

INCREMENTAL REHEARSAL

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Introduction

“Our classrooms are filled with students and adults who think of mathematics as rules and procedures to memorize without understanding the numerical relationships that provides the foundation for these rules” (Parrish, 2010, p. 4). Number sense is an important skill for elementary students to master in order to be successful throughout their educational lives. In the following paragraphs, the importance of number sense and multiplication facts, the definition of incremental rehearsal (IR), the advantages of IR, the disadvantages, and other considerations will be discussed.

Importance of Number Sense and Multiplication Facts

Jody Blessen, an elementary principal and experienced upper elementary teacher of twenty years, stated that number sense and multiplication facts are huge stepping stones for students to understand in order to be successful in math. She said that without these skills, students are likely to fail and be unsuccessful in their academic life, leading to unfortunate lives outside of school after graduation. As a teacher, she ensured that her students knew their multiplication facts by using the program called Rocket Math. This program was a repetitive multiplication system where the students were exposed to basic multiplication facts daily (J. Blessen, personal communication, December 13, 2017).

“Mastery of math facts allows the student to focus on other critical components when solving more advanced math problems, such as story problems, and is imperative for success in K-12 math” (Skarr, 2014, p. 78). Fact mastery is a foundational skill for students so they can build on their knowledge. Without the foundation, students will not understand the lessons and skills that are needed for more difficult math equations and

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problems. The National Council of Teachers of Mathematics “listed computation as a goal for mathematics instruction, and failure to rapidly recall basic facts a characteristic often associated with mathematics disabilities” (Burns, 2005, p. 238).

Ms. Blessen mentioned that she would be extremely concerned if students entered her classroom without knowing all of their multiplication facts (J. Blessen, personal communication, December 13, 2017). In another article, the authors write, “Children should master all 100 multiplication facts by the end of third grade or early fourth grade” (Skarr, 2014, p. 78). They made this conclusion because of the standards and critical skills that are needed to be taught and mastered during these grades and beyond. If students are not learning their basic multiplication facts, more difficult concepts are even more out of reach. An example includes fractions. Students would struggle finding a common denominator if they do not their basic facts. Math is about building on prior knowledge and adding skills as a student continues on. Without the basic understanding, students continue to struggle through harder lessons and understandings.

Incremental Rehearsal

“The incremental rehearsal technique is a drill ratio procedure designed to intersperse a ratio of unknown content to known content such as words, math problems, and word meanings” (Joseph, 2006, p. 803). IR (incremental rehearsal) is a one-on-one approach where a trained professional makes piles of known and unknown multiplication facts, words, or definitions. The professional shows all of the cards to the student and then makes the piles. Once the facts have been dispersed into the correct piles, the professional shows all of the known cards to the student and slips one or two unknown

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facts into the pile. The professional only goes through the cards once during the session. Then, the student and the professional do not go through the cards until another day. It is recommended to use fifteen flashcards with a mixture of twelve mastered facts and three that are not mastered (Skarr, 2014). The researchers then mixed in the idea of a racetrack to encourage the student to rapidly answer the basic fact questions to get to move his/her car. In a younger elementary school setting, the racetrack idea would likely be more successful because of the visual effect and self motivation younger students provide. In intermediate and upper elementary classrooms, students would find the racetrack childish, but students who struggle and learn visually may benefit. The author suggested using the racetrack until the student has mastered facts one through five. By combining IR with motivating features, the students in the study showed improvement of their basic multiplication facts.

Advantages

“Research has shown that students tend to be more motivated and choose to complete assignments and tasks that contain some items that are known to them and that appear to demand lower levels of effort because they feel confident” (Joseph, 2006, p. 805). By integrating the known facts, the student feels more confident and is more willing to learn the unknown facts. Over time, it is hopeful that the students will learn all of the unknown facts and be able to generalize them.

One of the biggest advantages of IR is the increased retention rate that has been proven through research. “When compared with other flashcard drill procedures, IR has

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the strongest effect on retention of items learned” (Swehla et al., 2016, p. 405). They described that retention is higher because of the exposure of the facts over time.

Another advantage of IR is that peers can become involved. It is highly motivating for students who struggle with their multiplication facts to practice them with a peer who has mastered all of the facts. It not only is beneficial for the struggling student but also for the tutor. “Subsequent research demonstrated that increased performance was also obtained for the students who served as tutors, regardless of age” (Cates, 2005, p. 638). Practicing facts multiple times increases the exposure to the facts for both persons involved.

Incremental rehearsal can improve multiplication skills, particularly with generalizing the skills across contents. Coddington, Archer, & Connell (2010) found that “generalization across similar stimulus conditions was achieved following fluent performance across each set of problems taught” (p. 103). Once the student learned the multiplication fact and could correctly say it in multiple sessions, the student was considered to have mastered the fact. With this research, they proved that the student could generalize the learned fact and retain it in further sessions.

Disadvantages

One disadvantage of IR is the time commitment of implementing the strategy. Since it is more beneficial one-on-one, the professional has to ensure that he/she has set enough time to work with the student on an individual setting. This could take away time from other students if the teacher is in charge of multiple students at one time. For a general education teacher, IR would have to be implemented during a plan time or after

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school hours. A solution to this problem would be to train other professionals within the school to implement IR.

Peterson-Brown, Panahon, and Schreiber (2017) researched the effectiveness of paraprofessionals implementing incremental rehearsal. The results “suggest that paraprofessionals may be well suited to implement IR [incremental rehearsal] with fidelity in a school” (Peterson-Brown, Panahon, & Schreiber, 2017, p. 59). The paraprofessionals within this study underwent training and had ongoing coaching to help prepare them to implement IR.

The last disadvantage of IR is the reliability of the professional or the tutor who is implementing the skill. The person who is showing the cards to the student has to be correct with the answer and ensure that the student is answering correctly each and every time. Human error could be a factor and result in a student learning a fact incorrectly.

Other Considerations

Swhla et al. (2016) studied the spacing between unknown facts during incremental rehearsal and found that altering the spacing of the known facts and unknown facts lead to more retention over time. The researchers discussed that “altering the spacing between known and unknown stimuli offers promise as a technique to improve efficiency while maintaining the effectiveness of this intervention” (Swhla et al. 2016, p. 405). By altering the space, the students do not consider the facts to be predictable.

A consideration to be made relates to technology and its usage to master facts. With the technological age that is now increasing in the students’ lives, education has had

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to keep up with it. A disadvantage of computers and other technology is the cost of the equipment and maintaining it. In one research study, participants showed that half were successful with computerized drilling and half were more successful with peer tutors (Cates, 2005).

The last consideration discussed includes the relativity to special education. “IR appeared to be an effective intervention for increasing fluency in single-digit multiplication facts among ... children identified as LD [learning disabled] in mathematics computation” (Burns, 2005, p. 245). IR is a method that can be implemented with students who have learning disabilities because of its one-on-one approach and repetitiveness.

Conclusion

Incremental rehearsal is a valid, flashcard approach where a student is shown multiplication facts that are known and unknown. The cycle of showing the student cards continues until all of the cards have become known facts. As discussed above, the importance of number sense and multiplication facts, incremental rehearsal, the strengths, the weaknesses, and additional applications are all pieces in implementing incremental rehearsal for students who struggle with basic multiplication fact mastery. Incremental rehearsal can be used during guided math stations and small group instruction. Paraprofessionals and other school staff may provide incremental rehearsal strategies to the student as well as peers. Incremental rehearsal can also be used for other subjects such as reading. IR would be a great strategy to use when teaching younger students sight words.

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Resources

Blessen, Jody. Number Sense and Multiplication Facts Interview [Personal interview].

(2017, December 13).

Bryant, B., Ok, M., Kang, E., Kim, M., Lang, R. r., Bryant, D., & Pfannestiel, K. (2015).

Performance of Fourth-Grade Students with Learning Disabilities on Multiplication Facts Comparing Teacher-Mediated and Technology-Mediated Interventions: A Preliminary Investigation. *Journal Of Behavioral Education, 24*(2), 255-272. doi:10.1007/s10864-015-9218-z

Burns, M. K. (2005). Using Incremental Rehearsal to Increase Fluency of Single-Digit

Multiplication Facts with Children Identified as Learning Disabled in Mathematics Computation. *Education & Treatment Of Children (ETC), 28*(3), 237-249.

Cates, G. L. (2005). Effects of Peer Versus Computer-Assisted Drill on Mathematics

Response Rates. *Psychology In The Schools, 42*(6), 637-646.
doi:10.1002/pits.20105

Codding, R. S., Archer, J., & Connell, J. (2010). A Systematic Replication and Extension

of Using Incremental Rehearsal to Improve Multiplication Skills: An Investigation of Generalization. *Journal Of Behavioral Education, 19*(1), 93-105.
doi:10.1007/s10864-010-9102-9

Joseph, L. M. (2006). Incremental rehearsal: A flashcard drill technique for

increasing retention of reading words. *Reading Teacher, 59*(8), 803-807.
doi:10.1598/RT.59.8.8

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Parrish, S. (2010). Number talks: Helping children build mental math and computation strategies. *Math Solutions*, 4.

Petersen-Brown, S. s., Panahon, C. J., & Schreiber, C. M. (2017). Effectiveness of Incremental Rehearsal When Implemented by a Paraprofessional. *School Psychology Forum*, 11(2), 52-62.

Skarr, A., Zielinski, K., Ruwe, K., Sharp, H., Williams, R. w., & McLaughlin, T. F. (2014).

The Effects of Direct Instruction Flashcard and Math Racetrack Procedures on Mastery of Basic Multiplication Facts by Three Elementary School Students. *Education & Treatment Of Children*, 37(1), 77-93.

Swehla, S. E., Burns, M. K., Zaslofsky, A. F., Hall, M. S., Varma, S., & Volpe, R. J. (2016).

Examining the use of spacing effect to increase the efficiency of incremental rehearsal. *Psychology In The Schools*, 53(4), 404-415. doi:10.1002/pits.21909