Rosa _____
¿Qué color es el círculo? / What color is the circle?

26. Caballo _____
¿Qué es? / What is it?

27. Seis_____
¿Cuántos círculos hay? / How many circles are there?

28. Negro_____
¿Qué color es el círculo? / What color is the circle?

29. Feliz_____
¿Cómo se siente? / How does he feel?

30. Amarillo _____
¿Qué color es el círculo? / What color is the circle?

31. Anaranjado_____
¿Qué color es el círculo? / What color is the circle?

32. Pez _____
¿Qué es? / What is it?

33. Tres_____
¿Cuántos círculos hay? / How many circles are there?

34. Gato_____
¿Qué es? / What is it?

35. Morado_____
¿Qué color es el círculo? / What color is the circle?

Total correct _____

.

APPENDIX 15

RVCBT ASSESSMENT FORM

Name: _____ **Date:** _____

DOB:_____ **Age:** _____ **Grade Completed:** _____

Administration: Administer all 45 items to all participants in order. Write down the response to each item and put a slash through the item number for an incorrect response.

Say to the examinee: "I am going to show you some pictures and say a word in Spanish. You point to the picture of the word that I say or tell me the letter of the word."

1. Se sienta– C _____
2. Azul – D _____
3. Elefante – D _____
4. Camina – B _____
5. Brazo – B _____
6. Verde – B _____
7. mono – B _____
8. bebe – D _____
9. pierna – D _____
10. negro – B _____
11. llora – C _____
12. baila – C _____
13. blanco – A _____
14. duerme – A _____
15. gato – D _____
17. escucha – D _____
18. boca – A _____
19. cabeza – A _____
20. caballo – A _____
21. café – B _____
22. pie – B _____
23. canta – D _____
24. grande – A _____
25. corre – C _____
26. rosa – A _____
27. oreja – C _____
28. come – B _____
29. ojo – C _____
30. perro – C _____
31. gris – D _____

16. morado – C _____

33. tiene miedo – B _____

34. pequeño – C _____

35. rojo – A _____

36. rana – D _____

37. triste – D _____

38. abrazo – B _____

39. se levanta – D _____

32. nada – D _____

40. monstruo – B ___

41. amarillo – A _____

42. tortuga – B _____

43. hombro – D _____

44. tiburón – C _____

45. anaranjado – C _____

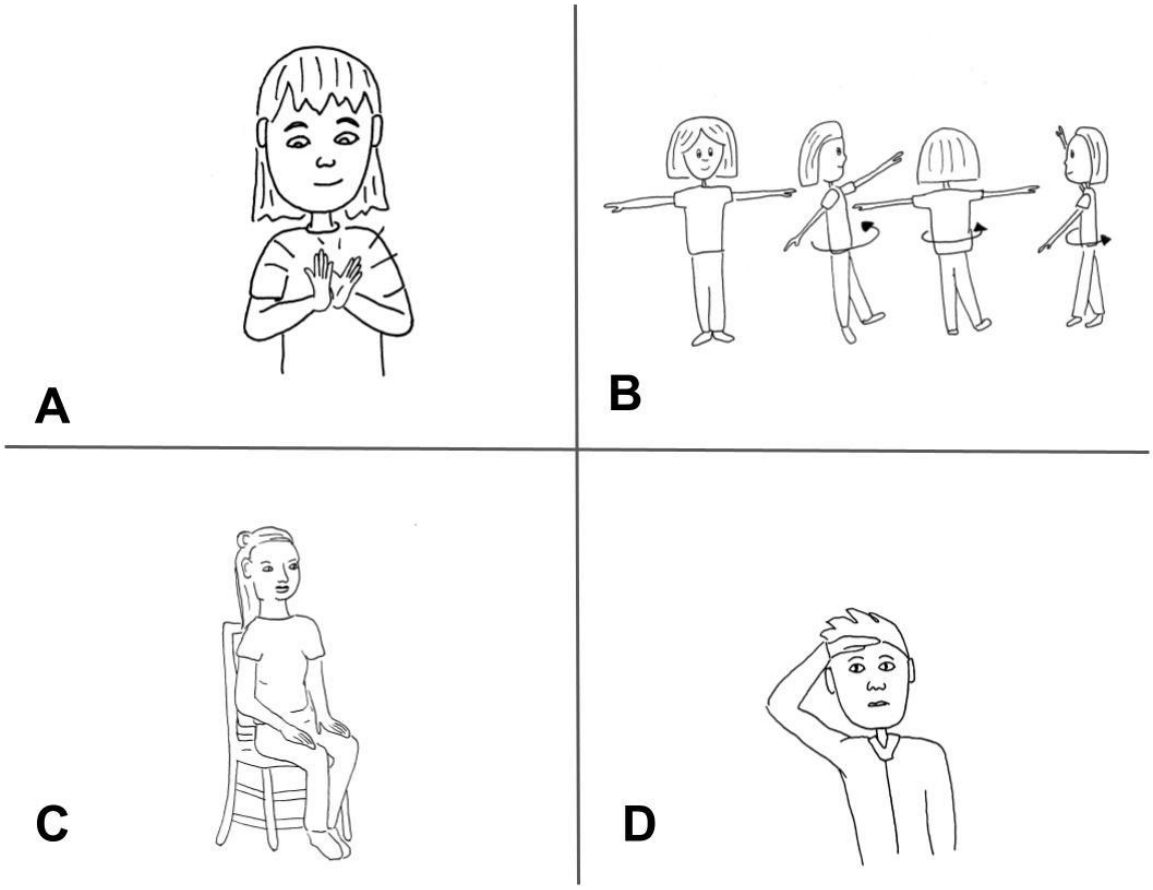
TOTAL CORRECT: _____

APPENDIX 16

EVCBT ITEM SAMPLE

APPENDIX 17

RVCBT ITEM SAMPLE



APPENDIX 18

INTERVENTION PARTICIPANT INFORMATION

Table A1. Intervention participant background information

Intervention Participant	Age	Gender	Grade Completed	NVMA	NVC Raw Score	Summer Camp Class	Hearing Status
1	6:9	F	K	<4:0	7	Middle	Normal
2	7:5	M	1	<4:0	9	Lower	Normal
3	8:2	M	1	<4:0	9	Middle	Normal
4	9:4	F	2	<4:0	6	Middle	Normal
5	9:6	M	2	<4:0	4	Middle	ML-NC
6	10:4	F	3	<4:0	4	Upper	Normal
7	10:9	M	4	<4:0	10	Upper	Normal
8	11:6	M	4	5:8	18	Upper	Normal
9	12:0	F	5	4:8	13	Upper	ML-NC
10	12:5	F	4	5:6	17	Upper	Normal
11	12:8	M	6	5:8	18	Upper	Normal

NOTE: Age (years:months); NVMA = nonverbal mental age (years:months); NVC = nonverbal cognition raw score; ML-NC = mild loss, no correction

Table A2. Intervention participant pre-intervention assessment results

Intervention Participant	KBIT-2 RS	EVT-2 RS	PPVT-4 RS	NWRT T/16
1	7	40	37	7
2	9	64	73	8
3	9	0	36	0
4	6	43	41	0
5	4	10	20	3
6	4	54	46	0
7	10	80	103	12
8	18	66	104	13
9	13	68	87	9
10	17	73	81	7
11	18	10	64	0

NOTE: RS = raw score; NWRT = nonword repetition task; T/16 = total out of 16

Table A3. Intervention participant post-intervention assessment results

Intervention Participant	EVT-2 RS	PPVT-4 RS	EOWPVT-B T/34	ROWPVT-B T/34	EVCBT T/35	RVCBT T/45
1	38	29	1	12	11	31
2	78	87	1	10	15	22
3	0	56	0	4	0	23
4	51	57	4	7	19	35
5	23	46	0	13	1	15
6	41	32	0	8	1	9
7	85	89	2	13	17	34
8	73	104	1	13	15	34
9	82	89	5	13	27	41
10	78	96	5	9	21	30
11	7	82	0	11	0	19

NOTE: RS = raw score; T/ = total out of

Table A4. Intervention participant
GSV difference

Intervention Participant	EVT-2 GSV DIF	PPVT-4 GSV DIF
1	-2	-15*
2	10*	9*
3	0	18*
4	6	14*
5	18*	7
6	-11*	-10*
7	2	-11*
8	4	-1
9	9*	0
10	3	10*
11	-4	12*

NOTE: GSV DIF = growth scale value difference from pre- to post-intervention; * = statistically significant difference ($p<.10$)

APPENDIX 19

PILOT TEST PARTICIPANT INFORMATION

Table A5. Pilot test participant background information

Participant	Age	Grade Completed	Language	Expressive Administered	Receptive Administered
TD1	11	5	English	Yes	Yes
TD2	11	5	English	Yes	Yes
TD3	11	5	English	Yes	Yes
TD4	11	5	English	Yes	Yes
TD5	10	4	English	Yes	Yes
TD6	9	3	English	Yes	Yes
TD7	9	3	English	Yes	Yes
TD8	8	2	English	Yes	Yes
TD9	7	1	English	Yes	Yes
TD10	7	1	English	Yes	Yes
TD11	7	1	English	Yes	Yes
TD12	7	1	English	Yes	Yes
TD13	6	K	English	Yes	Yes
DS1	8	1	English	Yes	Yes
DS2	10	3	English	Yes	Yes
DS3	10	4	Spanish	No	Yes
DS4	10	4	English	Yes	Yes
DS5	12	5	English	Yes	Yes

APPENDIX 20

CASE STUDY LANGUAGE PROFILES

Table A6. Case study participant language profiles

	Allen	Sammy	Rusty	Rosie
PPVT-4 PRE-I				
Raw	73	40	104	87
Age eq.	4:7	2:11	6:4	5:5
GSV	123	96	144	133
EVT-2 PRE-I				
Raw	64	10	66	68
Age eq.	5:2	NG	5:4	5:6
GSV	138	85	140	141
NWRT	8	3	13	9
PPVT-4 POST-I				
Raw	87	46	104	89
Age eq.	5:3	3:4	6:3	5:5
GSV	132	103	143	133
GSV DIF	9*	7	-1	0
EVT-2 POST-I				
Raw	78	23	73	82
Age eq.	6:1	2:4	5:9	6:5
GSV	148	103	144	150
GSV DIF	10*	18*	4	9*
EWOPVT-B	1	0	1	5
RWOPVT-B	10	13	13	13
EVCBT	15	1	15	27
RVCBT	22	15	34	41

NOTE: PRE-I = pre-intervention; POST-I = post intervention; Age eq. = age-equivalent (years:months); GSV = growth scale value; DIF = difference; * = statistically significant (p<.10); NG = none given

APPENDIX 21

VARIABLE MEANS AND STANDARD DEVIATIONS

Table A7. Variable means and standard deviations

Variable	*M*	*SD*
Chronological Age MO	120.82	25.55
Nonverbal cognition RS	10.45	5.32
L1 Expressive RS	46.18	28.12
L1 Receptive RS	64.72	26.37
Nonword repetition task T/16	5.36	4.99
Class Attendance T/30	27.73	2.41
Outside Exposure S/O 0–3	1.55	0.93
Maternal Education S/O 1–5	3.27	1.10

NOTE: MO = months; RS = raw score; T/ = total out of; S/O = scale of

APPENDIX 22

VARIABLE CORRELATIONS

Table A8. Pearson *r*-correlations to Spanish acquisition

	EVCBT	EOWPVT	RVCBT	ROWPVT
CA				
r(9)	.24	.39	.17	.296
p	.24	.12	.31	.16
NVC				
r(9)	.3	.28	.39	.24
p	.18	.21	.12	.23
L1 Exp				
r(9)	.79	.58	.51	.37
p	.002*	.029*	.056**	.13
L1 Rec				
r(9)	.59	.37	.51	.55
p	.027*	.13	.05*	.04*
NWRT				
r(9)	.64	.3	.61	.68
p	.017*	.18	.024*	.01*
Class Att				
r(9)	-.41	-.16	-.25	-.25
p	.1	.32	.23	.23
OE				
r(9)	.23	-.07	.11	.298
p	.25	.41	.37	.19
ME				
r(9)	.64	.62	.47	.13
p	.016*	.02*	.07**	.35

NOTE: CA = chronological age; NVC = nonverbal cognition; L1 Exp = L1 expressive (EVT-2); L1 Rec = L1 receptive (PPVT-4); NWRT = nonword repetition task; Class Att = class attendance; OE = outside exposure; ME = maternal education; * = statistical significance (*p*=.05); ** = approaching significance

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ABSTRACT

FOREIGN LANGUAGE ACQUISITION AMONG CHILDREN WITH DOWN SYNDROME: A PRECEDENT STUDY FOR CHRISTIAN SCHOOLS

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Children with Down syndrome are largely excluded from the foreign language classroom, and no research exists documenting their abilities to learn a foreign language. Research is needed to demonstrate the abilities of children with Down syndrome to learn a foreign language so that they might be included in the foreign language classroom along with their typically developing peers and be afforded the same benefits of learning a second language. This exploratory mixed methods multiple case study is the first to document the participation of elementary-aged children with Down syndrome in a foreign language class and to measure the receptive and expressive lexical acquisition of Spanish as a foreign language in students with Down syndrome. In the first phase, students underwent a six-week Spanish intervention. In the second phase vocabulary assessments based off of the Spanish intervention curriculum were developed and in the third phase participants were assessed on their expressive and receptive Spanish vocabulary using standardized assessments and the instrumentation developed in stage two. All students demonstrated measurable evidence of Spanish vocabulary acquisition, with receptive acquisition exceeding expressive, and exposure to a foreign language did not appear to impact L1 vocabulary development. Additionally, maternal education, L1 receptive ability, performance on a nonword repetition task, and L1 expressive ability were found to significantly correlate with FL acquisition. Finally, the qualitative and

quantitative data was combined to provide an overall language acquisition profile of each child who participated in the multiple case study. Implications for children with Down syndrome, foreign language teachers, school administrators and other professionals, and Christian schools are discussed.

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