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# Explicit Learning in Down Syndrome: A Cross-Sectional Developmental Trajectory Approach

B. Allyson Phillips

*Ouachita Baptist University*, [phillipsa@obu.edu](mailto:phillipsa@obu.edu)

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EXPLICIT LEARNING IN DOWN SYNDROME:  
A CROSS-SECTIONAL DEVELOPMENTAL TRAJECTORY APPROACH

by

B. ALLYSON PHILLIPS

FRANCES CONNERS, COMMITTEE CHAIR

EDWARD MERRILL  
JASON SCOFIELD

A THESIS

Submitted in partial fulfillment of the requirements  
for the degree of Master of Arts  
in the Department of Psychology  
in the Graduate School of  
The University of Alabama

TUSCALOOSA, ALABAMA

2012

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PREVIEW

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## ABSTRACT

**Introduction:** The purpose of the current study was to analyze the cross-sectional developmental trajectories of explicit category learning in individuals with Down syndrome compared to individuals with intellectual disability and typically developing individuals. Explicit learning is active, conscious, controlled, and intentional; it is a deliberate attempt to acquire new knowledge or skill from repeated tries with feedback. Explicit learning improves with age throughout childhood and is closely related to intelligence. Because of its relation to intelligence, we expected individuals with Down syndrome to perform below the level expected for their chronological age and nonverbal ability.

**Methods:** The sample was comprised of 41 individuals with Down syndrome, 25 individuals with intellectual disability, 40 individuals who were typically developing chronological age matches, and 27 individuals who were typically developing nonverbal mental age matches. All participants completed a measure of nonverbal ability, the Leiter International Performance Test-Revised, and two measures of explicit learning, the Category Task and the Concept Formation subtest of the Woodcock-Johnson-III.

**Results:** Cross-sectional developmental trajectories were created examining explicit learning over chronological age and explicit learning over nonverbal ability. For the Category Task over chronological age trajectory, the Down syndrome and intellectual disability groups had a delay in onset in explicit learning. For the Woodcock-Johnson-III over chronological age trajectory, the Down syndrome and intellectual disability groups had a delay in onset in explicit learning, and the Down syndrome group showed a slower rate in development in explicit learning. For the

Category Task over nonverbal ability trajectory, no group showed a delay in onset or slower rate in development in explicit learning. For the Woodcock-Johnson-III over nonverbal ability trajectory, the Down syndrome group had a slower rate of development in explicit learning.

**Conclusion:** The results suggested that in comparison to typically developing individuals and individuals with mixed-etiology intellectual disability, individuals with Down syndrome show similar performance in and development of explicit category learning in relation to their nonverbal ability as long as the explicit learning measure does not constrain their performance.

PREVIEW

## DEDICATION

This thesis is dedicated to everyone who offered me advise, support, and encouragement throughout this entire process. Specifically, I dedicate this thesis to my loving husband Camaron Phillips, who supports me daily and always reminds me of the bigger picture, and to my amazing mother Belinda Shelton, who has never once stopped believing in me and continuously encourages me to trust in God's perfect plan. Finally, this work is dedicated to my Heavenly Father, who continues to lead me on an amazing journey.

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## LIST OF ABBREVIATIONS AND SYMBOLS

CA	Chronological age
DS	Down syndrome
$F$	Fisher's $F$ ratio: A ration of two variances
GSV	Growth score value
ID	Intellectual disability
IQ	Intelligence quotient
MA	Mental age
$p$	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
$t$	Computed value of $t$ test
TD	Typically Developing
WJ-III	Woodcock-Johnson-III
<	Less than
=	Equal to
$\eta_p^2$	Partial eta squared: effect size



## ACKNOWLEDGMENTS

I would like to thank my advisor and thesis chair, Dr. Fran Connors, for providing me with wonderful advice, knowledge, and guidance throughout the entirety of this project. Additionally, I would like to thank the members of my committee, Dr. Ed Merrill and Dr. Jason Scofield, for their invaluable advice and for the time and service they invested in my thesis. I would also like to thank my fellow graduate students, Marie Moore and Susan Loveall, the research team at the University of Wisconsin under the direction of Dr. Leonard Abbeduto, and all of the research assistants who devoted great time and effort in collecting the data. Finally, I would like to acknowledge NICHD Grant HD055345. This project was truly a team effort, and I could not have done it without the help of each and every member of this team.

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## CHAPTER 1

### INTRODUCTION

Learning, or the process in which behavior changes as a result of interactions with the world, is vital for one's survival and well-being. Being able to obtain, assimilate, and apply knowledge correctly is crucial for any aspect of life—from getting ready in the morning to cooking a meal to succeeding at school or a job. In today's society, capacity to learn determines one's overall ability. Learning is important not just for typically developing individuals but also for individuals with an intellectual disability such as Down syndrome. Individuals with Down syndrome can learn, though they learn differently from typically developing individuals. Research has shown that individuals with an intellectual disability want to be independent (Wehmeyer & Metzler, 1995), and such independence requires the ability to learn. Therefore, understanding how individuals with Down syndrome learn is exceptionally important in helping them succeed in life, and knowledge gained about their learning abilities will aid in future intervention approaches.

Learning is not a unitary function; rather, two types of learning exist—explicit learning and implicit learning (Berry & Broadbent, 1988; Hasher & Zacks, 1979; Hayes & Broadbent, 1988; Lewicki, 1986; Reber, 1989; Weinert, 2009). The distinction between explicit and implicit learning has been a primary field of study in cognitive psychology for over forty years with some of the early work using terms such as automatic and effortful processes (Hasher & Zacks, 1979) and unselective and selective learning (Hayes & Broadbent, 1988). Explicit learning is active, conscious, controlled, and intentional. It occurs when deliberate instructions are given and only a