Learning Disabilities: A Contemporary Journal 15(2), 239-248, 2017

The Effects of a Modified Direct Instruction Procedure on Time Telling for a Third Grade Student With Learning Disabilities with a Brief Comparison of Interesting and Boring Formats

Adrianne Essex Wieber
Katie Evoy
T. F. McLaughlin
K. Mark Derby
Ethyl Kellogg
Randy Lee Williams
Gonzaga University; USA

Stephanie Marie Peterson
Western Michigan University, USA

Lisa Rinaldi
Spokane Public Schools, USA

We designed and implemented a modified eight-week Direct Instruction (DI) program intended to teach a third grade student with learning disabilities to tell time. The first objective was to determine whether or not the appearance (interesting or boring) of the worksheet affected performance. These data suggested the use of large-scale clocks and an emphasis on oral instruction resulted in better performance. Finally, the results from a pre-test indicated that many of the prerequisite skills needed for telling time were not firm with our participant. When a modified DI procedure was implemented, these skills were mastered quickly. The overall effect size for our use of DI for telling time indicated that the intervention was highly effective. It appears that the use of DI procedures was far more important than the interest of the materials.

Keywords: **Direct Instruction Math, Multi-Element Design, Telling Time, Learning Disabilities**

Introduction

The skills of being able to correctly tell what time it is, remains an important skill in the lives of children from the preschool years onward (Freedman & Laycock, 1989). When children first enter school, they are always curious about time. The teacher is confronted with questions such as: "What time does the school bus come? What time is lunch? What time is recess? When do we get to go home? When is art?" Another aspect of time telling in the lives of children is duration of events (knowing baseball practice is two hours: from 4:00 p.m. until 6:00 p.m.). Clocks are available in almost every classroom, so eventually the students should learn to rely on themselves rather than the teacher for telling time. Today digital clocks are more widespread, so some children might think that they do not need to know analog time. In reality, both

*Please send correspondence to: T. F. McLaughlin, PhD, Department of Teacher Education and Special Education, Gonzaga University, 502 E. Boone Ave., AD Box 25, Spokane, WA 99258-0025, USA, Phone: 509-313-3508, Email: tim.mclaughlin6@comcast.net.

ways of telling time are important to become an independent individual in society (Thompson, Wood, Test, & Cease-Cook, 2012).

The opportunity to learn is conceived of as having two major dimensions: the amount of exposure (which includes enrollment, rate, and length) and the quality of exposure (which includes intensity and accessibility) (Kilgore & Pendleton, 1993; Thompson et al., 2012). Some have postulated that repetition is the key to learning. For example, a child who works on time five days a week will likely acquire the necessary skills faster and retain the skills longer than a child who works one day and skips two days. Time telling consists of continuous exposure to clocks. This exposure is available in many different forms, for example in the classroom and at home. The exposure also takes many different forms, for example: wristwatches, enlarged learning clocks with moveable hands, sun dials, etc. In one study, students learned to tell time through classroom and playground activities that involved use of a clock face made of cement stones built into the school's playground (Moyer, 1988). The above examples show why realistic exposure, such as watches and clocks, should also be included while the time telling learning process is taking place.

Direct instruction (DI) is a comprehensive set of prescriptions for organizing instruction so that students acquire, retain, and generalize new learning in a humane, efficient and effective manner as possible (Marchand Martella, Slocum, & Martella, 2004; McLaughlin, Williams, Howard, & Reyes, 1995; Silbert, Carnine, & Stein, 1981, 1990, 1997, Stein, Kinder, Silbert, & Carnine, 2005). Time telling is difficult to learn due to the number of skills that need to be acquired, for example, telling the time to the hour, to the minute, to the half hour and quarter hour, and minutes before the hour, etc. For DI, students are taught a strategy in three stages for figuring out the time. These stages were learning (a) to express minutes after the hour, (b) alternate ways of expressing time as after the hour; and (c) learning to express minutes before the hour. This is a good way of breaking down the skills so students do not feel overwhelmed by the material (Silbert et al., 1997).

As teachers, we should focus a great deal of classroom time on DI, guided practice, core courses, and applications to the real world (Marchand-Martella, Slocum, & Martella, 2004; Massey-Wilson, 1995). People have been impressed with the results of using DI for learning time telling skills. However, in some cases it may not be appropriate to exactly follow the DI methods for teaching telling time. DI, therefore, takes on different characteristics, depending on the type of student being taught and the lesson objective (Silbert et al., 1990, 1997). With the objective of learning time telling skills, DI allows for variation in the instruction while maintaining positive results (Silbert et al., 1981, 1990, 1997).

The first purpose of this study was to employ a functional assessment analysis (FBA) (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994) in the classroom to determine whether boring or interesting lesson formats were the most effective. A second purpose was to determine the effects of an adapted DI (Stein et al., 2005) procedure on telling time by a third grade boy. The authors believed learning to tell time was socially relevant and therefore, implemented in the present case study. A final purpose was to provide a replication (Jasny, Chin, Chong, & Vignieri, 2011) of employing DI pedagogy for telling time. Replication provides the building blocks for

providing educators confidence in employing their teaching procedures (Jasney et al., 2011; Kazdin, 2011; McLaughlin, 1983).

Method

Participant and Setting

The subject in this study was a third grade boy, called Joe (name changed for confidentiality). Joe was viewed by his special education teacher as a child who needed to learn to tell time. The participant met the state and federal guidelines for learning disabilities. He was also viewed as disruptive by his general education teacher. The study was conducted in an elementary school resource room in a large urban school district in the Pacific Northwest.

The classroom teacher was a graduate of a local university and was certified in general and special education. These data were collected to verify the skills of the first two authors in changing an academic behavior. This program has been described elsewhere (McLaughlin, B. Williams, R. Williams, Peck, Derby, & Bjordahl 1999).

Pretesting

Prior to the beginning of the study, Joe was given a written time telling test consisting of 13 questions. Each question covered a different sub-skill of telling time (ranging from counting by five's to writing the time in quarters). Joe scored zero percent on this pretest. These results strongly suggested Joe had no time-telling skills.

Response Definition and Measurement Procedures

Responses were measured by counting correct and incorrect on the time telling questions. Responses were recorded on a data sheet and orally. For each oral session (Phase 2), Joe received a plus for answering correctly 75 percent (or higher), and a minus for answering incorrectly less than 75 percent of the time. These data were then plotted on a standard celeration chart (Lindsey, 1991) and the traditional line graph.

Corrects were defined as saying and/or writing the time that matched the time on the clock. The number of opportunities ranged from 10 to 25 each session. This was divided into the number of correct responses by the number of correct and errors to see if the corrects were at least 75% or greater. Incorrects were defined as saying and/or writing the time that did not match the time on the clock. The number of opportunities varied each session.

Reliability of Measurement

Reliability was calculated on six randomly selected sessions out of the total of 18 instructional sessions. For baseline and modified DI, the researchers took reliability by rescoring the worksheets completed by our participant. The instruction worksheets were scored independently by using a plus and minus system (plus being correct and minus being incorrect). These were compared and an agreement constituted one researcher having a plus and the other having the same making. Any deviation in scoring was defined as a disagreement. The formula for finding inter-observer reliability was: Agreements divided by agreements plus disagreements multiplied by 100. Inter-observer agreement was 100% for these 6 sessions.

Experimental Design and Experimental Conditions

An alternating treatments and multiple baseline design (Kazdin, 2011; McLaughlin, 1983) across skills was implemented by the researchers into two phases. During phase one an alternating treatments design was used to compare the effects of boring and interesting worksheets. The alternating treatment design was embedded within a multiple baseline design across the prerequisite skills of: determining which way the hands go (clockwise), distinguishing the minute from the hour hand, and counting by 1's/5's. During phase two, a multiple baseline design across time telling skills (determining the hour, telling time to the five minute, and telling time to the minute) was used.

Boring vs. Interesting Worksheets (Phase 1)

Baseline. Over three days, the first two authors used two styles of worksheets: boring and interesting. The researchers thought one or the other style might impact Joe's performance. Both a boring and an interesting worksheet were given to Joe at the same time and he was allowed to choose which one he would complete first. The boring worksheet consisted of fifteen clocks, all the same size and in line with one another. The interesting worksheet consisted of 15 clocks, all the same size all over the page with pictures of sports equipment and words. The pictures of sports equipment and words were spread out across the page, with clocks around and in front of them. Both consisted of 15 problems, five from each skill area listed above. Our data indicated that boring versus the interesting made no impact on Joe's performance, so this analysis was eliminated.

Instruction. The use of DI (Silbert et al., 1980) began on the fourth day with the first prerequisite skill of determining which way the hands move. The researchers used oral instruction with the white board. The researchers had Joe fill in the numbers of the clock in the blanks provided. For example, a clock would be drawn with the numbers 12, 3, 6, and 9 already placed in the correct blank, and Joe would write in the rest of the numbers. He was prompted and feedback was given. On day five the same procedure was implemented with the second prerequisite skill of distinguishing the minute from the hour hand. On a white board the researchers drew a blank clock with an hour hand and a minute hand that extended outside the clock (to make it more obvious that the minute hand was the longer hand). The first two authors would point at the minute hand and say: "The longer hand is the minute hand. What hand is the minute hand?" Joe would reply. This was repeated for the hour hand using the word *shorter*. A short review was given about the previous day's instruction. On day six the same procedure as above was implemented. The researchers used a white board and instructed Joe to point at the twelve and say: "Zero", to point at the one and say: "Five", etc. until he reached sixty. He mastered all three prerequisite skills in the three days of instruction, so the researchers returned to baseline to determine the next three skills.

Telling Time (Phase 2)

Baseline. Over the next three days the researchers used worksheets with eight clocks showing the time to the hour, five-minutes, and one minute. Joe was instructed to write the time under each clock. No prompts or feedback were given.

Instruction. On day 10, the skill of telling time to the hour was taught. The researchers followed the DI method for teaching this skill. On the white board, the researchers drew a clock with the time to the hour. Joe responded orally and the researchers wrote down his response. Instruction for this skill lasted for two sessions. On the next day of instruction telling time to the five minute was taught. Again, the researchers presented a clock with the time in five minute intervals. The same procedure for counting by five's was used. The instruction for this skill continued for four sessions. Telling time to the minute was the last skill the researchers taught. The same procedures were used and instruction lasted for four days. Throughout instruction, skills previously taught were also reviewed to solidify learning.

Results

Boring vs. Interesting Work Sheets (Phase 1)

The baseline in phase 1 for the first skill of telling which way the hands go showed increased from 20 to 80% correct using boring worksheets. When using the interesting worksheets, there was a 40% reduction in accuracy, and then an increase to 100 percent for the same three sessions. Instruction on the skill of telling which way the hands go began on day 4 with 100 percent accuracy, and remained at this level for the duration of the condition.

Baseline for the second skill of distinguishing the minute from the hour hand was low over three sessions for both the interesting and boring worksheets (0.0%). When DI was employed with this skill an increase from 0% to 100% was found. This high performance was maintained for two sessions.

Baseline for the third skill of counting by five's was low (0.0%) for both the interesting and boring worksheets. When DI was employed an increase in performance was found. Perfect performance was noted on the last session for the third skill.

For the boring worksheets, the mean correct was 73.3% ranging from 0 to 100%. For the interesting worksheets, the mean was 80% (range 0% to 100%). Since there was little difference in Joe's performance on the boring versus interesting worksheets, the researchers continued written worksheets that had been labeled as boring, since they were easy to produce and employ with our participant.

Telling Time (Phase 2)

Visual Analysis. Baseline for skill one of telling time to the hour was 0.0% for three days (See Figure 1). During DI, Joe earned a plus on the data sheet (75% or more correct); he had a five percent increase. There was a cumulative increase of Joe's performance over 15 sessions. For the skill of telling time to the five minutes, Baseline was in effect for five sessions. Instruction for this skill began on session six. The graph shows a cumulative increase in Joe's performance over 13 sessions of instruction. For the skill of telling time to the minute, Baseline was in effect for eight sessions. Instruction for this skill began on session nine. A cumulative increase in Joe's performance was noted over the duration of this condition.

Figure 1. **The percent correct during boring (closed squares), interesting (closed triangles) instruction (closed circles) in baseline and during Direct Instruction by skill.**

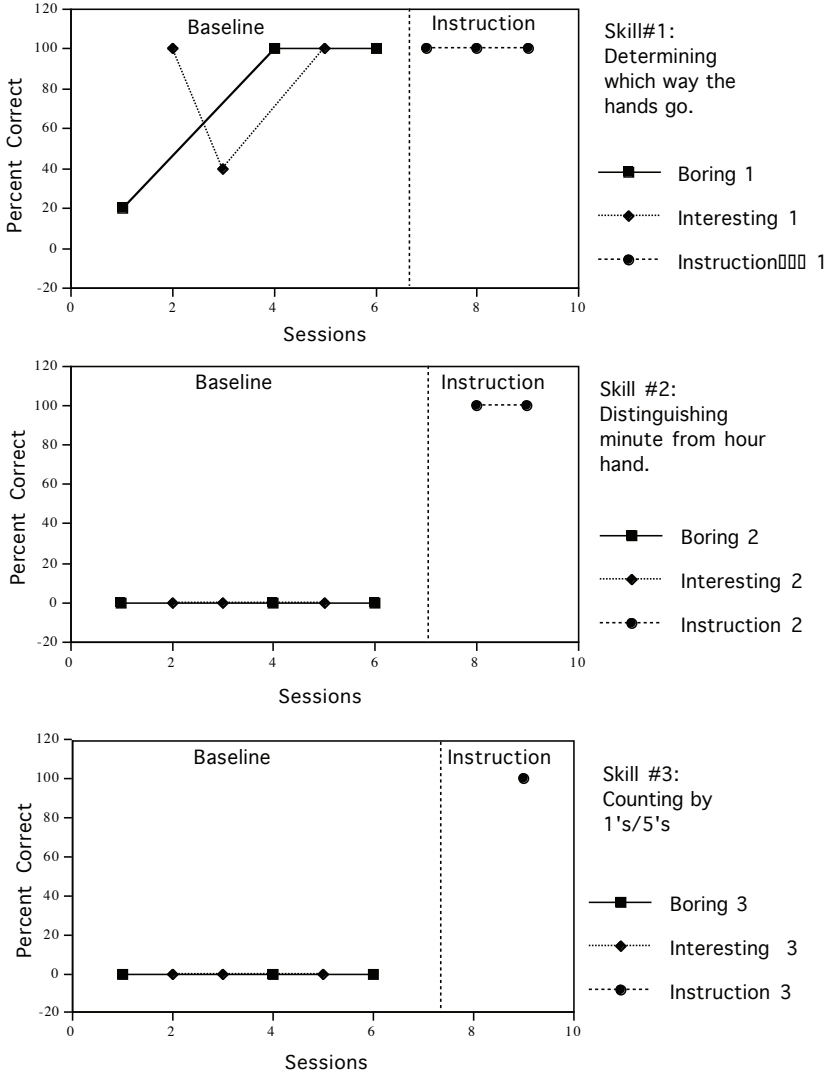
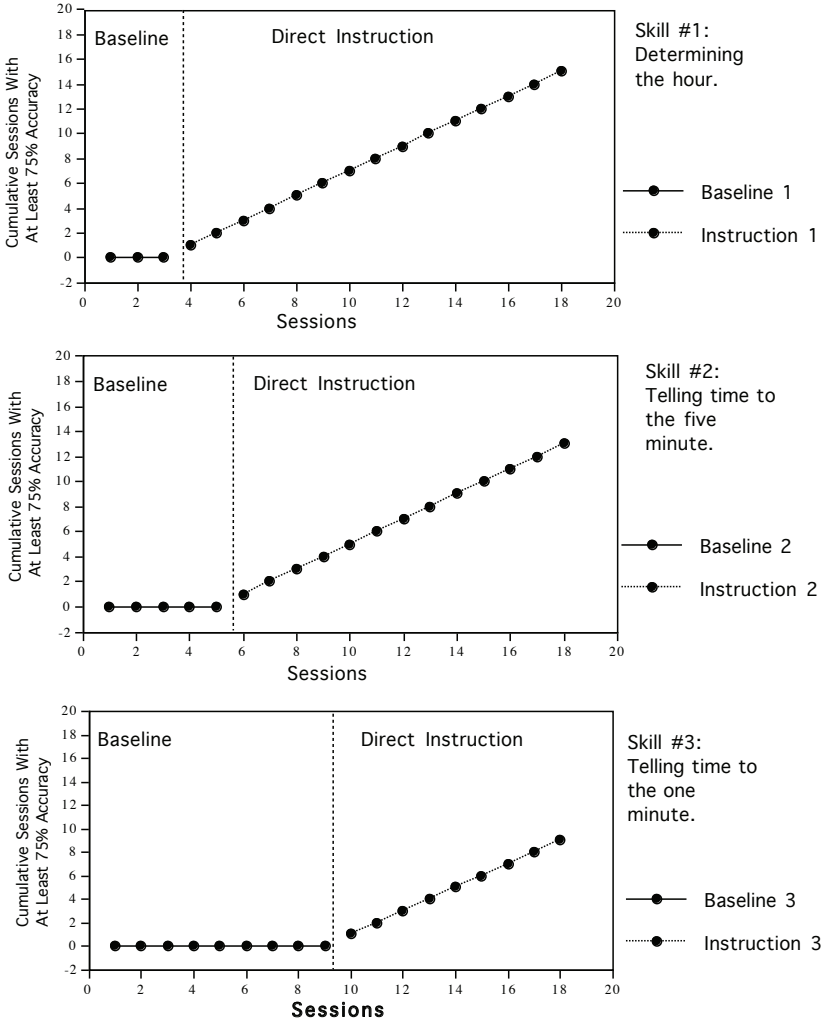


Figure 2. **The cumulative number of sessions with 75% accuracy or greater.**



Over the three skill sets, Joe received a plus for every day of instruction. Therefore, our graphs show a five percent increase for every session. The median and mean for all instruction in Phase 2 was 100%.

Effect Size Calcualtion. Finally, the percent of non-overlapping data points determined the effect size between baseline and instruction for telling time. For all three comparisons, there were no overlapping data points (Scruggs & Mastropieri, 2001, 2013, Scruggs, Mastropieri, & Casto, 1987). This would indicate that DI was highly effective for teaching telling time.

Discussion

Our participant's skills in telling time using DI time improved significantly. Data in Figure 2 indicate a functional analysis between the use of DI and results on telling time. Daily one-on-one instruction may have also been a vital aspect in this study. Joe was provided undivided attention for the duration of each session. This may have also contributed to the steadily improvement and mastery of each skill.

Through gradual steps set forth in the DI texts (Silbert, 1981, 1990, 1997), Joe mastered each telling time skill. Now, Joe will not constantly be asking people what time it is. He is now able to look at his own watch and the wall clock and tell the time. The time telling instruction, besides being very effective, was also very practical in terms of time, money, and effort. Other authors such as Moyer (1989) have also urged instruction in telling time for children with learning disabilities.

Since Joe enjoyed being in the resource room at his school, the first two authors conducted their sessions in that setting. Each session was about a half hour to an hour in duration. Usually, this time did not interrupt Joe's normal daily routine. When Joe and the researchers worked together, his general education classroom was having independent reading time. Thus, Joe never missed class instruction in his general education class. During the sessions, the only materials necessary were the DI text, a white board, marker, and paper and a pencil. Thus, the study was very cost effective: the only costs were those from the copy machine used to make the worksheets. In terms of time in instruction, Joe acquired each skill rather quickly, and little extra time was needed. Also, the authors meet once per work discuss Joe's progress. Therefore, the time involved in teaching time-telling to Joe was minimal.

The first two authors began with the idea of comparing the interesting and boring worksheets on telling time. After discovering Joe was interested in sports, the researchers used pictures of sports figures, ideas, etc., in hopes of increasing his performance. These items were spread out over the paper, around and behind each clock. After doing this for 3 sessions, the researchers realized it had no effect on his overall performance. However, because Joe was able to work on the worksheet of his choice, i.e. boring and interesting, he consistently performed better on the second sheet. We felt this was due to the fact he used the first sheet as practice. Therefore, the use of brief functional analysis procedures in academic settings was of use.

Due to Joe's low performance on the pretest, the first two authors began with the simplest of the pre-skills, believing that he had no time telling skills. As it turned out, Joe caught on very quickly. Since he moved so quickly, it left little time for the researchers to discuss the next steps. Since he picked the skills up so quickly, he became bored with our original method of strictly following the DI math text. Therefore, a modified DI format was employed.

Due to the academic calendar, Joe was not able complete all the lessons that the DI text and materials indicated should occur. Thus, the researchers began using the white board as the key method for teaching time. Having the first two authors say a sentence, Joe say a sentence, and then asking him to repeat what he said was eventually dropped. The pointing and counting were also later removed from our teaching procedures. The format of our teaching procedures also varied. At times, both a combination of oral and written questions and answers were employed. The first two authors felt this approach facilitated learning at a quicker pace. Consequently, it

should be noted that a modified DI methodology was used for teaching time-telling skills with this student.

Joe's performance appeared to be highly influenced by his motivation each day. Some days he would do extremely well and on others he simply did not want to do the time skills. The researchers believed this had a lot to do with his homeroom class. The researchers noted that Joe often engaged in inappropriate behavior as a means of escaping from difficult work in his classroom. It appeared having a good day in his classroom resulted in his doing well on his time telling program. At the same time of the instruction, a program for improving Joe's social behavior was being implemented. Upon implementation of this change by the special education teacher, Joe's behaviors improved in all areas.

When the authors became aware of Joe's interest in sports and used this as a non-contingent way of adding fun into the instruction. On an average of once a week, one of the researchers played tetherball with him. Also, he received edibles and was able to invite his friends into the resource room to blow bubbles and write on the board at the end of certain sessions. The researchers were pleased to observe that the resource room was a rewarding place to be for Joe and all of the students being served in that special setting.

It is hoped that Joe will maintain his recently mastered skills. Hopefully, Joe's other teachers and parents will encourage Joe to tell the time on his own and give him the practice he needs. The researchers plan to ask Joe's resource room teacher to occasionally conduct a time-telling lesson with Joe, or allow him to be present at one. That way, Joe may maintain his skills and develop them further. Just as Moyer (1989) recommends, we would want Joe to take his skill for telling the time on clocks on paper and the white board, and apply them to clocks on walls and wrists. Finally, the present case report provides an additional replication (Jasny et al., 2011) as to the efficacy of employing DI as well as applied behavior analysis. The use of the brief functional assessment was able to determine that the format of presenting the materials was not related to whether the format was boring or interesting.

References

Friedman, W., & Laycock, F. (1989). Children's analog and digital clock knowledge. *Child Development, 60,* 357-371.

Heward, W. L. & Alber-Morgan, S. R., (2016). *Teaching exceptional children: An introduction to special education* (11th ed.). Upper Saddle River, NJ: Pearson.

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K.E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, 27, 197-209. (Reprinted from *Analysis and Intervention in Developmental Disabilities, 2,* 3-20, 1982)

Jasny, B. R., Chin, G., Chong, L., & Vignieri, S. (2011). Data replication & reproducibility. *Science, 334,* 1225.

Katz-Sulgrove, M., Peck, S. M., & McLaughlin, T. F. (2002). The effects of code- and meaning emphasis in beginning reading for students with mild disabilities. *International Journal of Special Education, 17*, 65-83.

Kazdin, A. E. (2011). *Single case research designs: Methods for clinical and applied settings* (2nd ed.). New York, NY: Oxford University Press.

Kilgore, S., & Pendleton, W. (1993). The organizational context of learning: Framework for understanding the acquisition of knowledge. *Sociology of Education, 66*, 63-87.

Lindsley, O. R. (1991). Precision teaching's unique legacy from B. F. Skinner. *Journal of Behavioral Education, 1*, 253-266.

Lindsley, O. R. (1992). Precision teaching: Discoveries and effects. *Journal of Applied Behavior Analysis, 25*, 51-57.

Marchand-Martella, N. E., Slocum, T. A., & Martella, R. C. (Eds.) (2004). *Introduction to direct instruction.* Boston, MA: Pearson.

Massey-Wilson, J. (1995). Fill every unforgiving minute: A few changes helped this school district devote more time to academics. *American School Board Journal, 182*, 43-44.

McLaughlin, T. F. (1983). An examination and evaluation of single subject designs used in behavior analysis research in school settings. *Educational Research Quarterly, 7*, 35-42.

McLaughlin, T. F., Williams, B. F., Howard, V. F., & Reyes, R. (1995). Data-based and effective classroom procedures to assist Native American children with fetal alcohol syndrome and fetal alcohol effects. *Corrective and Social Psychiatry, 41*, 42-51.

McLaughlin, T. F., Williams, B. F., Williams, R. L., Peck, S. M., Derby, K. M., Bjordahl, J. M., & Weber, K. M. (1999). Behavioral training for teachers in special education: The Gonzaga University program. *Behavioral Interventions, 14*, 83-134.

Moyer, M. M. (1988). Let's teach time-using as well as time-telling. *Academic Therapy, 18,* 453-456.

Scruggs, T. E., & Mastropieri, M. A. (2001). How to summarize single-participant research: Ideas and applications. *Exceptionality, 12,* 227-244.

Scruggs, T., & Mastropieri, M. A. (2013). PND at 25: Past, present and future trends in summarizing single subject research. *Remedial and Special Education, 34*, 9-19.

Scruggs, T. Mastropieri, M. A., & Casto, G. (1987). Summarizing single case research: issues and applications. *Behavior Modification, 22*, 221-242.

Silbert, J., Carnine, D., & Stein, M. (1981). *Direct Instruction mathematics.* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Silbert, J., Carnine, D., & Stein, M. (1990). *Direct Instruction mathematics:* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall, Inc.

Silbert, J., Carnine, D., & Stein, M. (1997). *Direct Instruction mathematics* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall, Inc.

Stein, M., Kinder, D., Silbert, J., & Carnine, (2005). *Designing effective mathematics instruction: A direct instruction approach* (4th ed.). Upper Saddle River, NJ: Pearson Education.

Solis, T., Derby, K. M., & McLaughlin, T. F. (2003) The effects of precision teaching techniques and functional communication training on problem behavior of a 12-year-old male with autism. *International Journal of Special Education, 18*, 49-54.

Thompson, J.; Wood, C. L.; Test, D. W.; & Cease-Cook, J. (2012). Effects of Direct Instruction on telling time by students with autism. *Journal of Direct Instruction, 12,* 1-12.