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Lessons in a Different Language: Teaching Pre-Service Teachers to "Speak" Data

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Abstract

An undergraduate teacher education behavioral principles course focused on pre-service teachers' accuracy of data collection using simple technology during a field-based experience is described. Pre-teachers, mostly special education majors, completed questionnaires at the beginning and end of the semester regarding whether simple technology (i.e., stopwatch, tally counter, interval timer) impacted data recording and perceived effectiveness. Interrater reliability was randomly assessed across two K-5 locations in which the pre-teachers tutored elementary-aged students in an after-school program. On-campus and on-site data collection interrater reliability results were promising, demonstrating pre-teacher ability to collect data accurately. Conclusions and recommendations for future practices are provided.

Lessons in a Different Language:

Teaching Pre-Service Teachers to "Speak" Data

Teachers today have various policies and procedures which impact their practices. Mandates, (e.g., Every Student Succeeds Act of 2015 and The Individuals with Disabilities Education Act of 2004), require school personnel to adopt a support framework for both academic and behavioral aspects of their programs. Most commonly, multi-tiered systems of supports (e.g., Response to Intervention, Positive Behavior Supports) aimed at providing a quality core curriculum to all students and evidence-based interventions to those who are not showing enough progress are used to fulfill this requirement. Teamwork and data-based decisions are commonplace for both general and special education teachers. Therefore, teachers must know how to collect and interpret data to choose appropriate interventions for students.

Hoover and Patton (2008) reported that special educators' roles within a multi-tiered model are changing to fit this contemporary framework of educating students with and without disabilities. Special educators are now seen as teachers who collaborate, differentiate, and provide evidence-based interventions. They must provide social-emotional and behavioral supports and are key members of data-driven decision-making teams. It is unclear, however, if teachers are prepared for such "data-heavy" roles including decisions that follow.

"Data" is a language that must be spoken and understood by educators. Academic data collection is a task with which most teachers are likely comfortable. Grading daily work and chapter tests are common tasks for educators. For example, a student correctly answered 4 of 5 questions after reading. This data would (1) be recorded and (2) serve as a formative assessment to assist with planning for the next lesson. While teachers may know how to keep accurate and

consistent data for various academic subjects, their ability to generalize this to behavioral data collection is unclear, thus, perceptions of abilities in this area could be lower.

Literature Review

Out of necessity, resources were developed for practicing teachers who need guidelines for behavioral data collection. Lee et al. (2011) outlined steps for teachers to accurately record and analyze data in a timely manner, leaving time for intervention implementation. These steps included (1) scheduling time for data collection, (2) defining the behavior, (3) collecting data, (4) summarizing data, and (5) interpreting data. Gage and McDaniel (2012) also provided a guideline using a data-based decision making (DBDM) model. Described as a "process of collecting, analyzing, reporting, and using data for school improvement" (Dahlkemper, 2002, p. 1), DBDM can be a framework teachers can employ to (1) define the problem and establish criteria for success, (2) acquire a plan, (3) track data, and (4) evaluate data and modify instruction. This model can be used for both academic and behavioral decision making.

Although models and professional development may be available, Simmons and Ellis (2014) brought to light challenges one practicing special educator faced daily. Encouraged to blog while working full-time and taking graduate level course work, Ellis reflected that her biggest challenge as a self-contained teacher was data collection. Specifically, Ellis reported that amongst other responsibilities, dedicating time for data summarization and analysis, and then knowing how to best use the data were difficult tasks. Dedicating time to review and translate data to graphs were ways in which Ellis made better use of data collected, thus resulting in better outcomes for students. Ellis noted that through her graduate course work, she was able to explore how other teachers use data collection, noting her discovery that teachers' use of summarized

data for practical student gains was a challenge. Ultimately, Ellis noted how helpful it was to blog and focus her energies on meaningful data collection and analysis.

While resources and supports are available for practicing teachers, focus on pre-service training may be the key. Lerman et al. (2009) noted that there appears to be a lack of research regarding the accuracy of data collection and the best way to train educators. For pre-service teachers, resources on data collection would, presumably, come from their teacher preparation programs. However, minimal research describes (1) how this type of instruction is presented and (2) the accuracy of pre-service teacher data collection in field settings. This is unfortunate as data collection was described as one of "the most important and useful tools" for an educator (Simmons & Ellis, 2014, p. 521).

Pre-Service Teacher Training

Zimpher and Howey (2013) described teacher preparation programs as inconsistent and lackadaisical. Leko et al. (2012) noted that although these programs can be portrayed in a negative light, extensive preparation programs are available, especially in the field of special education. However, the research conducted to describe these programs and their outcomes has been "scattered in focus and uneven in quality, thus making it difficult to draw definitive conclusions about how high-quality special education teacher training should be conceptualized and implemented" (Leko et al., 2012, p. 3). Thus, centers of pedagogy which expose pre-service teachers to clinical and laboratory learning settings while learning appropriate teaching techniques from qualified faculty must be standards driven and provide academic rigor (Zimpher & Howey, 2013).

Shaw et al. (2013) used training prior to pre-service teacher data collection in their study. They reported the data collection practices of general education pre-service teachers (N=34) in

their final field experience of a 4-year program. Pre-service teachers' ability to record data using an electronic spreadsheet within a clinical experience was explored, as well as their perceptions on various aspects of data collection. Prior to the field experience, participants attended a workshop regarding classroom assessment strategies and data collection. Data were collected using a demographic survey and additional surveys before and after training with a computerized data collection system. Results indicated that pre-service teachers had a positive attitude toward data collection and its importance; yet, while in the classroom, many reported difficulties with the actual collection of data. The authors noted that pre-service teachers had issues with data collection consistency, only taking data for 50% of opportunities provided. This inconsistency was noted whether data collection was traditional (i.e., paper-pencil) or technology based. Although some insight into pre-service teachers' perceptions on the importance of data and how often data were collected, accuracy was not considered.

Research shows that when pre-service teachers enter schools that are using multi-tiered systems of support, skills in communication, collaboration, and data collection are required. These skills are needed to meet the demands of inclusive school settings, such as assessing student behavioral and academic needs and using that information to make decisions regarding interventions and instruction. A clear evidenced-based link has been made between positively engaged behaviors and academic success for students in schools (Rock, 2005; Wagner et al., 2006). To ensure the students' success, pre-service teachers need to be accurate data collectors and interpreters to plan for academic and behavioral strategy implementation.

Role of Teacher Educators

Teacher educators must assume responsibility for instructing pre-teachers collect data efficiently and effectively on Pre-Kindergarten-12 (P-12) students' behavior, to track progress

through data collection, and to analyze such data ensuring educational decisions produce results that reflect the expected outcomes. Pre-service teachers must be proficient data collectors, problem-solvers, and analytic thinkers to be successful in schools where multi-tiered systems have become common practice. One of the ways special education pre-service teachers have been prepared to assess P-12 students' needs is by using systematic direct observations (Riley-Tillman et al., 2007) on target behaviors. Much of this practice and learning to "speak data" occurs in pre-student teaching placements and field-based experiences.

The focus within higher education should be on the forefront of this data-centered world by preparing new teachers to be collaborators in quality instruction across tiers (Brownell et al., 2010) and competent in areas such as data collection, analysis, and problem-solving. As noted previously by Leko et al. (2012), the research available on teacher preparation programs is somewhat "hit or miss." One glaring problem noted by the authors was the lack of studies that have outlined how pre-teachers learn to "speak data."

The purpose of the current study was two-fold. The first purpose was to describe one teacher preparation program's course of study and field-based experience dedicated to data collection. Pre-service teachers were provided the opportunity to engage in such immersion with students (Grades 2-5) both with and without disabilities to aid in the data collection process. The second purpose was to determine the accuracy of pre-service teachers' data collection (systematic direct observations) skills in a supervised field experience using available technologies. Pre-service teachers' behaviors and self-reported perceptions related to technology use, data collection, and data recording were examined. Two research questions guided the current reporting:

1) What are pre-teachers' prior use of simple technology for data collection accuracy?
2) To what extent are pre-teachers capable of accurate data collection?

Methods

Setting and Purpose

A Midwestern, regional state university and two local P-12 partner schools were the settings used for the current study. The university, located in a rural setting, enrolled 9,970 undergraduate and 1,660 graduate students according to fall 2010 statistics. The special education program enrolled approximately 3,427 students the 2010 fall semester of the study. The total undergraduate population was comprised of 42% male and 58% female students. The racial/ethnic group makeup was White/Non-Hispanic (76.5%) followed by Black/Non-Hispanic (11.9%), Unclassified (5.7%), Hispanic (2.9%), Asian/Pacific Islander (1.2%), and Native American (0.5%).

The two local K-5 partner schools were in a neighboring Midwestern town and have served as cooperating schools for several years. For anonymity, the study has identified these two local schools as Elementary School #1 and Elementary School #2. These sister schools, located on opposite sides of town, were constructed using similar floor plans. Both schools have been partnering with the university's special education department to successfully offer after school tutoring sessions for students in Grades 2-5. Elementary School #1 hosted the pre-teachers on Mondays and Wednesdays; Elementary School #2 hosted the pre-teachers on Tuesdays and Thursdays. These schools provide education to approximately 750 students each with racial/ethnic background reported on state report cards as White, non-Hispanic, (88-90%), Black (4-5%), Hispanic (2-3%), Multi-racial/ethnic (2-4%), and Asian/Pacific Islander and

Native American (less than 1%). Over half of the student population (56-58%) was reported as coming from low-income earning families. Over 10%, (i.e., School #1, [13.8%]; School #2, [0.4%]), of the student population were identified as having an Individualized Education Program (IEP).

The initial purpose of this partnership was to provide after school academic assistance to students in second through fifth grades who were identified by their teachers and/or parents as needing extra assistance with homework completion, skill building (e.g., spelling, math facts), and/or reading (e.g., vocabulary, fluency, comprehension). As a part of their Behavior Principles coursework, pre-teachers were assigned an individual or small group of students with which to work. Pre-teachers were responsible for assisting the students with homework and skill building, but also to identify a social or functional behavior to change over the course of the semester (e.g., on-task, following directions). This would then be the foundation for their behavior change project throughout the semester. Although most pre-teachers who take this course have declared a special education major, early childhood pre-teachers with an endorsement of special education may also take this course.

Research Design

The current article is a report of a larger study in which a pre-post survey design and on-site observations made by the first author at the beginning, middle, and end of the semester were conducted. Data analysis included quantitative analysis pre/post means and qualitative analysis of open-ended questions. In-class (campus) data collection observations using the technology was conducted through an interrater reliability in both classes (one day/section). On-site (K-5 school) observations of pre-teacher's data collection and technology use were also conducted through interrater reliability.

Participants

Pre-teachers tutored individual or small groups of Grade 2-5 students (N=87). Participants included 50 pre-teachers made up of 48 undergraduates. Of these 48, 76% had received a high school diploma and 10% had earned an associate degree. There were two post-baccalaureate participants. Of the pre-teachers, 44 were female and six were male. The course could be taken at any time after acceptance in the department, an array of earned university credit hours was recorded. Forty-eight percent of the participants had completed between 61-90 credit hours while 40% had completed over 91 hours. Only two pre-teachers (4%) had 0-30 hours and four (8%) 31-60 hours.

Materials

Video clips from *Systematic Screening for Behavior Disorders: Observation Training* (Walker & Severson, 1994) were utilized on-campus for data collection practice. Further, an instructor-made computer-generated data collection activity sheet for frequency, duration, whole interval, partial interval, and momentary-sampling data collection was used. Simple technology tools included stopwatches (Champion Sports), interval timers (Gymboss GB2010), hand-held tally counters (GOGO), and clipboard-stopwatch-calculator combinations (Ultrax). Pre-post surveys were developed and contained Likert-scale prompts regarding pre-teachers' perceptions of their ability to collect various types of data (i.e., duration, interval, frequency). These also contained open-ended questions, requiring the pre-teachers to identify perceived strengths and weaknesses in their own data collection abilities (pre-) and to identify aspects of the technology which were less useful and more beneficial to data collection (post-).

Procedures and Description of Course

On-Campus

This undergraduate-level course was developed to bridge the gap between theory and practice for pre-teacher's knowledge on applied behavior analysis (ABA) principles. The course was divided into lecture and field-based experience. All pre-teachers attended the same lecture portion of the class for 1 hour and 40 minutes once per week. They were divided into two sections of 50 minute, bi-weekly field experience. Section 1 practicum was held on Mondays and Wednesdays; Section 2 practicum was held on Tuesdays and Thursdays. Pre-teachers learned theories and strategies within the lecture portion of the class, then applied these during a behavior change project in the field-based experience. Participants demonstrated their knowledge and skills at the end of the semester through a research paper and poster presentation of their project.

Prior to the field-experience, pre-teachers attended practicum preparation meetings on campus during their scheduled bi-weekly times. On-campus meetings were held over a 3-week time span. Due to a university observed holiday, Section 1 had four meetings on campus while Section 2 had five. During these meetings, the field experience supervisor for both sections, provided instruction, facilitated discussion, and conducted guided practice activities on defining behaviors in observable/measurable terms. The same procedures were used to teach all data collection methods required for the course: anecdotal, antecedent-behavior-consequence (ABC) analysis, duration, frequency, momentary time sampling (MTS), and interval (i.e., whole, and partial). Matching data collection procedures to observed behaviors were then examined. For example, one would use frequency recording to gather data regarding appropriate turn-taking, but this would not be a viable method to collect data regarding on-task behavior.

Once these topics were introduced, pre-teachers were provided opportunities for in-class practice application. During two class periods, pre-teachers were shown how to use technology

(i.e., stopwatch, tally counter, interval counter) for data collection and were given an opportunity to practice data recording. These were structured and supervised by the first and second authors. A video (Walker & Severson, 1994) was used to provide opportunities to practice data collection. Each video clip included a defined target behavior and a data collection technique (i.e., duration, momentary time sampling, whole interval, partial interval, frequency). The field experience supervisor reviewed each technique with the pre-teachers. Pre-teachers were led through a brief discussion to determine which type of data collection would be most effective for each video clip. Each clip was 3-minutes long. Pre-teachers recorded their data on a practice sheet. Discussion immediately followed each clip. Pre-teachers discussed any technology-related issues (e.g., how to restart or set an interval timer) and their perceptions regarding data collection (i.e., did this data collection method accurately represent the defined behavior?). Practice data recording pages were collected and reviewed by the first author to determine accuracy of data collection at the end of the class periods.

Informed consent from parents was obtained prior to any data recording instruction during the practicum portion of the class. Teacher candidate participants were then given a questionnaire prior to instruction and training with the technology tools. Demographic information was also collected at this time. Pre-teachers were notified that their decision to participate or decline participation would not affect their course grade. Prior to the study, permission was obtained by the administration at both elementary schools to allow the first author to visit each school three times during the semester (six total visits) to collect inter-rater-reliability data on the pre-teachers' data collection.

On-Site (Elementary Schools #1 & #2)

Assigned an individual or small group (i.e., 2-4 students), pre-teachers initially spent approximately one hour interviewing the students' classroom teacher. During this time, the classroom teacher shared information regarding students' strengths and weaknesses. Classroom teachers had been involved with this courses' procedures in previous semesters and were aware of the expectations.

Prior to each tutoring session on site, the field experience supervisor held meetings to reteach, review, and answer questions from pre-teachers regarding defining behaviors and selecting appropriate data collection methods. These lasted approximately 10 minutes. During tutoring sessions, pre-teachers were responsible for providing a tutoring plan which outlined four activities and any materials needed for the 40-minute tutoring session. Pre-teachers were also responsible for providing their own computer-generated data collection sheet. The field experience supervisor provided data collection technology tools at each site.

All pre-teachers were required to write anecdotal recordings during the first 5-6 sessions with their students. At least two of these recordings were then analyzed in ABC form to (1) help pre-teachers define a target behavior, and (2) determine a possible function of the behavior. Pre-teachers were then required to submit a target behavior definition, data collection technique, rationales, and function-based intervention examples they could use to increase the target behavior of one of their students. These materials were collected, reviewed by the field experience supervisor, and suggestions along with correction strategies were offered for consideration before the onset of the candidate's Behavior Change Project. The suggestions and correction strategies were directly balanced with the lectures and discussions that were occurring during regularly scheduled weekly "lecture" class. Pre-teachers were instructed on the principles

and theories of behavior analysis, single-subject design, and target and replacement behaviors. Multiple examples were provided during weekly class sessions.

Pre-teachers collected baseline data for three to five sessions. Once a consistent trend in data was observed, pre-teachers began the intervention phase of behavior change based upon the use of evidence-based positive reinforcement. Intervention phase data were collected for five to eight sessions. From here, pre-teachers either went back to baseline (A-B-A design) for 3-5 sessions, continued in intervention phase through the rest of the semester (A-B design), or went to a second intervention phase (A-B-C design). Pre-teachers were previously taught such design methods within the lecture portion of the class (Zirpoli, 2008). Discussions also included data-based decision making and ethical considerations.

During the beginning, middle, and end of the semester, one week was chosen for visitations to conduct interrater reliability tests at the schools. All consenting pre-teachers' school identification numbers were placed in an envelope according to their section. Prior to each visit, the ID numbers of four pre-teachers were randomly chosen. The behavior definitions of these pre-teachers were then examined to determine which data recording procedures would be viable for an on-going inter-rater reliability check. Pre-teachers who were documenting on-going behaviors, such as on-task or in-seat, and who also utilized a stopwatch, or an interval counter were given preference. Pre-teachers were then made aware that they were selected and were to have an extra computer-generated data sheet for the first author's inter-rater reliability check. When on-site, each chosen pre-teacher candidate was met with (two at each site; for each visit) and discussed his/her recording procedure, how to collect reliable inter-rater data, and if he/she was to be first or second in the rotation. Data was collected with the pre-teachers in 15-minute sessions. Primarily, pre-teachers chose to record on-task behavior. After the entire

tutoring session was completed, a brief data comparison session was held. At the end of the semester, pre-teachers were required to share their Behavior Change Project in two ways: a written report and a public poster session. Pre-teachers outlined their methods, procedures, and results in the written report. Pre-teachers were required to provide peer-reviewed references to support the importance of changing their student's behavior to impact educational performance. They included recommendations for future research. The poster was a visual representation of their paper, and, thus, their behavior change project. For the presentation, an oral explanation was provided by each candidate in a simulation of a professional poster session. Evaluations of the papers and posters were completed, and scores were used as part of the final grades for the completed course.

Results

The main purposes of this study were to explore the perceptions of pre-teachers concerning simple technology to accurately collect data and then to gather data on their accuracy. This study was conducted to add to the current literature base regarding pre-service teacher data collection. Information was also analyzed and used as a guide for curricular changes for one Midwestern special education program.

Perceptions of Technology Use

Prior to the course field experience, pre-teachers were asked to complete a pre-training survey on which pre-teachers were asked to identify (yes/no) if they had collected data prior to this class using a simple technology. If they had, pre-teachers were asked to name the technology used. In a review of the frequency of yes (n=22) and no (n=23) responses with 5 blank responses, pre-teachers were almost evenly split on their reporting of prior data collection experiences. The

simple technology named most often by pre-teachers was the stopwatch; some pre-teachers also used a tally counter.

After the Likert-scale prompts, pre-teachers were asked to circle simple technology utilized during previous data collection and to respond to the prompt: *An aspect of this technology use in my data collection that was less useful was… Why?* As in the pre-survey, the simple technology most often used by the pre-teachers was the stopwatch. However, the pre-teachers identified the tally counter as not being very useful. Some pre-teachers wrote "tally counter" because this was a device that they personally did not use; however, one candidate wrote "… it (tally counter) was easy to tally just with pen and paper." Some pre-teachers indicated that the noise the technologies made were distracting to the students. Predominately, pre-teachers either left this question blank or simply wrote statements such as "I didn't find anything about the technology that wasn't useful."

At the end of the semester, pre-teachers were prompted to answer this question: *An aspect of this technology use in my data collection that was most beneficial was… Why?* Many pre-teachers responded that they perceived they were able to gather more accurate and consistent data. For example, one candidate wrote, "Reminding me every 30 seconds because I often get involved in the activity and lose track of time," and "It (interval counter) was consistent and more accurate." Another candidate wrote, "Consistent data, allowed me to focus more on my student, not on the clock." Other pre-teachers noted that it was beneficial to have the technology keep the time for them, "It (interval counter) kept time for me which gave me the chance to give full attention to my students." Ease of data collection was a third noted theme with specific responses such as "The ease of start, stop, reset," and "It made it easier to collect the data." Another candidate wrote, "(The interval counter) automatically buzzed allowing easy recording."

Having the technology provided by the instructor while on-site was a definite plus for pre-teachers, who otherwise would have had to rely on a wall clock, a personal watch with a second hand, or provide their own device. Others did note that the technology made the data collection process more discrete while others encouraged their students to self-monitor using the devices.

Overall, pre-teachers reported that technology did "help" more than "hinder" their data collection. Pre-teachers again noted that by using a device, their data collection was made easier and, for some, made individuals more conscious of the data collection process. Other pre-teachers wrote that the technology tools seemed to make their data collection more efficient and allowed for more focus on the students. Accuracy within the data collected and time to focus on the students were again noted as why the devices were a perceived "help" over a "hindrance."

Interrater Reliability on Campus.

Before leaving campus, pre-teachers practiced collecting data by using a video simulation. Data were collected using duration, momentary time sampling, whole interval, partial interval, and frequency counts. Practice data collection sheets, which were provided by the instructor, were collected after the simulation. These were scored and checked by two of the authors. However, due to absences, only 46 of the 50 pre-teachers were present for the data collection practice.

To earn a correct score for the interval recordings, each candidate's recording had to match the answer key, interval for interval. Forty-three pre-teachers' momentary-time sampling recordings matched the answer key. Forty pre-teachers' whole interval recordings matched the answer key. In the partial interval recordings, 39 pre-teachers' recordings were correct. Of the 46 duration recordings, 27 pre-teachers' scores were within the ten-second time range pre-set as acceptable by the instructor. Nineteen of these scores were outside of the acceptable time range.

The frequency recordings were somewhat challenging in that pre-teachers were asked to write the frequency of both a positive and negative student response, to figure a rate of positive responses. which would allow them to figure a percentage of positive responses out of a total. To count as a correct response, pre-teachers had to answer correctly for both prompts. Only 24 pre-teachers' answers for positive and negative behaviors were correct, with 22 of pre-teachers answering part or all the video prompt incorrectly.

Interrater Reliability On-Site.

Pre-teachers were randomly selected for an on-site interrater reliability check. Behavior definitions were reexamined to find which pre-teachers were monitoring on-going behaviors (e.g., on-task, in-seat) and, thus, utilizing the technology tools, participated in the interrater reliability checks. These were conducted at the beginning, middle, and end of the semester. Eleven interrater data sets were collected (12 were attempted) with a range of reliability from 77.5% to 100% and a mean of 93.7%. See Table 1 for a summary of all results. For ease of use, the first author and the candidates used the two clocks given within the setting to "set" their timing schedules for data collection.

At Site #1, six pre-teachers were randomly chosen for interrater reliability checks with the first author. Three pre-teachers were collecting data using duration; Candidate A and B were selected, and data accuracy checked at the beginning of the semester. Interrater reliability data were varied for these two cases. Candidate A duration recording was at 11:21 minutes whereas the first author's recording was 14:46 minutes. After discussion with this candidate, it was realized that different start/stop times were used, mainly because the candidate and first author used different clocks. Candidate B used an analog clock at the far side of the tutoring area, which was also used by the first author. Candidate B interrater reliability was at 100%. Candidate C

was selected, and data accuracy checked at the middle of the semester. Interrater reliability was found to be at 99.9%, with the first author's recording being two seconds shorter than that of Candidate C's. Whole interval recording was employed by both Pre-teachers D and E. To complete the check at the middle of the semester, Candidate D interrater reliability was found to be at the 93.3% level. One interval was different between the candidate and the first author (+14/15 interval agreement); it was found that the pre-teacher had actually stopped data recording as she assisted a student with a homework related task. Candidate E also used whole interval recording but was checked for interrater reliability at the end of the semester. Interrater reliability was found to be at 95% (19 of 20 intervals in agreement). It was found that a student behavior occurred simultaneously with the buzzer sound to indicate time for the next interval causing both data collectors to record differently. The final candidate from Site #1, Candidate F, employed a latency recording of following directions and was checked at the end of the semester. Interrater reliability was at 100%; however, it should be noted that this was the last day on-site for the pre-teachers. Neither Candidate F nor the first author observed the student hesitate to follow any directions.

At Site #2, six randomly chosen pre-teachers were selected for interrater reliability checks with the first author (see Table 1 for individual results). As with Site #1, three pre-teachers were collecting data using duration; Candidate G and H were selected, and data accuracy checked at the beginning of the semester. Interrater reliability data were similar for these two cases. Candidate G duration recording was at 9.50 minutes whereas the first author's recording was 10.23 minutes. As with Candidate A at Site #1, the use of the analog clock at the far side of the tutoring area was an issue with accuracy between data collectors. Also, the first author had to stand further away from the student as to not create a distraction; the first author

noted that it was difficult to hear Candidate G's exchanges with the target student at times. Candidate H also used the analog clock at the far side of the tutoring area. Candidate H interrater reliability was at 91.6%, with the candidate recording on-task behavior for 8.38 minutes and the first author recording 9.15 minutes. Both data collectors noted that the student's off-task behavior occurred quickly and did not last long. Candidate I was selected, and data accuracy checked at the middle of the semester. Interrater reliability was found to be at 95.3%, with the candidate's recording being 26 seconds longer than that of the first author. Upon discussion with Candidate I, it was noted that she felt the student was "spacing out" and was not on-task. This was determined to be an issue with the candidate knowing and working with the target student more than the first author. Candidate J used latency recording and was found to be in 85.9% agreement with the first author's data recording. Unfortunately, Candidate K data collection was invalid. The first author was told that the target student would sit across from the candidate and, on this day, an additional student happened to be in attendance during the tutoring session and sat across from the candidate. Candidate K did not feel she was able to notify the first author of the mismatch of students without creating an issue with the students (i.e., possibly creating inappropriate responses/behaviors). Due to the nature of randomization, Candidate G happened to also be chosen for interrater reliability at the end of the semester. Therefore, this candidate is also Candidate L. Again, duration recording was used to determine the student's on-task behavior. Interrater reliability was at 100%.

Discussion

With the current emphasis on multi-tiered support systems, the special education teachers' ability to collect accurate and consistent data is an important skill to master. Special educators must discuss data with confidence and know their analysis and decision-making are

professionally-sound. Pre-service teachers, as a part of their coursework and preparation, must have the opportunity to not only learn various data collection techniques, but to also use simple technologies that would assist in the data collection process.

Two research questions that guided this study concerned pre-service pre-teachers' perceptions of using technology during data collection. There were increases in pre-teachers' perceptions of their knowledge and skills from the beginning to the end of the semester. Special education teacher preparation programs should take notice that practice and training does make a difference in candidate perceptions.

It should be noted that each candidate was required to select a target behavior in one elementary-aged student and define his/her own data collection technique. Therefore, on-site, pre-teachers were responsible for data collection on one target behavior and used one of the following techniques: frequency, duration, latency, or an interval method. This is meaningful because only on campus did the pre-teachers get to practice with all the technologies and utilize all the data recording techniques, yet the pre-teachers overwhelmingly perceived the use of technology as beneficial in their own specific data collection technique. Pre-teachers noted that they perceived their data to be accurate and consistent, which are two key components that would be helpful in a team-based problem-solving system. Other pre-teachers noted that it was useful because the devices "collected the data for them" in such a way that they were able to collect data yet keep focus on their students. Teachers often note that data collection is difficult because of the other demands found within the classroom setting. Burns et al. (2012) observed that data collection in the classroom puts high levels of demand on the teacher, who is often fulfilling many roles -- "a plan that may have a very low probability of implementation and maintenance" (p. 39).

Most pre-teachers did find that the use of technology helped in the data collection process more than it hindered the process. Pre-teachers noted the accuracy and ease in data collection made possible by the device utilized were important to their project. The technology did not seem to take pre-teachers' attention away from their students and activities; quite the opposite was reported. Teachers may worry that devices brought into the classroom are a distraction or may become a "toy," yet the pre-teachers in this study reported more focus and even discovered that the tools could be used to encourage student self-management.

How reliable is pre-service teacher candidate data collection versus their perception of their ability to collect data? It was found that pre-teachers did take accurate data while on campus and on-site. Although the duration and frequency recording accuracy were low on campus, pre-teachers demonstrated more accuracy with MTS, whole interval, and partial interval recordings. This experience in data collection seemed to impact candidate accuracy while on-site. Although only 11 interrater opportunities were available, the mean accuracy was above 90%. Briefings with the pre-teachers immediately following the data collection were also meaningful. Conversations regarding perceived difficulties with data collection for that specific day were reviewed. Celebrations were heard when data were the same, but more importantly when there were discrepancies, a discussion as to why would take place. It was noted that candidate use of an analog clock on the far side of the room was a challenge. This follow-through should be noted by other teacher preparation faculty and teacher trainers because accuracy in data recoding is key to behavior change in P-12 students. As Patrick (2012) observed, "data should be as accurate, truthful, or reliable as possible for if there are doubts about their collection, data analysis is compromised. Interpretation of results will be faulty that will lead to wrong conclusions" (p. 1).

Limitations

The generalization of the results of this study are limited by small sample size, a shortened time frame, and the implementation of only one type of data collection in which technology was an option. As this was a University course, the participant number was limited by those who had registered for the course. This was further reduced by those for whom low tech was an appropriate method of data collection. Results were further limited to a 30-minute data collection time twice a week. The after-school program schedule itself only allowed for 12-weeks of teacher candidate data collection. Pre-teachers practiced only one form of data collection within their single-subject design based on the behavior defined and need of the target student.

Limited opportunities for interrater reliability measures on site were had due to number of pre-teachers and the shortened timeframe. This was illustrated with data collection of both Pre-teachers K and L. With Candidate K, an additional student was in attendance the day of data collection. The candidate did not feel as if she would communicate this with the first author prior to data collection without creating an opportunity for the students to be off task. Once a candidate's identification number was chosen, it should not have been put back in the pool. Due to this, one candidate was accidentally chosen twice (Candidate G is also Candidate L). However, this did provide an opportunity to follow-up with the same candidate to ensure data collection was still at a high level.

Recommendations

Based upon the data analysis and limitations, several recommendations for further research and teacher preparation programs can be made. First, increasing the number of minutes per week of teacher candidate and P-12 student face time should be studied to provide more

information regarding teacher candidate perception and actualization of quality data collection. The same could be said for increasing the number of weeks for data collection.

As instructional and interactive technologies expand, pre-teachers need opportunities to practice appropriate data collection. Although the study setting was based within public schools, it was an after-school program. Pre-teachers need the opportunity to practice both low-tech and high-tech data collection techniques within a classroom setting while instruction is occurring. This practice would be beneficial prior to pre-teachers' final student teaching experiences. Since special educators teach and provide services across many settings, pre-teachers should also be afforded that practice prior to graduation and certification. Practice and training are key to accuracy.

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Table 1

Data Collection Accuracy

PRE-TEACHER	LOCATION	DATA COLLECTION METHOD	TIME OF SEMESTER	INTERRATER RELIABILITY
PRE-TEACHER A	Site 1	Duration	Beginning	77.5%
PRE-TEACHER B	Site 1	Duration	Beginning	100%
PRE-TEACHER C	Site 1	Duration	Middle	99.9%
PRE-TEACHER D	Site 1	Whole Interval	Middle	93.3%
PRE-TEACHER E	Site 1	Whole Interval	End	95%
PRE-TEACHER F	Site 1	Latency	End	100%
PRE-TEACHER G	Site 2	Duration	Beginning	92.9%
PRE-TEACHER H	Site 2	Duration	Beginning	91.6%
PRE-TEACHER I	Site 2	Duration	Middle	95.3%
PRE-TEACHER J	Site 2	Latency	Middle	85.7%
PRE-TEACHER K	Site 2	Momentary Time Sampling	End	*error in target student identified
PRE-TEACHER L	Site 2	Duration	End	100%