

THE EFFECTS OF MASTERY CRITERIA  
ON SKILL MAINTENANCE

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THE EFFECTS OF MASTERY CRITERIA  
ON SKILL MAINTENANCE

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**Abstract:** There is currently limited research detailing the effects of varying mastery criteria on skill maintenance for children with Autism Spectrum Disorder (ASD). Mastery criteria are used to determine whether a skill has been acquired and is typically based on a criterion of accuracy observed over a number of consecutive sessions. Results from a survey of BCBAs reveal that 80 percent accuracy across three consecutive therapy sessions is the most used mastery criteria (Richling, S. M., Williams, W. L., & Carr, J. E. (2019), which presumes that this criterion is a minimum standard for skill maintenance. However, there is currently no research on the effects of different mastery criteria on the maintenance of functional skills for children with ASD in a clinical setting. The goal of this study was to determine whether the often-used mastery criteria of 80 percent accuracy across three consecutive sessions is the mastery criteria that should be used in clinical practice when compared to other similar criteria by examining the maintenance of skills over time, across participants, skills, and mastery criteria. Specifically, this study examined whether the mastery criteria of 60, 80, or 100 percent accuracy across three consecutive sessions is efficient for maintaining a set of varying acquisitional skills for five weeks across participants in a clinical setting by measuring the number of sessions to obtain the mastery criterion and the percentage of loss of maintenance. Results from this study indicate that the 60 percent mastery criterion took fewer sessions to achieve mastery, generated a greater instructional efficiency, and demonstrated similar loss of maintenance to the 80 and 100 percent mastery criterion.

*Keywords:* mastery criteria, maintenance, skill acquisition, Autism Spectrum Disorder

## TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION.....	1
Mastery Criteria .....	1
Maintenance .....	2
Use of Mastery Criteria.....	3
Mastery Criteria in Education.....	5
Mastery Criteria in Education Without Maintenance .....	8
Current Study .....	10
II. REVIEW OF LITERATURE.....	12
Mastery Criteria .....	12
Maintenance .....	13
Use of Mastery Criteria.....	15
Mastery Criteria in Education.....	17
Mastery Criteria in Education Without Maintenance .....	26
Current Study .....	31
III. METHODOLOGY .....	32
Participants and Setting.....	32
Materials .....	32
Dependent Variable .....	33
Independent Variable .....	34
Experimental Design.....	35
Procedures .....	35
IV. RESULTS .....	40
Participant One.....	41
Participant Two.....	42
Participant Three.....	43
Interobserver Agreement & Treatment Fidelity .....	44

Chapter	Page
IV. DISCUSSION.....	45
REFERENCES .....	49
APPENDICES .....	51

## LIST OF FIGURES

Figure	Page
Figure 1 Participant One.....	vii
Figure 2 Participant Two.....	viii
Figure 3 Participant Three.....	ix

Participant 1

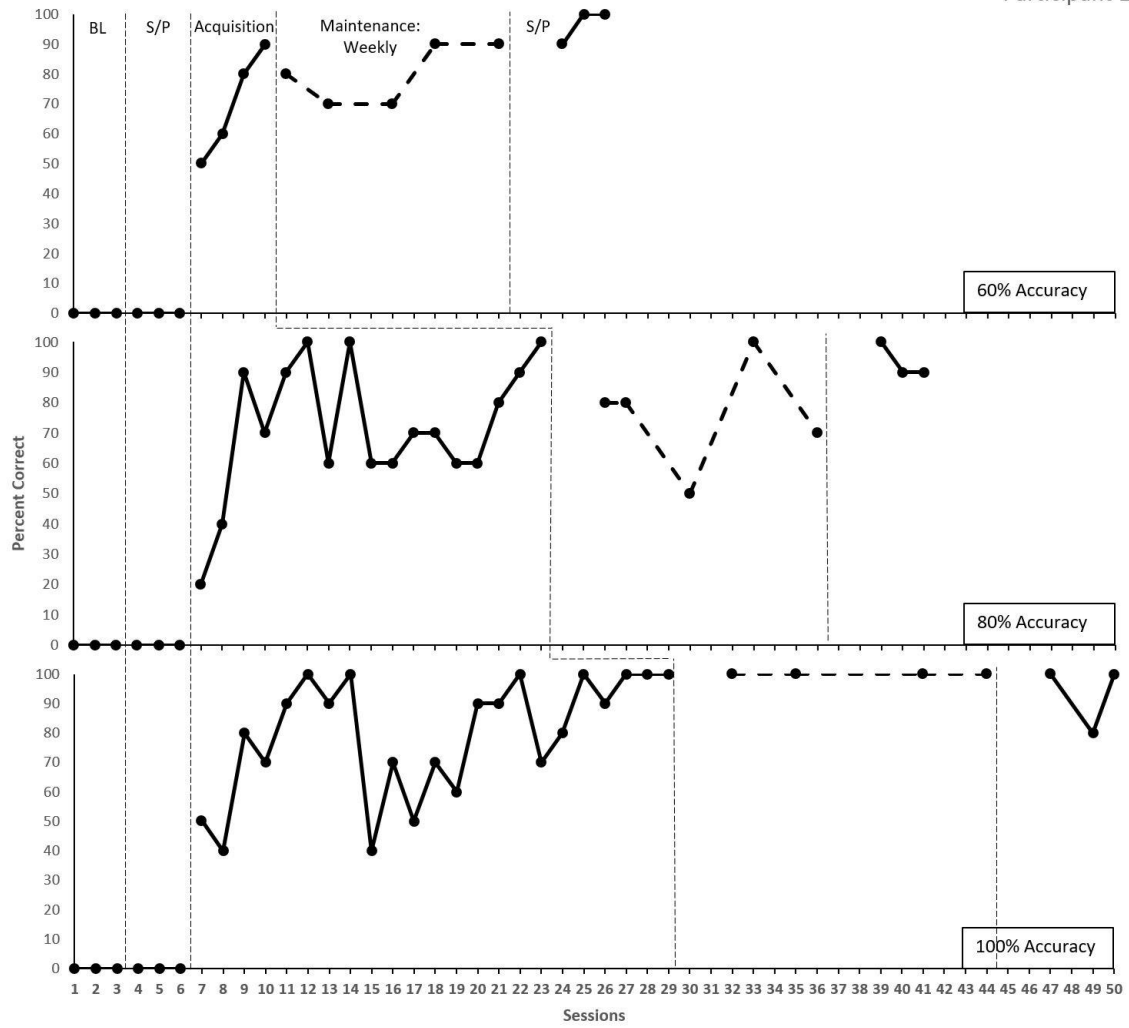


Figure 1. Percent correct data for 60, 80, and 100 percent accuracy sets across sessions for Participant One.

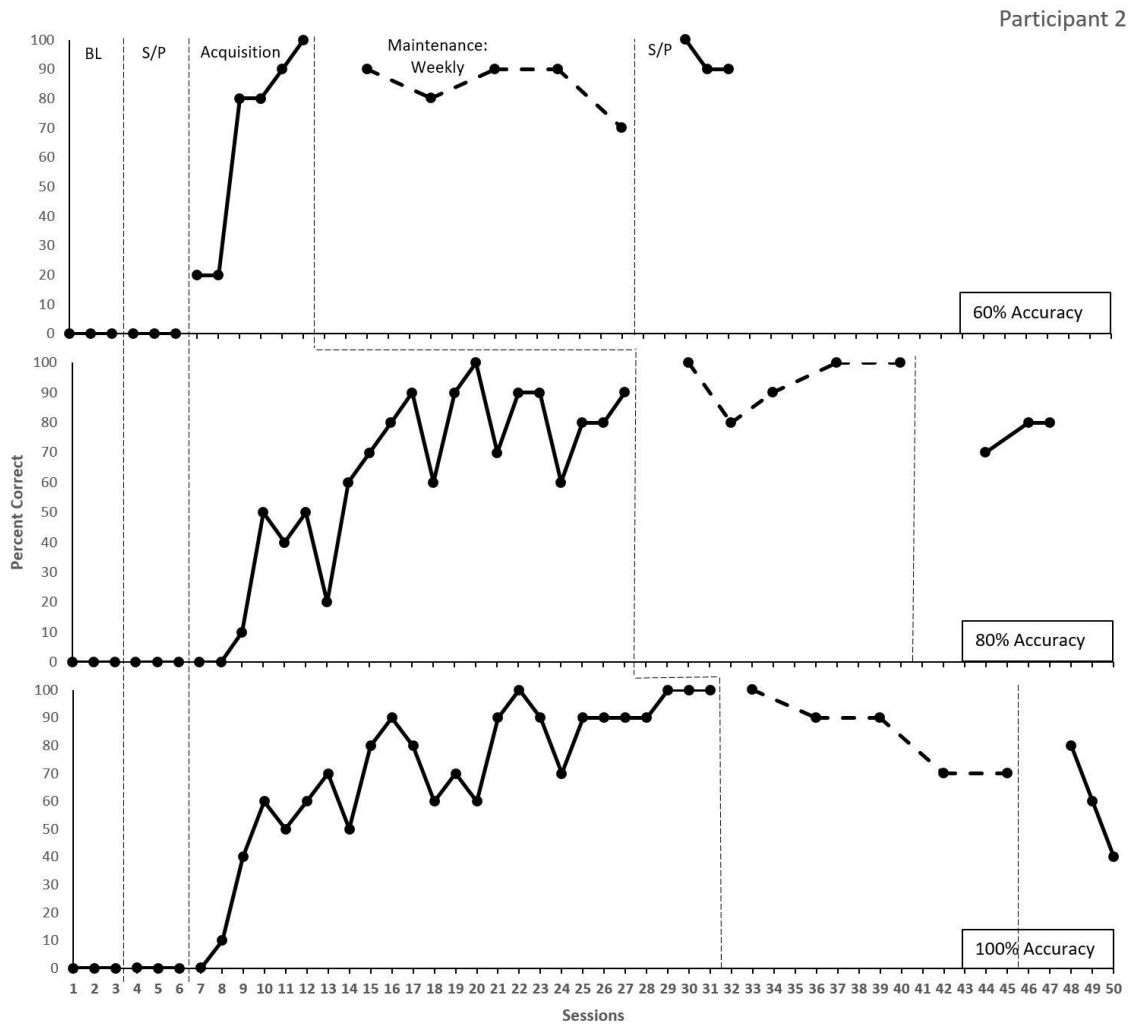


Figure 2. Percent correct data for 60, 80, and 100 percent accuracy sets across sessions for Participant Two.



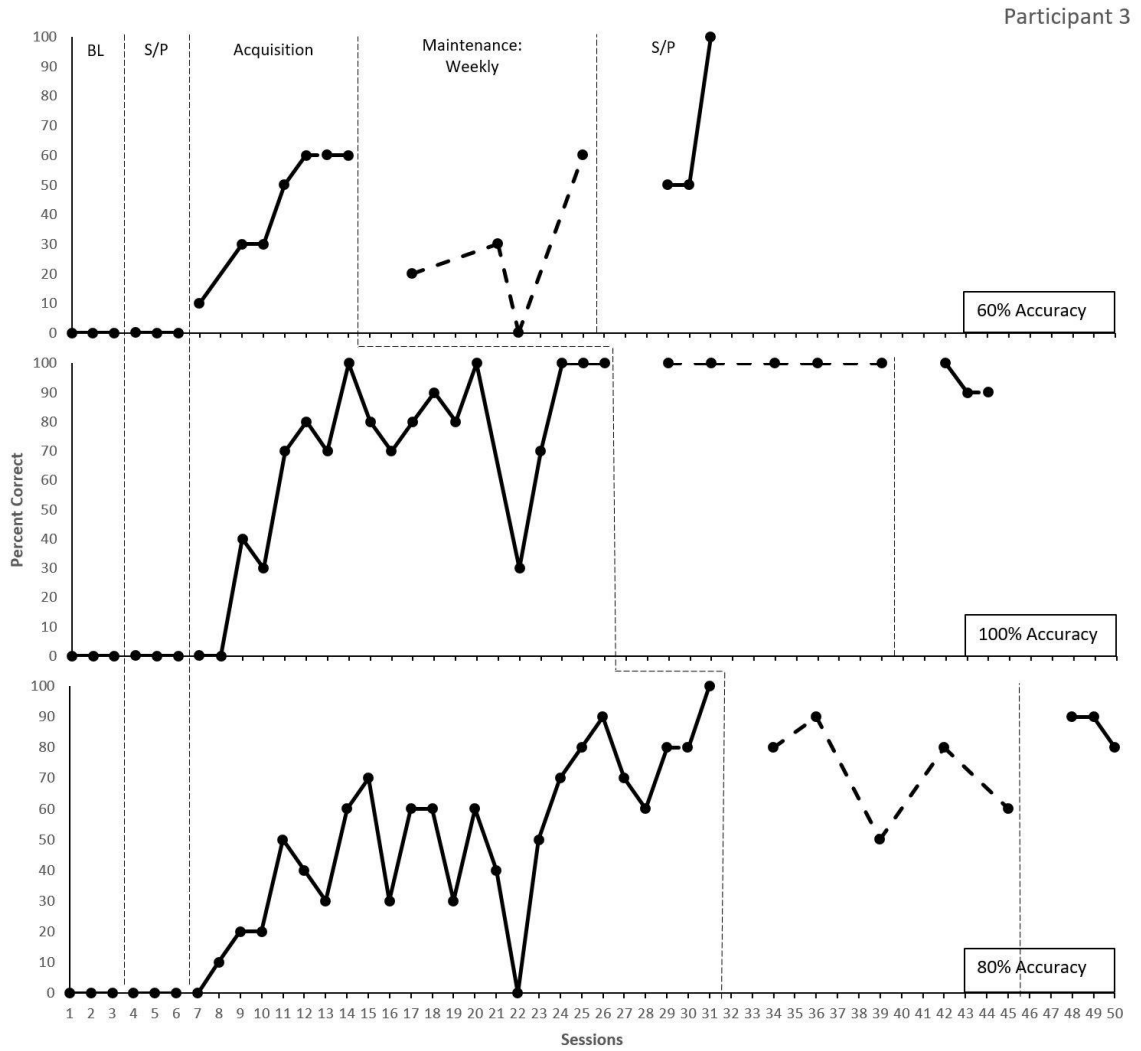


Figure 3. Percent correct data for 60, 80, and 100 percent accuracy sets across sessions for Participant Three.

## CHAPTER I

### INTRODUCTION

#### **Mastery Criteria**

There is currently limited research detailing the effects of varying mastery criteria on skill maintenance (McDougale et al., 2019). Mastery criteria are used to determine whether a skill has been acquired and is typically based on a criterion of accuracy observed over a given number of sessions (Fuller & Fienup, 2017). The significance of research examining mastery criteria is due to its vast use in clinical practice and educational settings. The use of mastery criteria is commonly used in education and with children diagnosed with a developmental disability to evaluate whether a skill has been acquired. The significance of setting an appropriate mastery criterion can be observed regarding the acquisition and maintenance of the skill. If a skill does not maintain over time, it will likely have a damaging effect on the acquisition of future skills thus making the study of mastery criteria vital for success in learning.

Applied Behavior Analysis (ABA) as a field overall works to develop skill acquisition and encourage the maintenance of these skills (Baer et al., 1968). Practitioners who utilize ABA frequently develop skill acquisition programs designed around achieving a preestablished mastery criteria to promote maintenance of the acquired skills (Luiselli, et al., 2008). The definition of skill acquisition used by behavioral practitioners and researchers includes meeting specific mastery criteria. The

typical criterion level set by educators and researchers is between 80 and 100 percent accuracy. Mastery criterion has also been evaluated across one session and three sessions (McDougale et al., 2019). However, a survey of Board Certified Behavior Analysts (BCBAs) reported that the mastery criteria of 80 percent accuracy across three sessions is the most commonly used mastery criterion (Richling et al., 2019), which infers that this criterion is considered by many to be a minimum standard for skill maintenance. Nevertheless, no research exists to support whether this is the most effective mastery criteria to use in this setting. Specifically, there is currently no research on the effects of different mastery criteria on the maintenance of functional skills for children with Developmental Delay or Autism Spectrum Disorder in a clinical setting.

### **Maintenance**

Once a skill is considered mastered, maintenance begins. Maintenance may entail no further instruction, less instruction, or probing the skill to determine whether additional teaching is necessary (McDougale et al., 2019). Maintenance is defined in applied terms as when a behavior continues to occur following the partial or full removal of the intervention (Pennington et al., 2019). Practitioners presume that once a skill is mastered, it will maintain in the context of instruction and generalized settings. Therefore, eluding that meeting a level of mastery predicts the future performance of the skill.

In a review on the literature of skill acquisition between 2015 and 2017, approximately half of the studies do not conduct maintenance sessions after the skill is mastered (McDougale et al., 2019). Consequently, the absence of the maintenance data may decrease the value of the intervention for clinicians (Stokes & Baer, 1977). Because

the overall goal of intervention implementation is typically maintained performance of that skill over time, reporting levels of skill maintenance could increase support for specific interventions associated with higher levels of skill maintenance. Maintenance is the overall goal of any intervention because without maintenance the intervention lacks purpose. Therefore, when maintenance is not reported, it becomes difficult to determine what mastery criterion is most effective in promoting maintenance.

Of the current literature, survey data reveals that practitioners frequently use lower criterion levels than have been found to reliably produce maintenance, such as requiring lower levels of accuracy across more observations (McDougale et al., 2019). Although mastery criteria can be found in both clinical settings and empirical skill-acquisition literature, there are only two studies (Fuller & Fienup, 2017; Richling et al., 2019) that have evaluated the relationship between different dimensions of mastery criteria and maintenance of the skill with individuals diagnosed with Autism Spectrum Disorder (ASD). At present, there is a lack of research that assesses maintenance following mastery of skills.

### **Use of Mastery Criteria**

There is a sizeable amount of research that both lack a technological description of utilized mastery criteria and is missing an assessment of maintenance after acquisition (McDougale et al., 2019). A descriptive analysis conducted by McDougale and colleagues provided a comparison of mastery criteria used by practitioners and in behavior-analytic research. The study analyzed skill-acquisition publications in multiple behavior-analytic journals from 2015 to 2017. The study compared this data to data gathered by Richling, Williams, and Carr (2019) through a survey of varying mastery criteria used by practitioners in applied settings.

The study conducted by Richling et al. (2019) was a survey of 199 Board Certified Behavior Analysts (BCBAs) designed to acquire information about specific mastery criteria utilized by practitioners. The BCBAs who participated lived in the United States and indicated an emphasis on work in areas of behavior analysis, behavior therapy, education, or positive behavior support. The survey was comprised of 23 multiple-choice and fill-in-the-blank questions with 16 of the questions covering clinical practices related to mastery criteria that the BCBA respondent used within their clinical practice. The results claimed that 80 percent accuracy across three consecutive sessions was the most often used mastery criterion. Specifically, 54 percent of participants reported using 80 percent across one or more sessions as mastery criterion, 28 percent of participants reported using a 90 percent criterion, and only seven percent reported using a 100 percent criterion. The results regarding the frequency of observation at mastery criteria level report that 50 percent of respondents apply mastery criteria across three days, 22 percent apply mastery criteria across two days, eight percent apply mastery criteria across four days, and 13 percent apply mastery criteria across more than four days.

Results from the descriptive comparison between Richling et al. (2019) and McDougale et al. (2019) displayed an overlap among the type of mastery criteria used by researchers and practitioners. Specifically, most researchers and clinicians use an accuracy percentage to decide mastery. However, differences found include, researchers require higher levels of accuracy, with 90 percent accuracy being most identified in research and 80 percent accuracy being most commonly used in clinical implementation. Another difference includes the number of sessions required for which the accuracy must be met. Clinicians commonly set criteria across three sessions, while researchers set criteria across two sessions.

Overall, the results from this study display that researchers use higher accuracy criteria and require fewer sessions to determine mastery than clinicians.

### **Mastery Criteria in Education**

Mastery criteria are not novel to educational settings although there is minimal research to support its efficacy (Fuller & Fienup, 2018). Educators similarly use mastery criteria to determine when a skill has been acquired. Once the responses of a participant meet a predetermined level of accuracy, the educator may move to a lesser prompt level, determine a new skill to teach, or assess generalization or maintenance. The limited research that does evaluate mastery criteria typically utilizes undergraduate students as participants (e.g., Johnston & O'Neill, 1973; Semb, 1974). Therefore, how these findings generalize to other populations is unknown.

One of the two studies that have evaluated the relationship between different dimensions of mastery criteria and maintenance of the skill with individuals diagnosed with ASD was conducted by Fuller and Fienup (2018). The study aimed to examine whether variations in the level of accuracy and the number of observations affect learning in children with disabilities through the use of discrete trial instruction. The study examined the effects of three mastery criterion levels (50, 80, and 90 percent accuracy) on response maintenance. Three elementary-aged male children with a diagnosis of ASD participated in the study at a private special education school. The school used ABA as its main form of instruction and used discrete trial training as their format for educational programming.

Response accuracy per trial and percentage of independent and accurate responding was recorded during the session with the accurate response having a latency within three seconds (Fuller & Fienup, 2018). Skills included physically spelling using an iPad and

vocally stating a word that corresponded to a presented discriminative stimulus. Procedures included the administration of 20 trials per session. Each condition was run once a day and for three to five days per week. However, during maintenance, each condition was only administered once a week for three to four weeks. Overall, the results suggested that the higher mastery criterion of 90 percent resulted in higher levels of maintenance responding when evaluated once a week for up to four weeks when compared to the 50 and 80 percent mastery criterion (Fuller & Fienup, 2018). This study was limited to using skills based on the participant's educational curricula which displays a need for research on the acquisition of functional skills often taught in a clinical setting. Additionally, this study did not control for the difficulty per item, did not use prompt fading procedures, and only met mastery for one session before moving to maintenance which is dissimilar from procedures used in a clinical setting.

The second study that evaluated the relationship between different dimensions of mastery criteria and maintenance was conducted by Richling and colleagues (2019). Richling and her colleagues conducted three comparison studies of mastery criterion with the same four participants. The participants were four children with a diagnosis of a developmental disability, health impairment, Williams Syndrome, and/or intellectual disability between the ages of six and nine. The participants were chosen from a classroom for students with mild to moderate needs within a public elementary school. The experimental setting was in a therapy room within the participant's school during school hours (Richling et al., 2019). Data was collected on the percentage of discrete trials in which the participants responded correctly during each 10-trial session. A correct response was an

independent response that occurred within three seconds of the presentation of the discriminative stimulus.

The first of the three experiments were designed to evaluate the effects of 60, 80, and 100 percent accuracy as mastery criteria across three sessions on the maintenance of skills. The measurement in the experiment was receptive identification where the participant would be presented a set of three stimulus cards and instructed to point at one of the items on the cards. The second experiment used the same mastery criteria of 60, 80, and 100 percent accuracy for three sessions but changed the skill to vocal tacting. The third experiment compared different mastery criteria of 80, 90, and 100 percent accuracy across three consecutive sessions on the same skill, vocal tacting, but with procedural variations.

Overall, the results from all three experiments suggest that the higher mastery criterion of 100 percent when compared to either 60 and 80 percent correct responding or 80 and 90 percent correct responding across three sessions resulted in greater maintenance over time. Furthermore, these findings do not support the use of the most often used 80 percent mastery criteria across three sessions because it produces lower maintenance than a mastery criterion of 100 percent. This study was also limited to an educational setting and it provided up to nine sessions of intervention a day across three to five days; however, in a clinical setting, sessions often occur once a day and not across consecutive days. Therefore, displaying a need to evaluate a comparison of mastery criteria in a clinical setting.

### **Mastery Criteria in Education Without Maintenance**

Research examining mastery criteria is critical due to its vast use in clinical practice and its use in educational settings; however, only research conducted in educational settings



currently exists. In typical educational settings, unit exams or single-use measures are often used to determine mastery of academic skills. Educators will examine how student responding relates to the pre-established accuracy level and decide to move to a different skill or decrease prompting levels. Once the results demonstrate mastery, the single skill is often not probed again through a measure such as an exam to evaluate the maintenance of the skill. The academic process is similar to that in a clinical setting and only a small number of studies have examined the effects of manipulating mastery criteria (Fienup & Brodsky, 2017). Furthermore, research on typically developing students is also limited and is only examined on college students.

One study by Semb (1974) examined both a 60 and 100 percent mastery criterion on academics through the utilization of quizzes in a college undergraduate class. Participants consisted of 89 students who were enrolled in an introductory child development class at the University of Kansas. Students were required to pass a series of quizzes to meet a predetermined mastery criterion. The conditions included a high criterion-short assignment (HC-SA) which required mastery criteria of 100 percent, a low criterion-short assignment (LC-SA) which required mastery criteria of 60 percent or higher, and a high criterion-long assignment (HC-LA) which required mastery of 100 percent. The results from the study demonstrated that the 100 percent mastery criterion with the short assignments resulted in overall higher test scores.

A study by Carter, Telaak-Carter, Couture, and Wright (1976) compared the effects of mastery criteria on unit exams between three groups, and results also support the use of higher mastery criteria. Participants included 102 students who were enrolled in one of three sections of educational psychology at the State University of New York at Geneseo. The

course consisted of reading material divided into ten weekly units and unit exams.

Participants met once a week for three hours. To receive a grade of an A in the course, group one was required to score at or above 90 percent on all unit exams, group two had to score at or above 100 percent on all unit exams, and group three was required to accumulate at least 90 percent of total points across all unit exams. The results from this study concluded that group two who were assigned the highest mastery criteria of 100 percent had overall higher unit exam grades, final exam scores, and course grades when compared to groups one and three.

Although most studies have produced results that suggest a higher mastery criterion is more effective, one study by Carlson and Mink (1975) displayed dissimilar results. The study evaluated the effects of 60 to 90, 80, and 90 percent mastery criteria on academic unit quizzes among three sections in a college undergraduate class. Participants consisted of 147 students enrolled in the course Psychology 100, Survey of Psychology, at the University of Hawaii.

Each of the three sections had unique mastery criteria for unit quizzes. For one section, the mastery criteria were successively increased and were to equal an overall average of 80 percent. The second section had a mastery criterion of 80 percent accuracy on all units and the third section had a mastery criterion of 90 percent accuracy on all units. The results for course grades concluded that students in the 90 percent mastery criterion section earned the lowest course grades compared to the 60-90 percent section and the 80 percent section (Carlson & Minke, 1975). Furthermore, the results from this study demonstrated that the 80 percent mastery criterion resulted in participants passing more quizzes.

There is limited research on the effects of mastery criteria on further skills, settings, length of maintenance probing, participants of different ages and developmental levels, frequency of observations, number of trials, and the time between sessions. Although it has been determined by Richling et al. (2019) that 80 percent accuracy across three sessions is the most frequently used mastery criterion in clinical settings, research demonstrates that mastery criterion higher than 80 percent produces better skill maintenance over time (Carter et al., 1976; Fuller & Fineup, 2018; Richling et al., 2019; Semb, 1974). Furthermore, there is currently no research on the effects of different mastery criteria on the maintenance of functional skills for children with Autism Spectrum Disorder in a clinical setting. Previous research also focused on conducting multiple sessions per day or sessions across consecutive days; however, clinical practice often consists of one session per day or sessions over discontinuous days (Carter et al., 1976; Fuller & Fineup, 2018; Richling et al., 2019; Semb, 1974). Overall, there is a void in the literature concerning the effects of varying mastery criteria on skill maintenance and there is no research conducted in a clinical setting.

### **Current Study**

The goal of this study is to determine whether the often-used mastery criteria of 80 percent accuracy across three consecutive sessions is the mastery criteria that should be used in clinical practice compared to other similar criteria by examining the maintenance of skills over time, across participants, skills, and mastery criteria. Specifically, this study will examine whether the mastery criteria of 60, 80, or 100 percent accuracy across three consecutive sessions is efficient for maintaining a set of varying acquisitional skills for five weeks across participants in a clinical setting by evaluating the number of sessions to obtain the mastery criterion and the percentage of loss of maintenance.

## CHAPTER II

### REVIEW OF LITERATURE

#### **Mastery Criteria**

There is currently limited research detailing the effects of varying mastery criteria on skill maintenance (McDougale et al., 2019). Mastery criteria are used to determine whether a skill has been acquired and is typically based on a criterion of accuracy observed over a given number of sessions (Fuller & Fienup, 2017). The significance of research examining mastery criteria is due to its vast use in clinical practice and educational settings. The use of mastery criteria is commonly used in education and with children diagnosed with a developmental disability to evaluate whether a skill has been acquired. The importance of setting an appropriate mastery criterion can be observed regarding the acquisition and maintenance of the skill. If a skill does not maintain over time, it will likely have a damaging effect on the acquisition of future skills thus making the study of mastery criteria vital for success in learning.

Applied Behavior Analysis (ABA) as a field overall works to develop skill acquisition and encourage the maintenance of skills (Baer et al., 1968). Practitioners who utilize ABA frequently develop skill acquisition programs designed around achieving a

pre-established mastery criteria to promote maintenance of the acquired skills (Luiselli, et al., 2008). The definition of skill acquisition used by behavioral practitioners and researchers includes meeting specific mastery criteria. Fuller and Fienup (2018) state, “Accuracy-based mastery criteria can be conceptualized as containing at least two dimensions: level of performance and frequency of observations at that level”. The level of performance, known as accuracy, is the number of correct responses in comparison to the number of total responses observed in the session. The frequency of observations is the number of consecutive sessions that are observed. Specifically, Mastery criteria are typically based on a criterion of accuracy observed over a given number of consecutive sessions.

The typical criterion level set by educators and researchers is between 80 and 100 percent accuracy. However, a survey of Board Certified Behavior Analysts (BCBAs) reported that the mastery criteria of 80 percent accuracy across three sessions is the most commonly used mastery criterion (Richling et al., 2019), which infers that this criterion is considered by many to be a minimum standard for skill maintenance. Nevertheless, no research exists to support whether this is the most effective mastery criteria to use in this setting. Specifically, there is currently no research on the effects of different mastery criteria on the maintenance of functional skills for children with Autism Spectrum Disorder (ASD) in a clinical setting.

### **Maintenance**

Once a skill is considered mastered, maintenance begins. Maintenance may entail no further instruction, less instruction, or probing the skill to determine whether

additional teaching is necessary (McDougale et al., 2019). Maintenance is defined in applied terms as when a behavior continues to occur following the partial or full removal of the intervention (Pennington et al., 2019). Practitioners presume that once a skill is mastered, it will maintain in the context of instruction and generalized settings. Therefore, eluding that meeting a level of mastery predicts the future performance of the skill.

In a review of the literature on skill acquisition between 2015 and 2017, approximately half of the studies do not conduct maintenance sessions after the skill is mastered (McDougale et al., 2019). Consequently, the absence of the maintenance data may decrease the value of the intervention for clinicians (Stokes & Baer, 1977). Because the overall goal of intervention implementation is typically maintained performance of that skill over time, reporting levels of skill maintenance could increase support for specific interventions associated with higher levels of skill maintenance. Maintenance is the overall goal of any intervention because without maintenance the intervention lacks purpose. Therefore, when maintenance is not reported, it becomes difficult to determine what mastery criterion is most effective in promoting maintenance.

Of the current literature, survey data reveals that practitioners frequently use lower criterion levels than have been found to reliably produce maintenance, such as requiring lower levels of accuracy across more observations (McDougale et al., 2019). Although mastery criteria can be found in both clinical settings and empirical skill-acquisition literature, there are only two studies (Fuller & Fienup, 2017; Richling et al., 2019) that have evaluated the relationship between different dimensions of mastery

criteria and maintenance of the skill with individuals diagnosed with ASD. At present, there is a lack of research that assesses maintenance following mastery of skills.

### **Use of Mastery Criteria**

There are limited studies that have investigated the effects of varying dimensions of mastery criteria on the maintenance of skills (McDougale et al., 2019). There is a sizeable amount of research that both lack a technological description of utilized mastery criteria and is missing assessment of maintenance after acquisition. A descriptive analysis conducted by McDougale and colleagues provided a comparison of mastery criteria used by practitioners and in behavior-analytic research. The study analyzed skill-acquisition publications in multiple behavior-analytic journals from 2015 to 2017. The study compared this data to data gathered by Richling, Williams, and Carr (2019) through a survey of varying mastery criteria used by practitioners in applied settings.

The study conducted by Richling et al. (2019) was a survey of 199 Board Certified Behavior Analysts (BCBAs) utilized to acquire information about specific mastery criteria utilized by practitioners. The BCBAs who participated lived in the United States, indicated an emphasis of work in areas of behavior analysis, behavior therapy, education, or positive behavior support, indicated intellectual disability, autism, special education, or college education as a primary area of work, and indicated that they primarily worked with children or adolescents. The survey was comprised of 23 multiple-choice and fill-in-the-blank questions covering the BCBAs certification status, practice area, and their clinical practices concerning mastery criteria. Of the 23 questions, 16 questions covered clinical practices related to mastery criteria that the BCBA respondent used within their clinical practice. The results claimed that 80 percent

accuracy across three consecutive sessions was the most often used mastery criterion. Specifically, 54 percent of participants reported using 80 percent across one or more sessions as mastery criterion, 28 percent of participants reported using a 90 percent criterion, and only seven percent reported using a 100 percent criterion. The results regarding the frequency of observation at mastery criteria level report that 50 percent of respondents apply mastery criteria across three days, 22 percent apply mastery criteria across two days, eight percent apply mastery criteria across four days, and 13 percent apply mastery criteria across more than four days.

Results from the descriptive comparison between Richling et al. (2019) and McDougale et al. (2019) displayed an overlap among the type of mastery criteria used by researchers and practitioners. Specifically, most researchers and clinicians use an accuracy percentage to decide mastery. However, differences found include, researchers require higher levels of accuracy, with 90 percent accuracy being most identified in research and 80 percent accuracy being most commonly used in clinical implementation. Another difference includes the number of sessions required for which the accuracy must be met. Clinicians commonly set criteria across three sessions where the client must meet a percentage for three sessions. While, data regarding the number of sessions required by researchers include fewer sessions, with two sessions being most used. Overall, the results from this study display that researchers use higher accuracy criteria and require fewer sessions to determine mastery than clinicians. The current literature has only examined these criteria across three sessions (Richling et al., 2019) and one session (Fuller and Fineup, 2018), with both using a variety of mastery criteria and number of trials per session displaying a need for further research.



## **Mastery Criteria in Education**

Mastery criteria are not novel to educational settings although there is minimal research to support its efficacy (Fuller & Fienup, 2018). Educators similarly use mastery criteria to determine when a skill has been acquired. Once the responses of a participant meet a predetermined level of accuracy, the educator may move to a lesser prompt level, determine a new skill to teach, or assess generalization or maintenance. The limited research that does evaluate mastery criteria typically utilizes undergraduate students as participants (e.g., Johnston & O'Neill, 1973; Semb, 1974). Therefore, how these findings generalize to other populations is unknown.

One of the two studies that have evaluated the relationship between different dimensions of mastery criteria and maintenance of the skill with individuals diagnosed with ASD was conducted by Fuller and Fienup (2018). The study aimed to examine whether variations in the level of accuracy and the number of observations affect learning in children with disabilities through the use of discrete trial instruction. The study examined the effects of three mastery criterion levels (50, 80, and 90 percent accuracy) on response maintenance. Three elementary-aged male children with a diagnosis of ASD participated in the study at a private special education school that they each attended. The private special education school used ABA as its main form of instruction and used discrete trial training as their format for educational programming. Overall, the typical mastery criterion set by the school for skill acquisition was set at 90 percent accuracy across two consecutive sessions.

Participant one was a five-year-old male who attended the school for two years (Fuller & Fienup, 2018). Participant one communicated through an iPad, could independently mand and tact various items through the use of an iPad, and his academics included sight word identification and number identification. Participants two and three were six and seven-year-old males who had approximately attended the school for one to two years. Both participants two and three had vast verbal repertoires, could mand and tact various items, and completed academics included sight words, beginner level addition, and spelling. Each of the participants received one-on-one instruction and received instruction at their desks in their designated classrooms. Skills tracked for maintenance included either spelling or sight words.

Response accuracy per trial and percentage of independent and accurate responding was recorded during the session with the accurate response having a latency within three seconds (Fuller & Fienup, 2018). An accurate response for participant one included physically spelling using the iPad and for participants two and three it included vocally stating the word that corresponded to the presented discriminative stimulus. An alternating treatment design was used to examine the effects of the parametric manipulation on response maintenance. The order of criterion-level (50, 80, and 90 percent) conditions were put in order so that the beginning condition was not conducted first on the previous day and the conditions that were left were run in a contrasting order than the prior day.

Procedures included the administration of 20 trials per session and included four trials per five target responses presented in a randomized order (Fuller & Fienup, 2018). Each condition was run once a day and for three to five days per week. However, during

maintenance, each condition was only administered once a week. Reinforcement was incorporated through a token exchange system where the participant received tokens for accurate responses and could exchange them for preferred items. During baseline, the instruction was provided but no assistance or prompts were given. However, praise and tokens contingent on correct responses were given during baseline. An error correction procedure was included during the skill acquisition phase. Error correction included the researcher repeating the discriminative stimulus, providing a textual model for participant one and a verbal model for participant two and three, repeating the discriminative stimulus, and allowing three seconds for the participant to respond. The final phase, maintenance, began one week after mastery criteria were met for respective skills. Maintenance sessions included identical procedures to the baseline phase and were conducted once per week for three to four weeks.

During the baseline phase, the participants all produced consistent low accuracy in responding (Fuller & Fienup, 2018). Once error correction was added, all participant's displayed steady growth in accuracy. Once the mastery criterion was met during the acquisition phase, maintenance was probed once a week. Overall, the results suggested that the higher mastery criterion of 90 percent resulted in higher levels of maintenance responding when evaluated once a week for up to four weeks when compared to the 50 and 80 percent mastery criterion (Fuller & Fienup, 2018). This study was limited to using skills based on the participant's educational curricula which displays a need for research on the acquisition of functional skills often taught in a clinical setting. Additionally, this study did not control for the difficulty per item, did not use prompt

fading procedures, and only met mastery for one session before moving to maintenance which is dissimilar from procedures used in a clinical setting.

The second study that evaluated the relationship between different dimensions of mastery criteria and maintenance was conducted by Richling and colleagues (2019). In relation to the survey conducted on BCBA's regarding mastery criteria reported as most utilized, three comparison studies of mastery criterion were conducted. The first of the three experiments were designed to evaluate the effects of 60, 80, and 100 percent accuracy as mastery criteria across three sessions on the maintenance of skills. The 80 percent criterion was chosen to be evaluated due to the results of the prior survey stating it was the most reported mastery criterion used by BCBA's.

Four children with a diagnosis of a developmental disability, health impairment, Williams Syndrome, and/or intellectual disability between the ages of six and nine participated in the study (Richling et al., 2019). The participants were chosen from a comprehensive life-skills classroom that was used for students with mild to moderate needs for support within a public elementary school. Each of the participants demonstrated discriminated responding toward a blend of auditory and visual stimuli based on the Assessment of Basic Learning Abilities-Revised (DeWiele, Martin, Martin, Yu, & Thomson, 2011). Participant one, Evan, was a six-year-old male diagnosed with ASD (Richling et al., 2019). Participant two, Sandy, was a seven-year-old female diagnosed with health impairment and intellectual disability. Participant three, Cyril was a nine-year-old male diagnosed with health impairment and intellectual disability. Participant four, Adam, was a six-year-old male diagnosed with health impairment, Williams Syndrome, and intellectual disability. Participant one, two, and three were able

to respond to multi-step instructions, speak in short sentences, display all verbal operants, and participate in basic conversation exchange. Participant four was able to respond to multi-step instructions, speak in complex sentences, display all verbal operants, and participate in a conversational exchange.

The experiment setting was in a therapy room within the participant's school during school hours (Richling et al., 2019). Data were collected during each 10-trial session on the percentage of discrete trials where the participants responded correctly. A correct response was an independent response that occurred within three seconds of the presentation of the discriminative stimulus. However, only responses for trials where the participant made a response to the instruction within the three seconds was recorded. Specifically, a response was only recorded as correct or incorrect if the participant pointed to an option in the receptive identification program without prompting. Furthermore, when a response was not generated within three seconds, the trial was repeated until a response was made. The procedure was designed in this way to ensure nonresponses caused by noncompliance were not included in the dependent measure.

The measurement in the experiment was receptive identification, an auditory-visual conditional discrimination (Richling et al., 2019). Receptive identification included teaching the participants three sets of three target stimuli that were color-printed pictures of animals, plants, and food items on cards. The participant would be presented with a set of three stimulus cards and instructed to point at one of the items on the cards. The items chosen were those that the participant's classroom teacher indicated she would not likely teach outside of the experimental sessions. Each participant participated in three to five training sessions each day for three to five days per week until

predetermined mastery criteria were met then maintenance probing began. The experiment used a nonconcurrent multiple-baseline design across participants which included an embedded modified alternating treatment design that allowed within-subject treatment comparisons and between-subject replications.

During baseline, reinforcement was not provided for correct responses, and prompting was not used for incorrect responses (Richling et al., 2019). However, access to preferred stimuli was given noncontingently on a one-minute schedule to decrease the probability of noncompliant behavior. During the teaching of the skills, sessions were identical to baseline, but praise was delivered on a continuous schedule for correct responses, and preferred tangible items were delivered on a variable ratio 3 schedule. When the participant gave an incorrect response, least-to-most prompting was used. Training sessions ran until participant responses met a designated mastery criterion (60, 80, or 100% accuracy across three consecutive sessions). Once a participant met the predetermined mastery criteria for each of the sets, probing for maintenance began as a follow-up phase. The follow-up phase was identical to the baseline phase and occurred approximately once a week for four weeks after the mastery of each stimulus set. A maintenance probe contained a single 10-trial session.

Results report that the 100 percent criterion response accuracy was either at or above 80 percent correct for each of the four participants across all four follow-up sessions (Richling et al., 2019). For the 80 percent criterion, two of the four participant's accuracy of responding maintained close to or barely below the mastery performance. For participant three, the 80 percent criteria developed an instant decrease in accuracy to 47.5 percent on average across all follow-up sessions. For participant one, the 80 percent

criteria developed an instant drop to baseline during weekly follow-up sessions. For the 60 percent criterion, performance similarly decreased. However, for participant four, the 60 percent criterion resulted in higher accuracy in the follow-up than the 80 percent criteria. Overall, the results suggest that the higher mastery criterion of 100 percent when compared to 60 and 80 percent correct responding across three consecutive sessions resulted in overall higher levels when maintenance was evaluated once a week for four weeks. Furthermore, the findings do not support the use of the most commonly reported 80 percent mastery criteria across all individuals in relation to teaching receptive identification tasks to manufacture maintained responding.

Richling et al. (2019) conducted two more systematic replication of this experiment with the same participants but with different acquisition tasks. For the first replication, the dependent variable was now vocal tacting but all procedures were identical to the first experiment. For the acquisition task vocal tacting, three sets of three pictures were used where each set was randomly assigned to one of three mastery criteria including 60, 80, and 100 percent accuracy for three consecutive sessions. The assignments of mastery criteria and sets of pictures were counterbalanced across participants. The stimulus cards included different pictures from the first experiments such as pictures of animals, plants, food items, and geometric or abstract shapes. Sessions were compromised of the participants being presented with one of the three cards and asked, "What is this?". An item was recorded as correct if the appropriate vocal response was given for the designated picture. If the participant responded incorrectly, least-to-most prompting was used.

Results from the first replication, the second experiment, report that the response accuracy for the 100 percent mastery criteria was at or above 70 percent accuracy for each of the four participants across all four weeks of follow-up sessions (Richling et al., 2019). However, the response accuracy for the 60 and 80 percent mastery criteria was variable for each participant during follow up sessions. For participant one, the 80 percent mastery criteria resulted in an instant decrease to 30 percent during weekly follow-up sessions then continued to decrease to zero percent which fell below the results for the 60 percent criteria. For participant two, the 80 percent mastery criteria produced an immediate decrease to zero percent across all four follow-up session and the 60 percent mastery criteria resulted in a decrease to zero percent across three of the four follow up sessions. For participant three, the 80 percent mastery criteria resulted in an immediate decrease for the first follow-up session then maintained above the mastery criteria for the following three sessions which appeared similar to the 100 percent criteria. The 60 percent criteria also resulted in an immediate decrease then maintained around 60 percent mastery. For the fourth participant, the 80 percent criteria resulted in maintained mastery at the one-week follow-up then response accuracy decreased to 60 percent across the following three weeks which was only slightly better than the 60 percent mastery criteria. Overall, the results from this experiment also suggest that the higher mastery criterion of 100 percent across three consecutive sessions resulted in greater maintenance over time when compared to an 80 and 60 percent mastery criteria across three consecutive sessions.

For the second replication by Richling et al. (2019), the measurement was also vocal tacting, but novel stimuli and target responses were now used. The mastery criteria



now being compared were 80, 90, and 100 percent accuracy across three consecutive sessions. There were also four new procedural variations. The first variation was the incorporation of stimulus targets that the participant's classroom teacher identified as likely being taught to the participants in the future. The second variation was the incorporation of nonexperimentally targeted stimulus sets so that the same number of target stimuli were being taught at the same time to control for effects of teaching less stimuli as each participant mastered other sets. The third and fourth variations included an increase in the sessions that were conducted each day and only a single maintenance probe was given as a follow-up session. The reason that this experiment included more training sessions per day and only a one-week follow up to assess maintenance was due to an extended academic break. However, a one-week follow up was still viewed as powerful by the experimenters because they reported that after instruction it is the purest representation of maintenance before effects of extinction can influence responding.

Procedures similarly included three target sets of three pictures where each set was randomly assigned to one of the three mastery criteria (Richling et al., 2019). The stimuli were again different from experiments one and two in that they contained pictures of states and natural land formations and black and white symbols. Participants concluded six to nine training sessions each day for five days per week.

The results for the second replication demonstrated that the 100 percent mastery criteria resulted in approximately 70 to 100 percent accuracy of responding after one week for all four students (Richling et al., 2019). However, for the 90 percent mastery criterion trial, three students were at zero percent accuracy at the one-week maintenance measure and participant one decreased to 40 percent accuracy. For the 80 percent

mastery criteria, two students were at zero percent accuracy at the one-week maintenance measure, responding for participant three decreased to 20 percent accuracy, and responding for participant four decreased to 60 percent accuracy. Overall, this experiment further suggests that the higher mastery criterion of 100 percent across three consecutive sessions resulted in higher maintenance when compared to a mastery criterion of 80 or 90 percent. These results add to the results found in the first and second experiments and supply increasing evidence in opposition of using 80 percent as a mastery criterion.

Overall, the results from all three experiments suggest that the higher mastery criterion of 100 percent when compared to either 60 and 80 percent correct responding or 80 and 90 percent correct responding across three sessions resulted in greater maintenance over time. Furthermore, these findings do not support the use of the most often used 80 percent mastery criteria across three sessions because it produces lower maintenance than a mastery criterion of 100 percent. This study was also limited to an educational setting and it provided up to nine sessions of intervention a day across three to five days; however, in a clinical setting, sessions often occur once a day and not across consecutive days. Therefore, displaying a need to evaluate a comparison of mastery criteria in a clinical setting.

### **Mastery Criteria in Education Without Maintenance**

Research examining mastery criteria is critical due to its vast use in clinical practice and its use in educational settings; however, only research conducted in educational settings currently exists. In typical educational settings, unit exams or single-

use measures are often used to determine mastery of academic skills. Educators will examine how student responding relates to the pre-established accuracy level and decide to move to a different skill or decrease prompting levels. Once the results demonstrate mastery, the single skill is often not probed again through a measure such as an exam to evaluate the maintenance of the skill. The academic process is similar to that in a clinical setting and only a small number of studies have examined the effects of manipulating mastery criteria (Fienup & Brodsky, 2017). Furthermore, research on typically developing students is also limited and is only examined on college students.

One study by Semb (1974) examined both a 60 and 100 percent mastery criterion on academics through the utilization of quizzes in a college undergraduate class. Participants consisted of students who were enrolled in an introductory child development class at the University of Kansas. There were 46 participants in group one and 43 in group two. The course was instructor-paced and student-paced and consisted of 30 class days over six weeks. Students were required to pass a series of quizzes that could be taken as many times as needed but in a different form to meet the predetermined mastery criterion. The study used a within-group reversal design that included three experimental conditions in which each group went through at a different sequence.

The conditions included a high criterion-short assignment (HC-SA) in which all content and review quizzes had a mastery criterion of 100 percent, a low criterion-short assignment (LC-SA) in which all content and review quizzes had a mastery criterion of 60 percent or higher, and a high criterion-long assignment (HC-LA) in which students only took review quizzes until mastery of 100 percent was met (Semb, 1974). The results from the study demonstrated that the 100 percent mastery criterion that was matched with

the short assignments resulted in overall higher test scores. Furthermore, it was clearly demonstrated through the data that the higher mastery criterion created superior results than the low mastery criterion. The results of the low mastery criterion displayed a considerable and consistent decrease in quiz grades when compared to the high, 100 percent, mastery criterion.

A study by Carter, Telaak-Carter, Couture, and Wright (1976) compared the effects of mastery criteria on unit exams between three groups, and the results also support the use of higher mastery criteria. Participants included 102 students who were enrolled in one of three sections of educational psychology at the State University of New York at Geneseo. The course consisted of reading material divided into 10 weekly units and unit exams that consisted of five multiple-choice items and five short-answer items. Participants met once a week for three hours where the initial 45 minutes was used to take a written exam on weekly readings and the remaining time was used for general discussion. One unit was covered per week and the unit exam could not be taken before its scheduled day. The unit exams could not be retaken after the next exam date and the exam could only be retaken once per day. The items on the unit exams and unit exams that were retaken were randomly selected from a pool of test items where no item appeared on the original test and on a retake. To receive a grade of an A in the course, group one was required to score at or above 90 percent on all 10 unit exams, group two had to score at or above 100 percent on all 10 unit exams, and group three was required to accumulate at least 90 percent of total points across all 10 unit exams. The results from this study concluded that group two who were assigned the highest mastery criteria

of 100 percent had overall higher unit exam grades, final exam scores, and course grades when compared to groups one and three.

Although most studies have produced results that suggest a higher mastery criterion is more effective, one study by Carlson and Mink (1975) displayed dissimilar results. The study evaluated the effects of 60 to 90, 80, and 90 percent mastery criteria on academic unit quizzes among three sections in a college undergraduate class. Participants consisted of 147 students enrolled in the course Psychology 100, Survey of Psychology, at the University of Hawaii. The participants were enrolled in three consecutive 10-week night classes of Psychology 100. Excluding the first class period, two class periods per week consisted of two 30-40 minute testing periods. The lectures for the class overlapped material in the textbook but purposefully did not consist of material used on the quizzes. Students were told that they were to meet a certain mastery criterion on the current 10-item multiple-choice quiz before the following quiz could be attempted. A bonus point was accessible if the student missed the designated mastery criteria by one item, in all three classes. A bonus point entailed a small card rewarded for a score of 10 within the first four attempts of any unit quiz. The study had four separate forms for each unit quiz for when students needed to retake the quiz; however, punishment was not administered for failure to meet the given mastery criterion. Between each quiz there was a 30-minute wait period to encourage additional studying for the next attempt and instructor permission was required to take the quiz a fifth time.

Each of the three sections had unique mastery criteria for unit quizzes and the conditions were randomly assigned to the three sections (Carlson & Mink, 1975). For one section of 52 students, the mastery criteria were successively increased such as unit

one requiring 60 percent correct, units two, eight, and nine requiring 70 percent correct, units 14, 19, and 23 requiring 80 percent correct, and units 24-28 requiring 90 percent correct. The criterion for this section was chosen to equal an overall average of 80 percent. The second section had a mastery criterion of 80 percent accuracy on all units and the third section had a mastery criterion of 90 percent accuracy on all units.

The results for course grades concluded that students in the 90 percent mastery criterion section earned the lowest course grades compared to the 60-90 percent section and the 80 percent section (Carlson & Minke, 1975). For the rate of progress, by week six the 80 percent section began to pass unit quizzes at a higher rate than the other two sections with the 90 percent section having the lowest rate of progress. The results from this study demonstrated that the 80 percent mastery criterion resulted in participants passing more quizzes when compared to participants who met the 60 to 90 and the 90 percent mastery criterion. This study is unique in its findings that the highest mastery criteria did not result in a higher level of performance.

There is limited research on the effects of mastery criteria on further skills, settings, length of maintenance probing, participants of different ages and developmental levels, frequency of observations, number of trials, and the time between sessions. Although it has been determined by Richling et al. (2019) that 80 percent accuracy across three sessions is the most frequently used mastery criterion in clinical settings, research demonstrates that mastery criterion higher than 80 percent produces better skill maintenance over time (Carter et al., 1976; Fuller & Fineup, 2018; Richling et al., 2019; Semb, 1974). Furthermore, there is currently no research on the effects of different mastery criteria on the maintenance of functional skills for children with Autism

Spectrum Disorder in a clinical setting. Previous research also focused on conducting multiple sessions per day or sessions across consecutive days; however, clinical practice often consists of one session per day or sessions over discontinuous days (Carter et al., 1976; Fuller & Fineup, 2018; Richling et al., 2019; Semb, 1974). Overall, there is a void in the literature concerning the effects of varying mastery criteria on skill maintenance and there is no research conducted in a clinical setting.

### **Current Study**

The goal of this study was to determine whether the often-used mastery criteria of 80 percent accuracy across three consecutive sessions is the mastery criteria that should be used in clinical practice compared to other similar criteria by examining the maintenance of skills over time, across participants, skills, and mastery criteria. Specifically, this study examined whether the mastery criteria of 60, 80, or 100 percent accuracy across three consecutive sessions is efficient for maintaining a set of varying acquisitional skills for five weeks across participants in a clinical setting by evaluating the number of sessions to obtain the mastery criterion and the percentage of loss of maintenance.

## CHAPTER III

### METHODOLOGY

#### **Participants and Setting**

Three children diagnosed with Autism Spectrum Disorder (ASD) participated in this study. Participant One was a five year old male, Participant Two was a five year old male, and Participant Three was a four year old male. The study was conducted in the behavior department at a pediatric therapy center. All three participants were clients receiving ABA therapy at the pediatric center. The participants met the criteria of not having received treatment for the measured skills at the pediatric center. The measured skills were in the participant's treatment plan as not previously mastered and required intervention based on prior assessment. Prior assessment and skill identification occurred for each participant by the BCBA at the center. The assessment used to identify skills based on the participant's presenting needs was conducted through the administration of one or more of the following, the Vineland Adaptive Behavior Scale Third Edition, the Verbal Behavior Milestones Assessment and Placement Program (VB MAPP), and the Assessment of Basic Language and Learning Skills – Revised (ABLBS-R). Parent consent was obtained prior to gathering data (see Appendix C).



## **Materials**

Materials for this study consisted of an outline of procedures and discrete trial training daily data recording sheets. Procedures were outlined for interventionists to refer to and were readily available to them on their clipboard during each session. Procedures included the explicit direction that was delivered to the participant during every trial, the client's goal, and how to respond to incorrect responses. The recording sheets documented the participant's name, the date, the skill, the number of trials, the participant's response, and the percentage of trials answered accurately (see Appendix A). The number of trials on the recording sheets consisted of 10 single trials for each set of the skill. The participant's response on the recording sheet was recorded as answered accurately and independently (+), answered inaccurately (-), no response (NR), or as a prompt (P) if any form of prompting was delivered. For a response to be scored as accurate, the response had to be accurately and independently produced within three seconds of the presentation of the discriminative stimulus. One recording sheet was used per day where 10 single trials of each set of the skill were administered. Each participant had a daily intervention folder that contained recording sheets and procedures.

## **Dependent Variable**

The first dependent variable consisted of measuring participant accuracy on specified skills chosen based on participant needs. For each participant, a tacting skill was chosen based on the needs of the participant. The identified skill for Participant One was labeling actions, the identified skill for Participant Two was labeling social interactions, and the identified skill for Participant Three was labeling letter sounds.

Participant accuracy was obtained by taking the total number of trials responded accurately to and dividing it by the total number of trials administered then multiplying it by 100 to create a percentage. The first dependent variable was defined as the percent of accurate responding obtained across 10 trials per one day.

The second dependent variable consisted of a measure of the number of sessions to achieve the mastery criterion. The number of sessions were obtained by counting the total number of sessions during the acquisition phase before maintenance begins. The second dependent variable was defined as the number of sessions needed to obtain the mastery criterion.

The third dependent variable was the measure of instructional efficiency after acquisition. Instructional efficiency was analyzed by taking the total items mastered and dividing the number by the number of sessions required to meet mastery. The third dependent variable was defined as an instructional efficiency percentage, based on total number of items mastered and number of sessions to meet mastery.

The fourth dependent variable was the percentage of loss of the skill after five weeks of maintenance. Accuracy was probed weekly for five weeks once the participant met the specified mastery criteria for the set of the skill. The accuracy score was obtained from the same recording probe format used during treatment. The fourth dependent variable was defined as the percentage of loss of the skill, based on the met mastery criteria.

## **Independent Variable**

The independent variable consisted of the mastery criterion set for the acquisition of the identified functional skills from each participant's treatment plan. Participants received intervention until they met or exceeded the specified mastery criteria for the set of the skill at 60, 80, or 100 percent accuracy for three consecutive sessions. Once mastery criteria were met, the intervention was removed and the maintaining of the skill was probed weekly for five weeks.

## **Experimental Design**

In this study, an exploratory design was utilized to examine a within-subject maintenance comparison and between-subject comparison. The study included a baseline, skill versus performance deficit, acquisition, maintenance, and second skill versus performance deficit phase. Each participant was typically present for two to three sessions per week of the study. However, due to the COVID-19 pandemic, severe weather, and client cancellations, participants were inconsistently present for the minimum of two sessions per week. A session was defined as when 10 single trials for a set of the skill had been administered.

## **Procedures**

Skill identification was conducted by examining the participant's treatment plan and consulting with the participant's BCBA to identify skills that were not in the participant's repertoire based on assessment results from the Vineland Adaptive Behavior Scale Third Edition, VB MAPP, and/or ABLLS-R. To further assess that the identified skills had not increased due to generalization from skills taught following the assessment,

the participant was probed on the skill by the researcher. During this assessment, the researcher presented an instruction with the necessary stimuli and waited up to three seconds for a response. The researcher did not provide any prompting or consequence contingent on responding. Next, the researcher evaluated the responses and randomly identify 15 total responses that were responded to with zero percent accuracy for each participant. These 15 responses were randomly divided into 3 sets of five to correspond with the 60, 80, or 100 percent mastery criteria.

The baseline, skill versus performance deficit, acquisition, maintenance, and second skill versus performance deficit phase were administered by a Registered Behavior Technician (RBT) or BCBA. During each phase, interspersing procedures were used. For example, two trials were administered at a time. Between every two trials, other skills that were unrelated to this study but were skills in the participant's treatment plan were administered. For example, two tacting trials such as labeling the action *kicking* and the action *throwing* were administered then two or more trials on other skills such as following two-step commands, attending to name, or manding for items were administered. The baseline phase included presenting the three sets of five items to the participant with similar procedures used for skill identification by providing the instruction and no consequence. Reinforcement using behavior specific praise was only provided based on appropriate work behaviors such as the client sitting in their chair or the client looking at the task to increase compliance. Reinforcement was not provided contingent on responding. Baseline was implemented for a minimum of three sessions with the first data point representing the data from the skill identification assessment.

Baseline lasted until there were three data points representing stable responding to indicate the participant's responses to the items were unknown.

During the skill versus performance deficit phase, procedures were identical to baseline; however, reinforcement was provided contingent on accurate responses. A multiple stimulus preference assessment without replacement (MSWO) was administered prior to the beginning of this phase to generate a ranked order list of preferences for each participant. The MSWO was used to identify a preferred item to be used as a reinforcer for correct responding. The MSWO included five edible options that were evaluated as reinforcers for the participant by the participant, RBT, or the BCBA. The items were placed in a randomized order in a line in front of the participant. The participant was instructed to pick their favorite item. The participant was allowed access to consume the item and the remaining items were rearranged. The choices were recorded in a ranked order by the researcher until all five items had been chosen. Participant One's most preferred item was mini marshmallows, Participant Two's most preferred item was M&Ms, and Participant Three's most preferred edible item was fruit snacks. A second MSWO was conducted with Participant Two due to his refusal of the first most preferred item after five sessions of offering this item as a reinforcer. Participant Two's most preferred item was updated to gold fish. After the administration of the MSWO, the skill versus performance deficit phase was implemented for a minimum of three sessions with stable responding to indicate that the participant's responses to the items were unknown which would conclude that there was a skill deficit. If during the baseline or skill versus performance deficit phase, a participant began to make growth on an item, another item that was not randomly assigned from the assessment would have replaced it.

During the skill acquisition phase, an error correction procedure was added by using a three second prompt delay. After an incorrect response or absence of response after three seconds of presenting the stimulus, the RBT restated the instruction and provide a prompt by modeling the correct response then restated the instruction and waited three seconds for the participant to engage in the modeled response. If the participant did not respond accurately after the initial error correction, a verbal prompt was used up to 10 times before the response was recorded as no response. A verbal prompt of 10 times was chosen to allow ample opportunity for a response and the allowance of the participant to receive continued treatment on other skills. The skill acquisition phase continued until the participant's level of accuracy met or exceeded the corresponding mastery criterion level for three consecutive sessions.

The maintenance phase began exactly one week after each mastery criterion had been met. Maintenance sessions were identical to baseline and occurred once a week for five weeks. If the participant was absent during the maintenance session, the maintenance data was collected at the next session that the participant was present. The Maintenance phase ended after the fifth week and the second skill versus performance deficit phase began the following week.

During the second skill versus performance deficit phase, procedures were identical to the first skill versus performance deficit phase where the instruction was administered, and reinforcement was provided for correct responses. This phase assessed whether the percent of loss was due to skill loss or due to the removal of reinforcement used to motivate correct responding. The second skill versus performance deficit phase

was implemented for three sessions with stable responding to indicate the percent of loss was due to skill loss.

Interobserver agreement and treatment fidelity was evaluated for a minimum of 30 percent of the sessions and was distributed across all phases. The interobserver agreement was calculated by dividing the number of trials that the observer and RBT marked the same accuracy response in a session by the total number of trials then multiplying the number by 100. Treatment fidelity was evaluated by a checklist developed by the researcher that included the procedural elements of the study (see Appendix B). The elements included the RBT using the daily data recording sheet and protocol, providing the correct discriminative stimulus, using interspersal procedures, providing the correct form of reinforcement, providing error correction for an inaccurate response through modeling, providing up to 10 prompts if error correction did not produce an accurate response, and allowing three seconds for a response. Treatment fidelity was calculated by dividing the number of correct responses observed by the researcher in the session by the total number of possible responses and multiplying that number by 100.

## CHAPTER IV

### RESULTS

The analysis included a visual analysis from the experiment. The number of sessions needed to obtain the mastery criterion were evaluated for each skill set at the mastery criteria of 60, 80, and 100 percent accuracy. The number of sessions were evaluated for each skill set at the 60, 80, and 100 percent accuracy criteria by counting the total number of sessions during the acquisition phase before maintenance began.

The number of sessions needed to obtain the mastery criterion was also evaluated for each skill set at the mastery criteria of 60, 80, and 100 percent accuracy to assess which mastery criteria produces greater instructional efficiency. Instructional efficiency is the examination of the impact of instructional time on data-based decisions (Cates et al., 2003). For example, when examining differential effectiveness between meeting a 60, 80, or 100 percent mastery criterion and the 100 percent criterion provides greater maintenance but also requires numerous more sessions then the intervention may not be as efficient and beneficial to clinical practice. Instructional efficiency was analyzed following the acquisition phase by taking the total items mastered and dividing the number by the number of sessions required to meet mastery.



The percent of loss of maintenance was evaluated for each skill set at the mastery criteria of 60, 80, or 100 percent accuracy to assess which mastery criteria produced sustained skill maintenance for five weeks on varying acquisitional skills across participants in a clinical setting. The percent of loss was calculated by taking the percent of accuracy for the mastery criteria that were met during the acquisition phase (60, 80, or 100) then subtracting the percent of accuracy for the corresponding mastery criteria during the fifth week of the maintenance phase. Therefore, the mastery criteria with the lowest percentage of loss demonstrates the highest ability to maintain the skill.

**Participant One.** Participant One demonstrated no growth during the baseline phase and the first skill versus performance deficit phase. The absence of growth during the baseline phase demonstrates the skill was unknown. The absence of growth during the first skill versus performance deficit phase demonstrates that the absence of correct responding was due to a skill deficit and not a motivation deficit.

The number of sessions needed to obtain the 60 percent mastery criterion was four sessions. The number of sessions needed to obtain the 80 percent mastery criterion was 17 sessions. The number of sessions needed to obtain the 100 percent mastery criterion was 23 sessions.

The instructional efficiency for the 60 percent set was 80 percent. The instructional efficiency for the 80 percent mastery criterion set was 29 percent. The instructional efficiency for the 100 percent mastery criterion set was 22 percent.

The percent of loss of maintenance for the 60 percent mastery criterion was zero percent. The percent of loss for the 80 percent mastery criterion was 10 percent. The percent of loss for the 100 percent mastery criterion was zero percent.

During the last phase, the second skill versus performance deficit phase, the 60 percent mastery criterion increased by an average of seven percent, the 80 percent mastery criterion increased by an average of 23 percent, and the 100 percent mastery criterion decreased by an average of 7 percent.

**Participant Two.** Participant Two demonstrated no growth during the baseline phase and the first skill versus performance deficit phase. The absence of growth during the baseline phase demonstrates the skill was unknown. The absence of growth during the first skill versus performance deficit phase demonstrates that the absence of correct responding was due to a skill deficit and not a motivation deficit.

The number of sessions needed to obtain the 60 percent mastery criterion was six sessions. The number of sessions needed to obtain the 80 percent mastery criterion was 20 sessions. The number of sessions needed to obtain the 100 percent mastery criterion was 24 sessions.

The instructional efficiency for the 60 percent set was 83 percent. The instructional efficiency for the 80 percent mastery criterion set was 25 percent. The instructional efficiency for the 100 percent mastery criterion set was 21 percent.

The percent of loss of maintenance for the 60 percent mastery criterion was 30 percent. The percent of loss for the 80 percent mastery criterion was zero percent. The percent of loss for the 100 percent mastery criterion was 30 percent.

During the last phase, the second skill versus performance deficit phase, the 60 percent mastery criterion increased by an average of 23 percent, the 80 percent mastery criterion decreased by an average of 23 percent, and the 100 percent mastery criterion decreased by an average of 10 percent.

**Participant Three.** Participant Three demonstrated no growth during the baseline phase and the first skill versus performance deficit phase. The absence of growth during the baseline phase demonstrates the skill was unknown. The absence of growth during the first skill versus performance deficit phase demonstrates that the absence of correct responding was due to a skill deficit and not a motivation deficit.

The number of sessions needed to obtain the 60 percent mastery criterion was seven sessions. The number of sessions needed to obtain the 80 percent mastery criterion was 25 sessions. The number of sessions needed to obtain the 100 percent mastery criterion was 19 sessions.

The instructional efficiency for the 60 percent set was 71 percent. The instructional efficiency for the 80 percent mastery criterion set was 20 percent. The instructional efficiency for the 100 percent mastery criterion set was 26 percent.

The percent of loss of maintenance for the 60 percent mastery criterion was zero percent. The percent of loss for the 80 percent mastery criterion was 20 percent. The percent of loss for the 100 percent mastery criterion was zero percent.

During the last phase, the second skill versus performance deficit phase, the 60 percent mastery criterion increased by an average of seven percent, the 80 percent

mastery criterion increased by an average of 27 percent, and the 100 percent mastery criterion decreased by an average of seven percent.

### **Interobserver Agreement & Treatment Fidelity**

Interobserver agreement and treatment fidelity were collected for 39 percent of Participant One's sessions. Participant One's interobserver agreement was 99 percent and treatment fidelity was 100 percent. Interobserver agreement and treatment fidelity were collected for 33 percent of Participant Two's sessions. Participant Two's interobserver agreement was 100 percent and treatment fidelity was 98 percent. Interobserver agreement and treatment fidelity were collected for 36 percent of Participant Three's sessions. Participant Three's interobserver agreement was 99 percent and treatment fidelity was 97 percent.

## CHAPTER V

### DISCUSSION

The number of sessions needed to achieve the 60 percent mastery criterion was consistently less than the number of sessions needed to achieve the 80 and 100 percent mastery criterion across all three participants. This concludes that it took fewer sessions for all participants to master their skill when a 60 percent mastery criterion was used. The instructional efficiency was also greater for the 60 percent mastery criterion than the instructional efficiency for the 80 and 100 percent mastery criterion across all three participants. This concludes that the 60 percent mastery criterion had greater impact of instructional time on data based decisions. The percent of loss of maintenance for the 60 percent mastery criterion was equal to or less than the 80 and 100 percent mastery criteria for all three participants. Specifically, the percentage of loss of maintenance for the 60 percent mastery criterion was zero percent for two participants and 30 percent for one participant. However, when the loss of maintenance was averaged for each mastery criteria across participants, each mastery criterion had an average loss of maintenance of 10 percent. This indicates consistency in the loss of maintenance between each mastery criteria, and indicates no advantage or disadvantage between mastery criteria when examining loss of maintenance. The effects of the second skill versus performance deficit phase increased performance by 7 or 23 percent across all

participants for the 60 percent mastery criterion but demonstrated inconsistency in increasing or decreasing performance across participants for the 80 and 100 percent mastery criteria. This indicates that the reinstatement of motivation did not consistently improve performance which indicates there was variable skill loss during the maintenance phase.

Overall, the 60 percent mastery criterion took fewer sessions to achieve mastery, generated a greater instructional efficiency, and demonstrated similar loss of maintenance to the 80 and 100 percent mastery criterion. The 60 percent mastery criteria is a viable option to teach skills efficiently. However, it is important to consider that the skill would only be taught to 60 percent mastery. Therefore, the skill would likely require opportunities of practice and feedback from the individual's natural environment to increase the accuracy, maintenance, and generalizability of the skill.

Limitations of the present study include that each participant was unable to attend at least two sessions per week of the study due to the COVID-19 pandemic, severe weather, clinic cancellations due to holidays, and client cancellations. Furthermore, when possible, sessions were adapted to occur over telehealth to combat missed sessions which could have affected client participation. When a session was missed, the data was typically collected at the next session that the client was present. However, if communication did not occur between RBT's or between the RBT's and the researcher, sessions were missed. Participant One was absent a total of 15 sessions, Participant Two was absent for 8 sessions, and Participant Three was absent for 20 sessions when data would have typically been collected.

For Participant One, maintenance for the 100 percent mastery criterion set was missed during the third week. Also, for Participant One, for the 100 percent mastery criterion set, the second session out of the three days of the second skill versus performance deficit phase was missed and data was made up at the following session. For Participant Two, mastery during the acquisition phase for the 60 percent set was met for four sessions instead of three. Also, for Participant Two, the second session of the second skill versus performance deficit phase was missed and data was made up at the following session. For Participant Three, maintenance for the 60 percent set was missed during the second week and the second skill versus performance deficit phase began two sessions after it was scheduled to begin. Participant Three also missed the administration of the 60 percent mastery criterion set on one day and the 100 percent mastery criterion set on a separate day during the acquisition phase due to noncompliant behavior of the participant during the session. The researcher set up preventive measures ahead of time to address similar errors such as providing procedures to each RBT with explicit directions for each phase, provided a minimum of weekly updates on phase changes, and was present multiple days during each week and available by phone for any questions. Future research should provide additional supervision and training to increase control of the study.

Future research should investigate additional skills, a larger population, and a more diverse population. Future research should assess for opportunities to respond to the identified skill in the participant's natural environment. If the participant engages in the skill in their natural environment, they could receive reinforcement or error correction outside of the study. The administration of reinforcement or error correction for the

identified skill outside of the study could affect the measurement of the number of sessions needed to master the skill. Future research should also investigate the effects of varying mastery criteria on the generalization of skills. This study focused on how well the skill maintained when assessed in a clinical setting but not how well the skill generalized to other environments.

The effects of mastery criteria on skill maintenance is vital to the future performance of the skill. This study contributes to existing literature because it was conducted in a clinical setting with a unique population and demonstrates that a mastery criterion of 60 percent could be an efficient alternative to maintaining a skill when compared to the most often used 80 percent mastery criterion and a higher mastery criterion of 100 percent. It is recommended that practitioners continue to replicate and expand upon the effectiveness of varying mastery criteria on skill maintenance across skills, populations, and environments.



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# APPENDICES

## Appendix A

### Discrete Trial Training Daily Data Record Sheet

Student: \_\_\_\_\_  
Date: \_\_\_\_\_

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Percent Correct:										Percent Correct:										
Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Response	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

## Appendix B

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### Fidelity Checklist

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Client: \_\_\_\_\_ Date: \_\_\_\_\_ Phase: BL S/P A M R<sup>+</sup>  
$$\frac{\text{_____}}{\text{(Steps Completed)}} \div \frac{\text{_____}}{\text{(Total Steps)}} = \frac{\text{_____}}{\text{(\% of Steps Completed)}}$$

This should be used by observers, is meant to ensure adherence to treatment, and should be used during each phase.

#### Materials Needed:

- Daily Data Recording Sheet
- Protocol

#### Intervention Procedures:

- RBT uses the daily data recording sheet and protocol
- RBT provides the correct discriminative stimulus.
- RBT uses interspersal procedure - two trials are administered at a time. Between every two trials, other skills that are unrelated to the study are administered.
- RBT provides correct form of reinforcement:
  - Baseline: Reinforcement for work behaviors only (sitting in seat or looking at task etc.)
  - Skill vs Performance: Reinforcement for accurate responding
  - Acquisition: Reinforcement for accurate responding
  - Maintenance: Reinforcement for work behaviors only (sitting in seat or looking at task etc.)
  - Reinforcement Only: Reinforcement for accurate responding
- RBT provides error correction procedures (modeling the correct response) only during the Acquisition phase.
- RBT provides least-to-most prompting if error correction does not produce accurate responding during the Acquisition phase.
  - (e.g., visual, verbal, gesture, model, partial physical, and full physical)
  - Verbal demand: uses a verbal prompt up to 10 times before recording response as “no response”.
- RBT allows three seconds for a response to be provided:
  - A response must be provided within three seconds to be identified as accurate
  - Error correction is provided after 3 seconds of no response or after an inaccurate response.

## Appendix C



# University Research Compliance

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## CONSENT FORM

### **Background Information**

Your child is invited to be in a research study about the effects of varying mastery criteria on skill maintenance. Your child was selected as a possible participant because their treatment plan includes the skill that will be intervened on in this study. We ask that you read this form and ask any questions you may have before agreeing to have your child be in the study. Your child's participation is entirely voluntary and not participating in the study will not affect your child's treatment plan.

**This study is being conducted by:** Lauren Adams, School Psychology, Oklahoma State University, under the direction of Dr. Gary Duhon, School Psychology, Oklahoma State University.

### **Procedures**

**If you agree for your child to be in this study, we would ask the following things:** For your child to be present at each of their current scheduled therapy session.

**Participation in the study involves the following time commitment:** The study will occur during the child's therapy sessions and consist of a skill already in their treatment plan that will occur for approximately 10-15 minutes of a session. Of your child's already scheduled therapy sessions, this study will take place for a minimum of 17 sessions and a maximum of 35 sessions.

### **Risks and Benefits of being in the Study**

**The study involves the following foreseeable risks:** Loss of privacy. In order to assist with the offset of this risk, all data for the proposed research project will be obtained from the research records maintained by the principal investigator. All confidentiality safeguards will be used to maintain security of the information in the research files. This includes storing the research files in separate, locked locations to ensure confidentiality. At no point in the process will any identifying information be stored within a research file.

If an adverse event or unexpected problem that could be potentially harmful arises, the principal investigator will immediately contact the faculty sponsor for the project (Dr. Gary Duhon) to discuss the appropriate actions, and immediately follow the faculty sponsor's action plans.

As researchers, we are legally bound to report any instances where a child is being hurt or mistreated. If child abuse or neglect is reported by a parent or child at any time during the course of this project, the principal investigator will immediately contact the faculty sponsor for the project (Dr. Gary Duhon) and then immediately contact the Oklahoma Child Abuse Hotline (1-800-522-3511),

### **What Steps Are Being Taken to Reduce Risk of Coronavirus Infection?**

The following steps are being taken to address the risk of coronavirus infection:

**Screening:** Researchers and participants who show potential symptoms of COVID-19 (fever, cough, shortness of breath, etc.) will NOT participate in this study at this time.

**Physical distancing:** Whenever possible, we will maintain at least 6 feet of distance between persons while conducting the study.

**Mask/Covering:** Researchers will wear and participants will be advised to shield their mouth and nose with a cloth face cover or mask during the study, even when maintaining at least 6 feet of distance. Tissues will be available to cover coughs and sneezes.

**Handwashing:** Researchers and participants will wash hands before and after the therapy session or use a hand sanitizer containing at least 60% alcohol.

**Disinfecting materials:** We will clean and disinfect surfaces between participants, using an EPA-registered disinfectant or a bleach solution (5 tablespoons of regular bleach per gallon of water) for hard materials and by laundering soft materials. Disinfected materials will be handled using gloves, paper towel, plastic wrap or storage bags to reduce the chance of re-contamination of materials.

**The benefits to participation are:** (a) increased functional skill development; (b) mastery of skills in the individual's treatment plan; (c) may help the researchers learn more about improving maintenance of skills and may help future clinical practices.

### **Compensation**

There will be no compensation for your child participating in this study.

### **Confidentiality**

The researchers will make every effort to ensure that information about your child remains confidential, but cannot guarantee total confidentiality. Your child's identity will not be revealed in any publications, presentations, or reports resulting from this research study.

We will collect information through direct observation of your child. This data will be stored in a locked filing cabinet in a locked office at the clinic. When the study is completed and the data have been analyzed, any code lists linking names to pseudonyms will be destroyed. This is expected to occur no later than May 2022. This informed consent form will be kept for 3 years after the study is complete, and then it will be destroyed. Your child's data collected as part of this research project, may be used or distributed for future research studies.

It is unlikely, but possible, that others responsible for research oversight may require us to share the information you give us from the study to ensure that the research was conducted safely and appropriately. We will only share your information if law or policy requires us to do so.

### **Voluntary Nature of the Study**

Your child's participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your consent and participation in this project at any time. The alternative is to not participate. Your decision whether or not to participate in this study will not affect your standing with the OSU IRB.

### **Contacts and Questions**

The Institutional Review Board (IRB) for the protection of human research participants at Oklahoma State University has reviewed and approved this study. If you have questions about the research study itself, please contact the principal investigator at 405-458-0403, lauren.white10@okstate.edu. If you have any questions or concerns regarding the principal investigator, please contact the faculty sponsor for this study at 405-744-9436, gary.duhon@okstate.edu. If you have questions about your rights as a research volunteer or would simply like to speak with someone other than the research team about

concerns regarding this study, please contact the IRB at (405) 744-3377 or [irb@okstate.edu](mailto:irb@okstate.edu). All reports or correspondence will be kept confidential.

*You will be given a copy of this information to keep for your records.*

**Statement of Consent**

I have read the above information. I have had the opportunity to ask questions and have my questions answered. I consent to participate in the study.

Indicate Yes or No:

I give consent for my child to be observed during this study.

Yes  No

I give consent for my child's data to be used in future research studies:

Yes  No

I give consent to be contacted for follow-up in this study or future similar studies:

Yes  No

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Signature of Investigator: \_\_\_\_\_ Date: \_\_\_\_\_

## Appendix D



### Oklahoma State University Institutional Review Board

Date: 11/02/2020  
Application Number: IRB-20-423  
Proposal Title: The Effects of Mastery Criteria on Skill Maintenance

Principal Investigator: Lauren Adams  
Co-Investigator(s):  
Faculty Adviser: Gary Duhon  
Project Coordinator:  
Research Assistant(s):

Processed as: Expedited  
Expedited Category:

**Status Recommended by Reviewer(s): Approved**

**Approval Date:** 11/02/2020

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The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

**This study meets criteria in the Revised Common Rule, as well as, one or more of the circumstances for which continuing review is not required. As Principal Investigator of this research, you will be required to submit a status report to the IRB triennially.**

The final versions of any recruitment, consent, and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be approved by the IRB. Protocol modifications requiring approval may include changes to the title, PI, adviser, other research personnel, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms.
2. Submit a status report to the IRB when requested
3. Promptly report to the IRB any harm experienced by a participant that is both unanticipated and related per IRB policy.
4. Maintain accurate and complete study records for evaluation by the OSU IRB and, if applicable, inspection by regulatory agencies and/or the study sponsor.
5. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

If you have questions about the IRB procedures or need any assistance from the Board, please contact the IRB Office at 405-744-3377 or [irb@okstate.edu](mailto:irb@okstate.edu).

Sincerely,  
Oklahoma State University IRB



## VITA

Lauren Adams

Candidate for the Degree of

Doctor of Philosophy

Dissertation: THE EFFECTS OF MASTERY CRITERIA ON SKILL MAINTENANCE

Major Field: School Psychology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in School Psychology at Oklahoma State University, Stillwater, Oklahoma in May, 2022.

Completed the requirements for the Master of Science in School Psychology at Oklahoma State University, Stillwater, Oklahoma in 2019.

Completed the requirements for the Bachelor of Arts in Psychology at University of Central Oklahoma, Edmond, Oklahoma in 2017.

Completed the requirements for the Associate of Arts in Psychology at Oklahoma City Community College, Oklahoma City, Oklahoma in 2014.

Experience:

Oklahoma Private Practice Internship Consortium

Oklahoma Pediatric Therapy Center

School Psychology Practicum at the Oklahoma State University School Psychology Center

School Psychology Practicum at Skyline Elementary

University of Central Oklahoma Learning and Behavior Clinic

Professional Memberships:

Oklahoma School Psychology Association

National Association of School Psychologists