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Progress Monitoring Timing Effects in Speech and Written Language Therapy

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Progress Monitoring
Timing Effects in Speech and Written Language Therapy

by

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Dedication

This document is dedicated to my family and friends. Without their love and support, I would not be where I am at today. My career and life goals have been inspired by you and are done for you. This document is also dedicated to those that I may treat someday, as this paper was performed in an effort to provide the best care I can give with my talents graced from God.

Abstract

Progress monitoring is a crucial aspect of speech-language pathology. Without it, speech-language pathologists (SLPs) have little way of determining if patients are making progress with the implemented therapy. Currently, most SLPs perform progress monitoring *during* therapy. This study compared the traditional, status-quo, method of progress monitoring to that of progress monitoring performed *before* therapy begins in an effort to determine if a timing change would affect therapy outcomes. 2 boys, receiving articulation therapy, and 1 girl, receiving spelling therapy, each had 1 treatment goal for the *during* condition and 1 treatment goal for the *before* condition. The children all received their normal therapy, with the only difference being the timing of the progress monitoring. The progress monitoring data were collected and graphed. Comparison of the effectiveness of the *during* vs *before* as well as treatments vs baseline were measured by utilizing Cohen's *d*. The first boy showed a small effect in favor of the *before* condition. The other boy and girl bowed showed large effect sizes in favor of the *before* condition. It was determined that the results of the timing change can be effective in causing a more rapid improvement in skills being taught. While the results are promising, they should be taken with caution, as the sample size of the study was small and confined to a small portion of treatments that encompass speech-language pathology.

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Chapter 1

Introduction

Progress monitoring is one of the most critical aspects of therapy in children and adults of any disorders. Initial thinking might have us believe that this includes more testing for children. However, progress monitoring can be performed continuously, and it is. Without progress monitoring, speech-language pathologists (SLPs) and other professionals have no other method, other than visual experience, to determine if a student is or is not progressing on specified skills. Through progress monitoring, SLPs are able to determine how effective their teaching is over a span of time (McLane, 2008). Progress monitoring is critical for academic and therapeutic success. With the outcome data, the SLP can make informed, data-based decisions to make changes to a student's objective or to keep it the same. For an SLP, progress means that the method of teaching is working for that individual student (Hosp & Hosp, 2003). When that student has progressed to the point where mastery has occurred for that level of complexity, the SLP must make the objective more complex until total mastery has occurred. If the student does not respond well to the teaching even at the most basic level of complexity, the SLP must change the way the objective is taught until progress occurs. This is the general idea around most therapies in speech and language. In this study, the timing of progress monitoring, during versus before treatment, was compared in speech and language therapy.

1.1 Curriculum-Based Measurement. Curriculum-based measurement (CBM) is an assessment tool that can be used by educators in many different settings and with many different subjects. CBM is usually composed of: standard directions, a timing device, education materials, scoring rules, standards for judging performance, and record forms or charts (Hosp, Hosp, & Howell, 2007). Directions are just that and are not different than a student would see during typical instruction. Materials should look like classroom materials. Timing is performed in a way that instructors count the number of responses correct within a specified time period under a set of predetermined scoring rules. Because standards or scoring rules cannot be seen with charting, the evaluation will only look like a teaching activity. In CBM, this is called *alignment*: efforts towards teaching will become more effective if the clinicians will "test what we teach and teach what we test." The goals that are to be met to be considered competent should be what is taught (Hosp et al., 2007).

CBM came from the need of a continuous data collection system that would be used to guide decisions for curriculum modifications. It was originally developed by Stan Deno and Phyllis Mirkin in the late 1970s to fill this need within their intervention process: Data-Based Program Modification (DBPM) (Deno & Mirkin, 1977). CBM can be characterized by 9 attributes (Deno, 2003):

1. Alignment: students are being tested on what the instructor is teaching them.

2. Measures technically adequate: measures have established reliability and validity. CBM has solid empirical evidence that supports it and its application.

3. CBM makes use of criterion-referenced measures: these are used to show that students can demonstrate their knowledge on reaching set performance levels.

4. Standard procedures: those who want to share data use a set of pre-determined procedures.

5. Performance sampling: CBM uses low-inference measures where correct and incorrect responses or behaviors are measured on clearly defined tasks within a set time period.

6. Standard rules: Decision rules are set in place to aid those who use the data with information about what it means when students perform at different levels.

7. Repeated measurement: CBM data can be used for progress monitoring to show the rate of learning as it occurs.

8. Efficient: CBM is efficient in that instructors can be taught on procedures quickly and measures can be given quickly as well.

9. Efficient summarization: The data are easily accessible and can be given to instructors and students.

CBM has three primary advantages: efficiency, alignment, and progress monitoring. CBM is efficient in that it can be easily implemented. Alignment is important in all settings in that students are actually taught what they are being

tested on. The main focus of this study, progress monitoring, allows for repeated measurements from equivalent sampling. Frequent measurement allows CBM to be more sensitive to instruction than other measures. From this, instructors can determine if instruction and teaching methods are effective within a fairly short period of time (Fuchs & Fuchs, 2002). It is important to understand that CBM is not used to determine what therapy is appropriate; that is left to the judgment of the clinician. It is a way to measure the "academic health" of the student. In other words, the strength of the skills of the student are analyzed (Shinn, 1989).

Unfortunately, educational planning and therapeutic intervention has not evolved to the point where every instructional method can guarantee positive results. This is where progress monitoring comes into play. SLPs use progress monitoring during program implementation in order to gauge the effectiveness of the intervention or teaching strategy being used. It is important to note that progress monitoring tools must: be a direct sample of what is being taught, have adequate samples, and allow for multiple, repeated administrations. Repeated administration allows for more sensitive data that can better influence decisions on how instruction is approached (Hosp & Hosp, 2003).

Deno, Fuchs, Marston, & Jongho (2001) performed a study in which the students, who were either typically-developing or in special education, were exposed to curricula using CBM. In this study, Deno et al. utilized a control group of students that were typically-developing and an experimental group of 638 students with learning disabilities. In grades 1-4, the control group had a faster growth rate. But, in grades 5-6, the growth rate decreased and the rate of the two

groups became nearly identical. The results from the study indicated that all students can benefit from CBM's implementation, not just those requiring services. Because of the ease of implementation for all populations, CBM could be considered for use over yearly, time consuming assessments (Fuchs & Fuchs, 2004).

In this study, the timing change of progress monitoring during articulation and spelling therapy was measured. However, this does *not* mean that progress monitoring was in any way excluded from this study. When tracking progress of students in therapy, progress monitoring should be utilized no matter what the outcome is intended to be. It is vital for the treatment of students so that the clinician can ensure therapy is doing what is intended to do.

1.2 Articulation Intervention. The traditional approach to articulation intervention is motor-oriented and was the dominant therapy technique at a time when clinicians had few school-aged children with language disorders and more mild disorders than at the present time (Bernthal, Bankson, & Flipsen, 2013). The approach is still widely used because of its ease of implementation in therapy and is deemed to be suitable for errors that are articulatory, rather than phonological, in nature. Newman (1985) notes that the traditional method, while occasionally changing form with new research, has survived time and is more widely used than any other method. Traditional articulation therapy focuses on teaching the placement and movement of the articulators. The skill becomes a learned skill that has been practiced through increasingly complex linguistic levels. Ruscello (1984) notes that mastery of any motor-based skill requires

frequent practice. In the case of articulation, more opportunities to learn the motor-based skill equals faster learning of the skill in the linguistic context it is taught.

Treatment of articulation can be broken down into three main phases: establishment, generalization, and maintenance (Bernthal, Bankson, & Flipsen, 2013). Establishment of the target behavior starts with elicitation of the sound from the patient, then stabilizing the behavior. Procedures for establishment are based on production tasks as in the example that Bernthal et al. give where a clinician teaches: "a child who does not produce /l/ where to place his or her tongue to say /l/" (p. 271). The next phase of instruction is generalization. Generalization is designed to help with the carryover of behavior at different levels: positional, contextual, linguistic unit, sound, and situational. While performing instruction of this phase, clinicians will generally follow the common linguistic progression of moving from smaller to larger contexts (sounds, syllables, whole words, sentences, conversation.) As previously stated, opportunities to succeed in the skills being taught must be bountiful; giving high amounts of opportunities for the student are crucial in developing the skills required to succeed at each linguistic level. The last phase of motor-based treatment is maintenance. This phase is solely designed to stabilize the skills learned in the previous two phases. Instruction in this phase is generally reduced, and more of the responsibility of ensuring correct production falls on the child. Examples of this may include the child. keeping track of productions during a meal with family or friends every night of the week or keeping track of target

productions while at school and conversing with a teacher once a day during the week.

Shriberg and Kwiatkowski (1982) showed that the drill-based therapy approach is both effective and efficient for improving speech sounds compared to approaches where play-based activities. From their intervention, Shriberg and Kwiatkowksi showed that the average time to reach criterion in drill was less than 2.5 hours, whereas it was over 3.5 hours in the play condition. Swanson & Sachse-Lee (2000) performed an analysis of interventions for children with learning disabilities and found that drill-based therapies were more effective than those that were not; these results are consistent with what Shriberg and Kwiatkowski found much earlier.

1.3 Spelling Intervention. Proficiency in spelling stems from the ability to use four different linguistic strategies (Bourassa & Treiman, 2001). The inability to use any one of the linguistic strategies can result in a breakdown of word reading and spelling. Apel and Masterson (2001) outlined the four possible factors that could contribute to a child's spelling errors. The first example outlined is an error of *omission* where the child fails to represent each phoneme in the word with at least one letter (e.g. "soop" for *stoop*). Another pattern for misspelling is a lack of *orthographic* knowledge. This refers to an impaired ability to translate spoken phonemes to graphemes. Apel and Masterson give this example: "students have to learn that /ae/ is spelled with the letter *a* and the /ɛ/ sound is spelled with the letter *e,* and not vice-versa" (p.183). Children must also have *morphological awareness* to spell words correctly (e.g. jumped, knitted). These words in

particular are spelled similarly because they denote past tense. Children can rely on this knowledge when spelling words in that specific tense. Children must also rely on *mental graphemic representations* (MGR) of words. Children develop this representation through repeated exposure to specific words, morphemes, and syllables in text. If the other skills above are poor, a child can rely on MGRs. With an increased amount of MGRs, spelling can become more accurate. For example, children can properly spell the unstressed schwa in multi-syllabic words despite their different spellings. They are able to do this because of their MGR.

According to Foorman, Francis, Fletcher, Schatschneider, & Mehta (1998), remediation of these breakdowns must be explicit and intensive to show a more marked improvement. The children that need remediation must have many direct opportunities to repair the strategy breakdowns (Elbro, King, Rown, & Oakhill, 2016). One such method of providing such instruction is the use of the *SPELL-Links to Reading and Writing* (Wasowicz, Apel, Masterson, & Whitney, 2004). The instructional program utilizes a system that encompasses the teaching of five strategies to ensure that a child that needs instruction can improve or strengthen all areas. SPELL-Links describes the connectionist model as the encompassment and interplay of phonological, orthographic, morphological, semantic, and the mental images of words. By targeting these skills, a student builds the representations needed in order to be more successful in writing. The program builds upon this idea by "advancing student's spelling, listening, speaking, reading, and writing abilities" using all five of the strategies

described by the connectionist model (Wasowicz, Apel, Masterson, & Whitney, 2004).

Julie Masterson, a SPELL-Links creator, performed a study for classroom (grades 3-5) implementation to determine if classroom-administered word study would be associated with an increase in literacy performance (Masterson, 2008). She found that nonsense word reading improved for all grades. This was likely due to the analytical approach to word decoding that is intrinsic to SPELL-Links. Real word reading improved in Grade 5 only, likely due to the increase in multimorphemic word knowledge. Spelling skills defined by right/wrong did not improve, as shown by the TWS-4. Masterson utilized a different method of scoring in this study. The system used is now called the Spelling Sensitivity Score (SSS) (Masterson & Apel, 2010). This system of scoring does not utilize right/wrong answers. Rather, the system breaks down words into different elements: phonemes, juncture changes, and affixes. The system is scored from 0-3. If the word is spelled correctly, the student receives a 3 for that word. If the word has an incorrect spelling but a plausible spelling, 2 points are awarded. If the word is spelled incorrectly without a plausible spelling, 1 point is awarded. If the word is missing an element completely, the student receives a 0. Using the SSS, spelling showed improvement across both academic and grade levels for the participants of the study not in terms of right and wrong, but in improvement of the different elements analyzed by SSS. (Masterson, 2008).

1.4 Progress Monitoring. In articulation and spelling therapies, the clinician traditionally would take data during the course of the objective. While a surplus of

research has been performed on different ways to perform articulation and spelling therapy, there is a seemingly nonexistent field of research on progress monitoring/data collection itself. This is not to say there is not a large field of research on CBM, there is. But progress monitoring is a large aspect of CBM and this is surprising considering how crucial progress monitoring is for speech and language therapy. If the progress monitoring can be changed so that objectives can be met faster, children with mild, or perhaps even severe, disabilities would likely not need to be in therapy as long as they may have originally. CBM requires a general approach in progress monitoring for specific interventions. While the method will vary from intervention to intervention, the principle stays the same. Hosp et al., (2007) note that if a student is learning and making progress with one approach, the clinician stays with that approach. If the student is not making progress, the clinician must change the approach. However, what if the clinician can make progress more efficient during intervention? In this study, this question is approached not by changing the methods of intervention, but by manipulating the timing of when progress is tracked during the session.

The purpose of this study, therefore, was to determine whether the timing of progress monitoring data collection during articulation and spelling/language therapy influences the speed of improvement. The standard progress monitoring method that nearly all SLPs use is to take the data *during* the objective teaching. This is considered the standard method, or status quo, of data collection for therapy. The author compared this standard method to a modified method in which the data are taken *before* the objective teaching. In doing so, more focus is

put towards instruction with progress monitoring occurring before instruction, rather than instruction and progress monitoring occurring simultaneously. The author hypothesized that the objectives that received a progress monitoring modification would progress further and faster than the counterpart objective. The author believed that this would be the case for the before condition because clinicians would be able to devote full attention to teaching rather than splitting attention between teaching and progress monitoring.

Chapter 2

Materials and Methods

The research protocol for this study was approved by the Institutional Review Board at the University of South Carolina.

2.1 Participants. There were three participants in this study. Two were boys with articulation disorders and one was a girl with spelling difficulties. All participants were recruited from the University clinic, where they were already receiving speech-language services. Participants were chosen with methods laid out below. All participants were monolingual speakers of English and had normal hearing as determined by parent report.

2.2 Procedures. The study consisted of two steps: participant selection and single subject intervention. First, participants were selected within the university clinic based on their therapy objectives, as described below. All of the children's parents were asked for consent to participate in the study. After selection, intervention began the following semester.

2.3 Selection. The two boys with articulation disorders were selected because of the sounds with which they exhibited difficulties and were appropriate to target for their age. The sounds had to be relatively similar to each other in place, but different in voicing. The first boy, Eric (all names are pseudonyms), exhibited articulation difficulties with /θ/ and /ð/ in all positions. Eric had been in therapy for approximately 3 years and had high skill levels with articulation therapy and what

it entailed. The second boy, Nick, exhibited articulation difficulties with /dʒ/ and /tʃ/. Nick was instructed by another student clinician. This was also Nick's second semester in therapy, yet he was not as skilled with articulation. The girl, Kasey, exhibited spelling difficulties with syllabic-r and syllabic-l. Kasey had been in therapy for one semester before the intervention began. Because of previous participation in therapy, each participant had pre-established goals that addressed two distinct sounds or spelling patterns that were of similar difficulty. Targeted sounds were chosen because of similarities between them. Spelling patterns were chosen because these were the patterns Kasey had the most difficulty with based on previous SPELL-Links testing.

2.4 Single Subject Intervention. This study employed the use of a single subject adapted alternating treatment design (AATD) (Sindelar, Rosenburg, & Wilson, 1985). Single subject AATD compares different intervention methods and the rate at which the subjects improve upon the given targets. With this design, timing change as well as the traditional method of progress monitoring can be compared side by side for the rate of acquisition of targeted speech sounds and spelling patterns. This study compared the rate of targeted speech sounds and spelling patterns acquisition by changing when progress monitoring data was taken during therapy. Because targets were different for each of the articulation participants, materials were different to perform the assessment. However, this was deemed to be appropriate for this study due to the nature of drill-based therapy for articulation.

2.5 Progress monitoring material development. For the two students receiving articulation intervention, picture cards were used that represented the actions or objects that the target words would represent. There were 10 words chosen that began with each target sound for a total of 20 words. Images were printed on standard 8.5 x 11-inch white computer paper in color with four to a page. All cards were laminated and cut to have relatively equal dimensions. For the student receiving spelling intervention, 10 words were selected for her that included each target spelling for a total of 20 words. Words were presented orally with an example sentence. Importantly, the progress monitoring measure for each condition differed only by target words.

2.6 Baseline. Each participant partook in baseline interventions for each sound and letter combination and were assessed for 3 weeks. During the baseline assessments, study-specific intervention was not administered. For Eric and Nick, the therapist presented the picture cards and asked the student to name the word. If the participant did not know the image, the therapist would state: "This is a _____. It does _____. What is this called?" In Kasey's SPELL-Links intervention, the spelling patterns did not require introduction because she had already been introduced to them in a previous semester. Instruction for SPELL-Links is similar to that of articulation therapy: instruction is given on the patterns and the student practices that lesson. The main difference is that SPELL-Links provides pre-written instruction that the clinician follows. To determine baseline for the SPELL-Links instruction, Kasey was asked to spell a set of ten words that

contained her target patterns. These ten words were pre-selected and were different from the target words in treatment.

Participants were scheduled to be seen for one hour weekly throughout a 14-week semester. While regular attendance is stressed at the beginning of the semester, consistency was not always observed. Attendance was inconsistent for all participants: Eric missed three sessions (all three were between baseline and intervention); Kasey did not miss any sessions, but his treatment sessions were not consistently spaced throughout the semester; Nick missed two sessions (one between baseline and intervention; one during intervention).

2.7 Experimental Intervention. Trained SLP master's students administered the interventions for each participant. Interventions lasted anywhere from 30 minutes to one hour for one session per week. Nick also had a fluency disorder that was being targeted separately from the intervention. Half of his one-hour therapy session was dedicated to his fluency disorder.

The articulation intervention followed Van Riper and Emerick's (1984) drill model. In this approach, the instructor provided a preceding instructional event before introduction of the training stimulus. During the event, the instructor described and demonstrated the sound being targeted. The training was provided on the flashcards described above. The child then provided the response when shown the flashcard. If produced correctly, the interventionist gave praise: "Very good!", "That sounded great!". If the target was produced incorrectly, the interventionist followed a 3-step hierarchy. After an initial incorrect production, the interventionist prompted for a repetition. After a second incorrect

response, the interventionist prompted the child to produce the target sound. After a third attempt, the interventionist provided the sound, with exaggerated duration and placement, and prompted the child to repeat.

The intervention occurred similarly for both targets. The difference was in the timing of the intervention itself and when the data were collected. Sounds/spelling patterns were randomly assigned to "before" and "during" conditions. For the "before" sound, data were collected before the intervention was given. The flashcards were shown at the beginning of the session, before the intervention, and data were collected based on those cards. For the "during" sound, data were collected during the intervention itself, imbedded during teaching activities. Intervention targets are shown in Table 2.1.

Table 2.1

Intervention targets

	Eric	Kasey (SPELL-Links)	Nick
During	Voiceless /θ/	Syllabic /r/	/tʃ/
Before	Voiced /ð/	Syllabic /l/	/dʒ/

2.8 Data Analysis. This study compared the effectiveness of the timing of intervention and data collection in articulation and spelling therapy. The level of concluding performance of each sound and spelling pattern was analyzed to determine if the changes administered lead to faster rates of improvement. Rates of improvement were also analyzed. Congruent with single subject design, each probe was graphed to allow for visual analysis.

2.9 Comparison of Effectiveness of Timing of Progress Monitoring. The purpose of this study was to compare the effectiveness of differences in timing of progress monitoring on student outcomes of targeted skills. Visual analysis indicates that timing changes to progress were effective at helping Eric and Nick reach criterion levels of 90%. Only Eric reached criterion with both the timing change and the traditional progress monitoring. Kasey did not reach criterion for her goals for either the traditional progress monitoring or the timing change. Visual analysis also indicates that after baseline treatments were performed, the participants progressed faster and maintained that increased progression throughout the treatment.

Chapter 3

Results

3.1 Eric

      3.1.1 Eric – During Condition. The traditional method of articulation was used for Eric in both conditions. The during condition featured traditional articulation therapy with the traditional way of performing the progress monitoring, taking data while the therapy was in progress. Figure 2 displays the baseline data and the progress Eric made with the during condition. The sound targeted in this condition was the voiceless "th" sound, /θ/. The baseline in this condition was consistently above 50% with the first baseline data point at 70%. After 3 weeks of baseline, the treatment condition began. Eric's initial data point started at 50%. The next week there was a 10% decrease in accuracy. Thereafter, Eric began to make progress. Accuracy was at 80% after 3 weeks of therapy. There was a 20% decrease two weeks later to 60% accuracy. The last treatment session saw a final accuracy of 90%, which met the criterion of the university clinic. Cohen's d was used to determine if the treatment method was effective in baseline versus treatment for the during condition. The effect size was 0.52, indicating a medium effect for this condition.

      3.1.2 Eric – Before Condition. The before condition featured the condition change of performing progress monitoring before the treatment session. Figure 2 displays the baseline data and the progress Eric made with the

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before this condition. The sound targeted in this condition was the voiced "th", /ð/. The baseline in this condition started at 80% and slowly began to decrease over the next two therapy sessions to 60%. The intervention began where his initial data point starting at 50%. The next therapy session saw accuracy at 50%. From there, accuracy dramatically rose to 100%. Accuracy was inconsistent for this condition, as the next session saw a decrease in accuracy to 60%. The session two weeks later saw accuracy increase to 90% again. The next session saw a decrease in accuracy to 70%. And the last treatment session saw accuracy rise to 90% once again. Cohen's *d* was used to determine if the treatment method was effective in baseline versus treatment for the before condition. The effect size was 0.18, indicating no effect seen for this condition.

      3.1.3 Eric – During versus Before. Cohen's *d* was used as a comparison of the effectiveness between the two conditions as well. To calculate this, the average of each treatment was used. The effect size seen for the two conditions was 0.45, indicating a small effect.
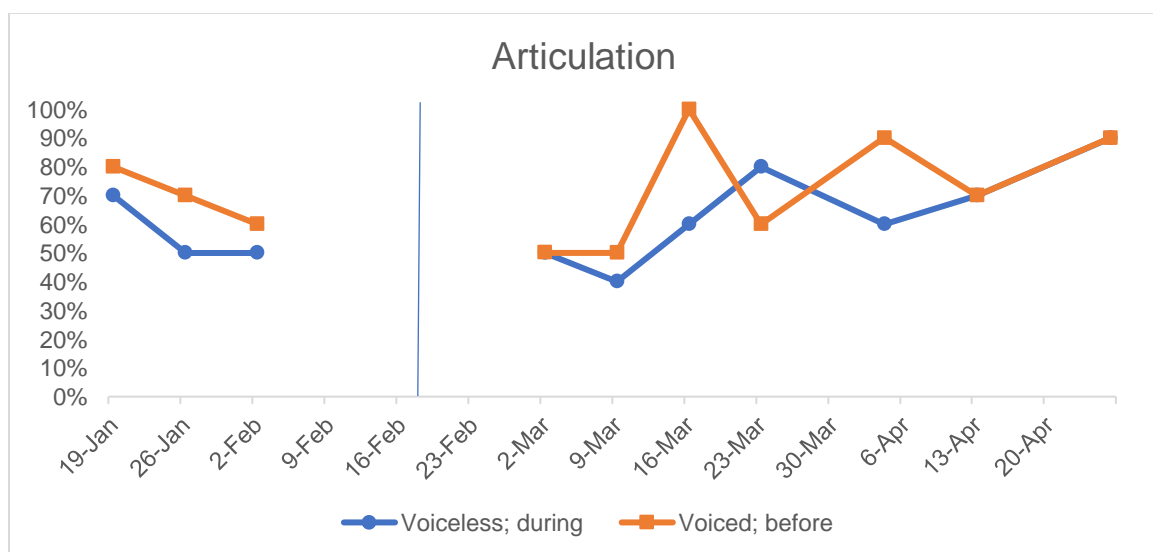

Figure 3.1. Eric

3.2 Kasey

    3.2.1 Kasey – During Condition. Both conditions for Kasey used SPELL-Links for the therapy. The during condition for Kasey did not change the way SPELL-Links was administered during therapy. Figure 3 shows the progress made by Kasey in this condition. The treatment target for this condition was syllabic-r. Baseline accuracy was 50% or below for the three weeks of therapy. During this time, accuracy decreased to 20%, then rose to 40%. The initial accuracy of the during treatment condition started at 20%, with a rise to 30% the week after and a decrease back to 20% in week 3 of the treatment. From there, accuracy began to rise steadily, with a height of 60% accuracy in the second to last week of treatment. The last treatment session had a 10% decrease to 50% accuracy. Cohen's *d* was used to determine if this treatment method was effective in baseline versus the during condition. The effect size that was produced was 0.03, indicating no effect seen in effectiveness of the during condition.

    3.2.2 Kasey – Before Condition. The treatment target for this condition was the syllabic l. Figure 3 shows the progress made in this condition. With this condition, the progress monitoring was performed before the treatment session began. The three baseline treatment sessions started at 40% and steadily rose to 60%. Intervention accuracy began at 50%, then decreased the next session to 40%. Kasey saw another increase to 60% in the third treatment week. In the fourth week, Kasey's accuracy decreased to 50%. The next two sessions saw accuracy at 70%, with the last treatment session for this condition at 60%.

Cohen's *d* was used to determine if this treatment method was effective in baseline versus the before condition. The effect size that was produced was 0.67, indicating a medium effect.

3.2.3 Kasey – During versus Before. Cohen's *d* was used as a comparison of the effectiveness between the two conditions as well. To calculate this, the average of each treatment was used. The effect size seen for comparison of the two conditions was 1.45, indicating a large effect in favor of the before condition.
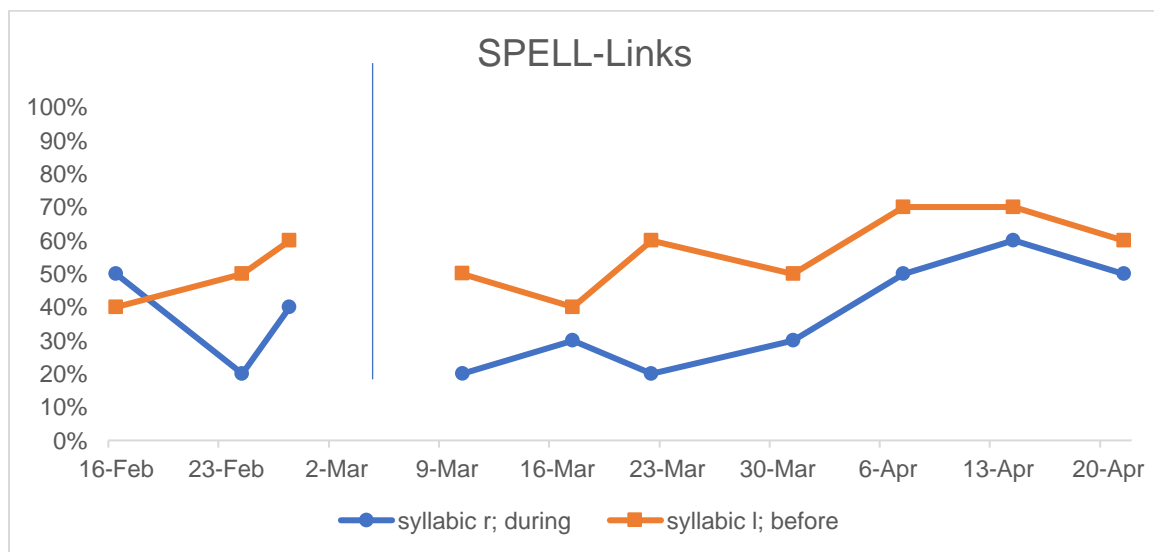

Figure 3.2. Kasey

3.3 Nick

3.3.1 Nick – During Condition. Both conditions for Nick utilized traditional articulation therapy. The during condition featured traditional articulation therapy with the traditional way of performing the progress monitoring in therapy, taking data while the therapy was in progress. Figure 4 displays the baseline data and the progress Nick made with the during condition. This condition targeted the "ch" sound, /tʃ/. Baseline for this condition started at 30%, and sharply rose to 90% by

the third baseline session. Treatment accuracy started at 80%. The next session had a large decrease in accuracy to 10%. Over the last two treatment session, accuracy gradually increased to 40% then 60%. Cohen's *d* was utilized to determine if this treatment method was effective for baseline versus the during condition. The effect size seen was 0.42, indicating a small effect in favor of the during condition.

      3.3.2 Nick – Before Condition. The before condition featured the condition change of performing process monitoring before the treatment session. Figure 4 displays the baseline data and the progress Nick made with the before condition. The sound targeted in this condition was the "dg" or "j", /dʒ/. Baseline started at 50% and sharply rose to 100% accuracy during the last baseline session. Initial accuracy for treatment in this condition started at 90%. Despite the student reaching criterion levels, the target was continued because the intervention had begun, and it had to be determined if the intervention had an effect. The next treatment session saw a decline of 90% to 70% accuracy. The last two treatment sessions displayed accuracy of 100%. Cohen's *d* was utilized to determine if this treatment method was effective for baseline versus the before condition. The effect size seen was 0.57, indicating a medium effect in favor of the before condition.

      3.3.3 Nick – During versus Before. Cohen's *d* was used as a comparison of the effectiveness between the two conditions as well. To calculate this, the average of each treatment was used. The effect size seen for

comparison of the two conditions was 1.82, indicating a large effect in favor of
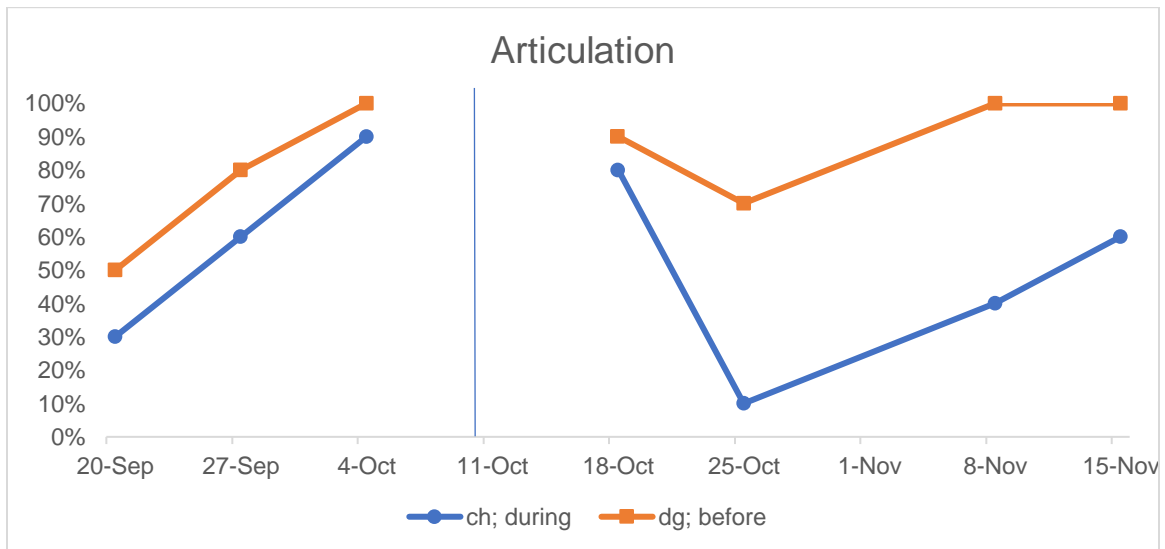
the before condition.

Figure 3.3. Nick

Chapter 4

Discussion

4.1 Overview. To the knowledge of the researcher, this study is the first to study the effectiveness of the timing of progress-monitoring in therapy, especially for that of drill-based articulation and literacy therapy. This study was performed primarily because progress monitoring is used widely in educational settings. And, as noted by Hosp et al. (2007), CBM is important in determining if instruction is appropriate for the student. SLPs use progress monitoring during every therapy session to ensure that their patients are making progress from session to session. For the two male subjects, the traditional method of articulation therapy, as described by Van Riper and Emerick (1996), was utilized as the basis of articulation therapy. This method is not just drill-based; it also stresses that speech perception training is important. The treatment method utilized for spelling was SPELL-Links, a literacy instruction program that encompasses four distinct strategies to improve literacy: phonological, orthographic, morphological, and the mental image properties of words (Wasowicz, Apel, Masterson, & Whitney, 2004). The hypothesis was that the participants of the study would make faster progress with the targets that received a timing change with progress monitoring versus that of typical progress monitoring seen in therapy. To do this, a single subject adapted alternating treatment design (AATD) was utilized to compare different treatment methods

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and determine if one treatment was more effective than the other (Sindelar et al., 1985). In the case of this study, the progress-monitoring timing change was compared for effectiveness. The data collected indicates that the hypothesis was confirmed in 2 of 3 subjects. Although Eric had a no effect between the two goals, Nick and Kasey showed large effects between their two goals in favor of the before condition. This indicates that the timing change worked for these subjects and they were able to progress faster for this target versus the target for which there was no change to the timing of the traditional progress monitoring.

4.2 Participants. It is important to note that only 2 of the 3 participants were able to meet criterion levels for their goals. Eric was able to meet criterion levels for both targeted sounds. Nick was able to reach criterion levels for the target that included the timing change. Nick also made some progress with the goal that did not include the during condition but did not meet criterion. Kasey failed to reach criterion levels for both goals. However, she did show a medium effect between baseline and the during condition and showed overall a large effect between the two SPELL-Links targets.

Although Eric did not show an effect with the treatment differences, he also likely started with a higher skill level than the other two participants. Eric was consistently above 50% at baseline for both targets. Eric had also previously been in therapy for an extended period of time and was further along in the articulation hierarchy compared to Nick. Nick's baseline increased drastically over time; he was also inconsistent during the treatment phase and was not as consistent as Eric was during the treatment phase. Because of Eric's higher skill

level, the timing change may not have shown as much an effect as it did for the other two subjects in this study. Kasey was relatively new in treatment, having only received one semester of treatment before the study. Nick had also only received one semester of treatment. From this, this treatment may benefit those with lower skill levels or are earlier in the treatment process versus those that have better, more established skills.

    4.3 Baseline Stability. The baselines for Nick were not stable. That is, the baselines did not exhibit a flat plane over the course of the 3 baseline sessions. Ideally, stable baselines, unlike those seen in this study, are preferred to determine the effects of an intervention. If an intervention were not given, the baseline would be expected to continue on that same plane of stability. Because of this, the more stable a baseline, the easier it is to determine if the intervention is effective (Engel & Schutt, 2014). Nick's baseline, in contrast, showed an upward trajectory.

    Typically, threats to internal validity are revealed during baseline, because the lines will not be on a flat plane (Engel & Schutt, 2014). Lines that have a trend often reveal that the internal validity of the study has been threatened. During this study, Nick's baseline revealed an upward trajectory, uncovering a potential threat to validity. Recall that Nick was receiving fluency intervention that was not part of the study and occurred simultaneously with the baseline phase. Nick's baseline instability may be explained by carryover effects from the fluency intervention that Nick was receiving outside of the study. Because this theory cannot be confirmed, the other participant who received the articulation

intervention did not have an upward trajectory baseline, and it is likely that a factor external to the study best explains Nick's unstable baseline. The fluency intervention, which focuses broadly on speech production, could have had a positive effect on the production of target sounds during baseline, creating an upward trend. In Nick's case, the carryover effect occurred not during the treatment phase, but the baseline phase from the intervention not in the study. The outside intervention was performed because the student was being treated, and the study was being performed, at the university clinic. If this were a controlled environment, other treatments would not have been performed during this study, thus potentially eliminating carryover effects affecting baseline.

Upon reviewing Nick's baseline, the study team met and decided to move forward with the intervention without a stable baseline. The primary reason for this decision was that the study was performed at a university clinic during regular therapy time, and the parents have a right for their child to receive as much therapy as possible. Unfortunately, the clinic is not a true research setting, and it was decided that the intervention must be initiated because of the setting of the study.

4.4 Timing Change Effects. The author of the study expected the during condition to show some effect for the participants. However, the author did not expect large effects to be shown for some of the participants. Since these therapies are proven to be effective methods of treatment, progress was expected to be made. The authors only expected a somewhat faster progress to be made for the before condition goals. An unexpected result that was seen upon

visual analysis of the charts was the participants seemed to be able to maintain their progress when there were setbacks or dips in the progression of their therapy. Eric showed an interesting movement where during condition dipped below that of the before condition. But, during the next session, the before condition showed a small recovery to stay above or at that of the during condition.

Something else to note in this study that was not considered before the study is that changing the timing of the progress monitoring allows for more consistent therapy. In therapy, progress monitoring measures success while the therapy is being performed. With the before condition, more focus is put toward the therapy and the progress data are collected before the therapy begins as it shows progress made since the previous session.

4.5 Clinician Views. The writer of this study and the other clinician who worked with Nick, believe that the before condition has the potential to be beneficial in the treatment. It was found that the timing change did not hinder the experience of treatment. At first, it was slightly difficult to implement, because the change is not the norm. After the first session, implementation became easier. By end of the treatment sessions for the semester, implementation became more natural and it felt easier for the clinicians to utilize. The therapy was more consistent, and more focus was put towards the student, rather dividing attention between taking data and the student. Both clinicians preferred teaching the timing change condition and felt as if the condition made it easier to perform the

duties as a clinician more fully without sacrificing progress monitoring during therapy.

4.6 Limitations and Future Research. One limitation of this study is that the sample size was small; involving only three participants. Although this was part of the study design, the small sample size may not be a true representation of the populations studied. Another limitation that was discussed early in the process of this study was the lack of research on progress monitoring timing changes. Because of this, as far as the researcher knows, this was the first study to assess the timing of progress monitoring. Another limitation is that one of the students was instructed by another clinician. Because of this, the language used in instruction varied from student to student and could have had an effect on the end results. The students also had varying skill levels because of varying amounts of previous therapy exposure. Future research on this topic should ensure that students have equal amounts of previous therapeutic exposure to eliminate potential skill level bias. Future research should also be in a more controlled environment, to ensure that carryover from external sources cannot occur and will not affect baseline stability. Further research on the effects of the timing of progress monitoring should be performed before implementation of the timing change occurs in a clinical setting. As such, the results of this study should be interpreted cautiously, as this study was the first to address this question. Findings of the study should only be applied to those in these populations and further research is needed on other populations.

Chapter 5

Conclusions

To the knowledge of the authors of this study, this study was the first to investigate the effects of the timing of progress monitoring in therapy, particularly that of articulation and spelling intervention. The effects of the timing of progress monitoring were compared in drill-based articulation intervention and SPELL-Links intervention for spelling to determine if the timing of progress monitoring in these interventions would have an effect on the speed of which students would progress in their therapy goals. Findings were promising and indicated that the timing change may improve the speed of which children will improve their goals. Two of the three participants showed large effects in their goals with timing change compared to the goal without the change and another had a small effect in this comparison. It is therefore concluded that timing change may be beneficial for helping students reach their goals more quickly, as more focus is put towards the teaching, rather than being split with progress monitoring. The two students that showed larger effects likely also had less developed therapy skills compared to the student that showed a smaller effect. However, more research is needed with more subjects and other disorders before the timing changes can be implemented with confidence.

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