Mnemonic Strategies: Tools to Increase Achievement in Fourth Grade

Multiplication

Abstract

Fourth graders of a Western state school district were evaluated and results showed that they perform poorly in multiplication and problem solving. Most of them had below fourth-grade mastery level and had difficulty progressing in mastering their multiplication facts. Mnemonic strategies such as using flash cards, timed examinations and drills were presented as a solution in order to enhance the students' memory and mastery skills in multiplication. Mnemonic strategies are effective in memory enhancement, which employ recoding, relating, and retrieving functions for instruction.

Chapter 1: Introduction

Background

Description of Community

The city is located in a high desert region of a Western state with a population of approximately 85,000. The school district represents the larger employer in the area and 80% of the students receive free or have reduced lunch fee.

The school is located in an old residential neighborhood. The area experienced some significant transformations in terms of new housing in the community, which interspersed among the older homes. There are also a number of low-income apartment complexes in the area. The mode of transportation for students is via school transport services.

Students usually belong from lower class to middle class families. Most of their parents work full-time jobs and some work two shifts. Classrooms are also considered to be fully occupied throughout the year.

Demographic Information

The enrolment of students for 2006 to 2007 included 20% white, 8% African-American and the other 3% was Asian and other races. The staff had six males including the principal and three females including the assistant principal. The school had a computer laboratory technician, librarian, maintenance crew, and food service personnel.

The school is considered unique in terms of the staff's cohesiveness and support for each other. Teachers and staff work at a unified manner in school and offsite. The community where the school is located also provided a significant role. The parent-teacher conferences raised funds that exceeded the school's expectations for its size. The school's adult literacy program for English learners is also commendable. Its mission statement is that all students could learn.

The work setting of the research involved students from elementary school or kindergarten through fifth grade. It had three self-contained structures and eight mobile classrooms. The school also has a soccer field, which is one of its numerous facilities and common areas.

Instructional Information

The school employed the traditional multiplication mastery instruction in lectures and discussions. In this research, mnemonic strategies were employed as instructional approaches for the fourth grade students. Mnemonic strategies have been used to enhance people's memories, including the elderly and students with disabilities.

Writer's Role

The writer worked as elementary school teacher. The writer taught students qualified at the fourth grade level, which has an average of 32 students per class. There is a consistent exposure and interaction with students of this grade level and the writer is familiar with the subject matter of fourth grade mathematics. The writer would employ mnemonic teaching strategies to raise students' capabilities in fourth grade multiplication. The writer would employ the actual application of instructional methods in the evaluation.

Importance of the Study

Mathematics is one of the most difficult academic areas and multiplication is considered as one of the most challenging mathematical operations. The research's purpose is to present alternatives to current teaching strategies when it comes to students' mastery and multiplication skills.

The study of new instructional strategies is instrumental in helping students overcome their difficulties in mastering multiplication. Students are often intimidated to perform more complex mathematical operations because they lack skills in mastering the multiplication

table. If they have mastery in multiplication, they could develop their confidence to improve their performance.

Statement of the Problem

The purpose of this study is to provide input in introducing and implementing mnemonic strategies to improve the multiplication mastery of fourth grade students. It would evaluate mnemonic strategies and their efficiency in enhancing fourth grade multiplication skills through pre-test and post-test evaluations. It would show if fourth graders will be able to develop mastery of the multiplication table through this instruction, which would gauge the advantages of these strategies as they advance to middle school.

Research Questions

This research would ask the questions:

1. How can mnemonic strategies be employed in helping fourth grade students' mastery for multiplication?

2. What is the level of effectiveness mnemonic strategies have when used as instructional modes for teaching multiplication mastery?

3. Would fourth grade students be evaluated positively in gaining or improving multiplication mastery after being taught using the mnemonic strategies?

Definition of Terms

Mnemonic Instruction

Mnemonic strategies are also known as memory-enhancing strategies that include a certain reconstruction of specific content to relate new information to learners' existing knowledge base and to teach information retrieval (Fontana et al., 2007). This instruction mode is based on the premise that concrete information is made meaningful or familiar to the individual when elaborated to something they already know. It transforms something that was

abstract and seemingly unrelated information into something the individual learner could

relate to and value (Fontana et al., 2007).

Chapter 2: Related Research

Problem Statement

The purpose of this study is to provide methods for introducing and employing

mnemonic strategies to improve the multiplication mastery skills of fourth grade students. It

would evaluate the effectiveness of this instructional approach in the improvement of

multiplication mastery skills.

Problem Description

Like any other school district, grade school students find it hard to master the

multiplication table. Students lack confidence in developing their mathematical operation

skills because of their inability to perform multiplication operations. Most of the students did

not have options to avail the services of tutors in order to improve their multiplication skills.

This prevented them from improving their mastery. Thus, teachers need to employ

instructional strategies that could help students master the operation.

Since the instructional approach was relatively new, it could not be widely received at

first. Students and other teachers could develop a certain resistance because of its novelty for

grade school instruction. Teachers of grade school students need to look for several ways to

help them develop their mastery. The limitation of approaches to traditional modes of

instruction had prevented teachers from utilizing new modes of instruction.

Problem Documentation

The researcher had worked with 12 fourth graders who were placed in two groups.

There were pre-tests and post-tests as instruments of evaluation to document the students'

multiplication skills and mastery. The tests were informal and timed. The test scores of

students showed that they did not have mastery in multiplication. In fact, the previous test

scores gathered by the researcher revealed that students in this school district showed only a third grade level mastery of multiplication.

The evidence for this study was gathered using the analysis of the students' grade records from their mathematics grades. The pre-tests and post-tests were also used as evaluation tools. Pre-tests showed that there was a low mastery level and proved that students needed to improve their mastery in multiplication.

Analysis of the Problem

Insufficient Instructional Approach

The most common method of instruction relied on the classroom approach of simply teaching the multiplication table. This involved slow introduction of the different tables and letting the students memorize it as is. This commonly involved classroom recitation and board or seat exercises. Most of the time, students feel inadequate when they recite in class or perform board exercises, as they had not received enough training to master the multiplication table. Oftentimes, they end up feeling frustrated and develop a fear because of their inability to master the multiplication table.

Lack of Instructional Variety

Different strokes work for different people. Not everybody could cope with what the teacher has been teaching. This problem reveals the need to employ different instructional approaches in order to provide the students a variety of opportunities to choose from in terms of learning the operation.

Lack of Practice and Training

Usually, multiplication mastery could only be developed through practice. The students' fear and frustration of the subject would prevent them from practicing it on their own. Since most students could not afford private after-school tutors, they had not found the time and method of developing their skills in multiplication. Instructional approaches that

would offer the students' self-study motivation as well as confidence in multiplication

mastery would be beneficial to address this concern.

Relationship of Problem to Literature

The fourth graders in the school district displayed that they had no mastery of

multiplication at the fourth grade level. In fact, tests had shown how most of them only had

third grade mastery of multiplication. This reflected the need for an instructional approach

that would increase their abilities to master the operation at the grade level they are in.

The mnemonic strategy was selected for this research because of its different

characteristics in relation to providing the students with better skills for multiplication

mastery. A review of literature would provide more pieces of evidence and background to

show how mnemonic strategies are efficient modes of instruction to develop students'

mastery in multiplication.

Memory

Memory performance is influenced by the modality that the stimuli presented and

there was some type of encoding activity that was employed (Aleman et al., 2002). An

illustration could include how mental imagery can produce a substantial increase in the

amount of remembered material.

Experiments show how subjects used presented words by vocalizing them, mouthing

them silently or writing them down. An experiment made their subjects list down words on a

computer monitor as they were asked to read the words either aloud or silently. Results of

this study showed that visual presentations are better remembered when they were read aloud

by the subject compared to when they were read silently (Aleman et al., 2002). There was

also an auditory advantage when it comes to memory decoding.

The temporal distinctiveness theory is considered to enhance memory performances

from different activities used to carry out encoding. There was a scholarly suggestion that

stated how memory-encoding activities gave rise to memory traces that were more easily accessible to retrieval processes. Vocalization certainly carried a strong advantage.

Mnemonic strategies have a great role in the encoding and retrieval process in terms of the "strategic selection of probes and inputs which are to be sent to memory and in terms of interpretations given to the output" (Anderson & Bower 1979, p. 140). Subjects could actually restructure and edit what they had previously encoded in their memory to make new information more meaningful using this strategy.

Mnemonic strategies have always been practiced even in the ancient times. These are strategies that are often related to paired-associate learning and serial learning as well as the use of interactive imagery (Carney et al., 1998; Pressley & Schneider, 1997). Memory improvement books have provided and recommended mnemonic strategies for learners of all ages. They are also presented in self-improvement courses.

Study Skills and Academic Performance

Study skills are always considered as a fundamental factor for academic competence (Gettinger & Seibert, 2002). Most of these skills are associated with positive outcomes for multiple academic content areas for diverse learners. Academic competence is also related to knowledge and the application of study skills. Students could experience difficulty in school not because they do not have any intellectual abilities but they lack good study skills.

The teacher's instructions must include the facilitation of good study skills. Students need to know how they would comprehend and remember the lessons through the mode of instruction used by the teacher. Even if some students develop study skills on their own, most students go through schools without acquiring effective studying skills and as a result, they miss an opportunity to gain academic competence. Such skills are considered as "academic enablers" because they function as important tools for learning (Gettinger & Seibert, 2002).

Study skills involve a range of coordinated cognitive skills and processes that enhance the

effectiveness and efficiency in students' learning.

The most common cluster of study skills involves repetition or rehearsal-based study

strategies. They are considered as the most basic strategy that involves repetition, rereading

or rehearsal of information. They are useful for storing smaller bits of information for the

short-term or as content used are frequently studied. They are also easy to learn and use.

Seemingly simple, these strategies could be enhanced by promoting greater

elaboration and providing deeper processing of information during rehearsals. The strategy

shows extensive evidence-based approach in the creation and use of mnemonic devices

(Gettinger & Seibert, 2002). Over the years, mnemonic strategies are seen as effective study

skills that have positive effects on student performance.

Related Cases for Learner Memory Problems

There are different groups that are expected to have poor memory skills. Mnemonic

strategies are already employed as memory enhancers for adult learners and learners with

disabilities. Older adults complain about their memories and most of the complaints are due

to the heightened perception that mental abilities decline with age (Carney et al., 1998).

However, studies reveal that the employment of mnemonic strategies shows how they could

enhance memory, even if the process is more difficult and complex. It also helps allay the

fears of adult and elderly learners regarding memory loss (Carney et al., 1998).

Middle school students with learning disabilities were also studied as they used

mnemonic strategies to enhance their ability to recall information (Dela Paz & Macarthur,

2003; Allinder, 2001). It showed how these strategies were effectively used. Past experiments

gauged the potential of these strategies to provide potential mnemonic maps for enhancing

the recall of information.

Mnemonic Strategies

There are different kinds of mnemonic strategies to choose from. For example, the keyword strategies utilize concrete and acoustically similar words to remember a new term (Fontana et al., 2007). These keywords are actually used to combine interactive illustrations that demonstrate the meaning of a new term. The keyword and definition are related by a meaningful interactive scene (Carney et al., 2004).

Peg word mnemonics are used to facilitate the learning of information using numbers or order to be part of what was being recalled (Fontana et al., 2007; Pressley & Schneider, 1997). One example for this strategy is the memorization of United States presidents in numerical order.

Letter strategies use acronyms and acrostics that could facilitate the recall of information (Fontana et al., 2007; Pressley & Schneider, 1997). Using acronyms to recall information would make the information easily stored and retrieved. The most complex format of mnemonics would combine letter mnemonics, peg words, and key words with symbolic illustrations. Cognitive psychology would always point out how "learning proceeds most efficiently when to-be-acquired information can be meaningfully related to previously acquired information" (Carney et al., 1998, p. 164).

Organizational mnemonics facilitates the acquisition of ordered information. They include the method of loci and peg word method. The method of loci is considered as the oldest mnemonic method since it dates back in the ancient Greece as a memory aid for oratory (Carney et al., 1998). The strategy is used by mentally setting a specific location or loci. The to-be-remembered items are to be related with these locations by storing in the mind interactive images.

The peg word method is considered organizational in the application of memorizing a set of concrete rhyming words that correspond to a number from one to ten. In this case, "1 =

bun, 2 = *shoe*, 3 = *tree*, 4 = *door*, 5 = *hive*, and so forth, up to 10 = *hen*" (Carney et al., 1998, p. 167).

Existing Multiplication Strategies

Reciprocal teaching for mathematics is one of those evaluated to promote fourth graders' response to complex two-step word problems (Cox & Taylor, 1997). The concept of this method is for the educator to elicit solutions from students and to explore multiple solutions for seeking group agreement. In this method, students get to use mathematical operations as a group. The justification for this form of teaching is to solve communication difficulties wherein students could explain to their peers who could not understand what they had tackled from the subject.

The distribution of associations model is also considered as an approach in multiplication (Perlmutter, 1986). The first step in this model is to examine which strategies do children recently learning to multiply use. Middle school students are presented with 100 multiplication problems generated by factorial possible combinations of multiplicands and multipliers. The problems were presented orally as children wrote their answers on pieces of papers to work out the problems.

According to this experiment, the methods used were through retrieval and other overt strategies (Perlmutter, 1986). Overt strategies include the repetition of problem orally and the writing down of problems on the answer sheet. Other overt strategies include repeated addition to solve multiplication problems and drawing visual representations and counting them.

When Children Want to Remember

Children have developed a range of techniques that are used for remembering information. Most of the literatures that discuss children's memory involve the deployment of strategies involved in rehearsal, organization and elaboration (Folds et al., 1990). The

behavior of children towards information storage and retrieval has been discussed and has

received significant attention for decades.

Mnemonic techniques are also applied in a range of contexts. Studies show that the

consistent use of strategies has increased the effectiveness in enhancing memory (Folds et al.,

1990).

Children aged 9 to 14 were given a list of to-be-remembered items and asked to

rehearse them aloud. As they presented, there existed age-related change in the types of

rehearsal techniques that were employed (Folds et al., 1990). Children from different ages

would approach the task of remembering in different ways. Nine-year-olds would focus on

rehearsing what was presented while 14-year olds would rehearse each word along with

several previously displayed items in their memory.

There were differences presented in past studies with the organizational strategies

children employ when it comes to information recall. For instance, when presented with low-

associated items and asked to form groups that would help them remember, young children

would rarely create groupings based on semantic relationships, but older children who were

sixth-graders and above would do it spontaneously (Folds et al., 1990). The differences

between the age group were related to differences in the recall success.

Decreasing Information-Processing Demands

Having memory as the explicit goal would entail strategic information-processing

requirements (Folds et al., 1990). Visual access of to-be-remembered items must be increased

in a more active manner even without providing explicit instruction for doing so. Visual

access could lessen the demands for the learner's information processing capabilities.

Lesser effort would be required in the maintenance of to-be-remembered items in the

immediate memory. In this manner, there would be more efforts that will be devoted to

strategic behaviors that can enhance recall. The simplification of memory tasks for young

children is presumed to involve the reduction of demand in information processing when it comes to strategic performances (Folds et al., 1990)

Expanding the Knowledge Base

Another avenue by which children's memorization skills would be enhanced with mnemonic strategies would be if the students could develop a wider knowledge base. The increase in the content and complexity of the child's knowledge base would make any mnemonic activity more effective (Folds et al., 1990). Increased knowledge is related to corresponding changes when it comes to recall performance.

Basic Classroom Application

Mnemonic strategy instruction had emerged as one of the most powerful instructional techniques. It improved "systematically integrating specific retrieval routes within to-be-learned content" (Masterpiori & Scruggs, 1991, p. 219).

Common classroom application of mnemonic strategies involved "reconstructive elaborations" or drill-and-practice techniques by which pictures were used for visual representations. Students who were under such condition had substantial recall of the content than other students.

The language of mathematics had always been difficult and confusing at first (Rubenstein & Thompson, 2002). Technical terms were considered to be difficult to remember, and some were even used in more ways than one. The children's mathematical learning was also dependent on their fluency with mathematical language. Teachers must make the remembrance of these terms and languages as well as operations to be less complex for their students.

Related Results from Mnemonic Application

A study conducted by Masterpiori and Scruggs (1991) showed how the implementation of mnemonic strategy instruction after three weeks of training by regularly

assigned teachers resulted in high performance scores. The study showed how the strategy

used was also significantly correlated with the performance that showed how mnemonic

strategies were relevantly effective for the students. According to this study, these strategies

were successful because they provided systematic procedures for retrieval of target

information (Masterpiori & Scruggs, 1991).

Creation of Schemata for Learning

As mentioned earlier, the expansion of the knowledge base would enhance the

effectiveness of mnemonic strategies. Schemata involved this knowledge base. Memory

retention was the process of remembering through the schemata of the learner. Association,

clustering, imagery, location, mnemonic, and visualization devices were seen to provide

information recall for long-term memory (Goll, 2004; Boston, 2001).

Information, if emotionally charged, was usually easy to be remembered. The sounds,

smells, tastes, and movements as well as feelings were encoded in the person who had

experienced them. Cognitive psychologists would move that long-term memory was

organized in terms of schemata that provided expectations about objects and events (Goll,

2004).

Part of the enhancement of children's mastery of multiplication skill involved

providing memorable moments that were positive for remembering. Teachers must avoid

charging multiplication mastery activities with fear and discouragement. The imagination,

association and location also helped students remember what they were supposed to

remember. There would be an imaginative click in the mind wherein information retrieval

took place.

It was also important to consider the retrieval of information after it had been stored.

There were different obstacles to retrieval, "clogging at the synapse, deterioration of the

neural pathways involved and stress" (Goll, 2004, p. 306). To address this, learners must use

their brains and specific to-be-remembered information regularly in order to create an easy retrieval. Contiguity learning utilized drills from repeated pairings such as in multiplication tables. They were considered to be effective even if they could be tedious.

Why Mnemonic Strategies Worked

There were three R's for the mnemonic techniques it included recoding, relating, and retrieving (Bunnell et al., 2002). These properties had been applied to attain the effectiveness of this strategy as an instruction tool. The numerical, symbolic, and procedural components of computation had to be recoded into more relatable characters or visuals. In mathematical operations, instead of recalling the correct procedures for solution, they would incorporate the symbols and visuals use to retrieve information (Bunnell et al., 2002).

Chapter 3: Methodology and Data Collection

Description of Selected Solutions

There was a need for the instruction to require a more intimate approach to teaching because according to literature information that was more emotionally charged was easier to retrieve (Goll, 2004). A small group environment could better provide this requirement. Data needed to be presented in small group or one-to-one setting because there was success attributed with this strategy for overcoming academic learning difficulties.

Research showed how fear and the lack of confidence of the students could move them to be less participative and interested in their classes (Goll, 2004). It also followed that confidence was built with a more focused and teacher-connected development of the students' study skills (Gettinger & Seibert, 2002). This strategy could build on the confidence of the students in their ability by working consistently with the researcher using mnemonic strategies (Masterpiori & Scruggs, 1991).

Mnemonic strategies were seen to be effective for memory retention even for elderly and adult learners as well as children with learning disabilities (Carney et al., 1998; Dela Paz

& Macarthur, 2003; Allinder et al., 2001). The literature that supported mnemonic strategies as a valid instructional method that had worked for a more complex group of people held it to be a viable instructional strategy to be used for fourth graders' mastery of multiplication.

Sample

There were 12 fourth grade students who participated as subjects of this study at an elementary school in the high desert region of a Western state. There were seven females and five male students included. Their age ranged from nine to 10 years. There were nine Hispanics, two African Americans, and one white student. They were selected based on the multiplication assessment tests they took. The common denominator for them was their inability to excel beyond a certain level of multiplication mastery. Group one of the students remained on their table of three's for months and group were not able to advance from their table of five's.

Materials

There researcher utilized self-created pre-test and post-test forms that were timed in order to evaluate multiplication mastery of the subjects. There were worksheets that listed 50 multiplication problems randomly organized into columns. All of the problems were based on one level of mastery at a time. For example, the first column would reflect 1x1 thru 1x12. Automaticity or mastery to the next level was determined by completing 50 problems under or in two and a half minutes. There was a margin of 10 per cent error. The researcher used the whiteboard, multiplication flashcards as well as a standard electronic timer for the tests and lessons.

Procedure for Data Collection

The study took place over a period of four weeks. The research had worked with twelve students who were placed into two groups. The first group was described and assessed to have below automaticity level that meant there were struggling or stuck in the table of

three's and could not move beyond it. The next group was described to had below automaticity as well as they could not advanced beyond the table of five's in their multiplication timed tests.

During the initial selection process, the research disseminated to the students a pre-test to obtain the said results. The group was divided for ten minutes of mnemonic instruction. The first group had directly worked with the researchers doing repetitive multiplication facts on the whiteboard. Group two worked with flashcards in a round robin fashion.

The other group was separated from each other but they were still under the researcher's observation during the time this was happening. Group one worked with multiplication facts one to five and the other group worked with multiplication facts one to seven. The researcher alternated working with the groups for each sessions. The students who worked with the researcher had to verbally answer problems that were written on the whiteboard when called upon.

The researcher worked with these subjects for 20 days for over four-week period. At the end of the study, the students from both groups were given post-test to assess if there was any improvement or advancement in the levels of multiplication. The results showed that five out of six students from group one advanced at least to their focus. Group two did even better than the first. All of the subjects advanced to their six's and two of them even completed their seven's. Mnemonic strategies were shown to increase the student achievement in mastering multiplication facts.

Data collection was conducted through the tests that were given to the students. The data that was collected included their multiplication mastery levels as well as the change increase that occurred after the mnemonic strategies were implemented.

Chapter 4: Data Analysis

Methods for Analyzing Data

Testing for aspect-specific tests required further development. Different levels were supposed to be received customized difficulty when it came to evaluation (Idol & Jones, 1991). The researcher took the two groups' result from the pre-test and the post-test of the timed multiplication facts and compared the results. The researcher had run a statistical analysis of the data. The independent samples of the t-test were compared with the scores of each student's pre-test raw scores and the scores of their post-test. The mean scores for group two increased to 22 points.

The hypothesis of the research that held mnemonic strategies to increase multiplication mastery was proven to be valid.

Groups	N	Mean Pre	Mean Post	St. Error of Means	T Ratio
Group 1	6	0.376	0.935	0.615	0.388
Group 2	6	O.696	0.923	0.227	

Table 1. Comparison of Pre-Test and Post-Test Results for Groups 1 and 2

Stories

During the selection of subjects for this study, the researchers chose twelve students who struggled immensely with mathematics, specifically multiplication mastery. These students attended a remedial mathematics class in addition to their regular math subject instruction. One of these subjects, a female from group one was the most challenged in mastering her multiplication facts, yet after the study she had showed the most progress from all of the students in the two groups combined.

Moreover, the researcher fondly recalled when one of the male students told the researcher that he had enjoyed working with his multiplication facts as a result of the mnemonic instruction approach. This was very enlightening for the research because the

same student displayed very low levels of self-esteem and little self-confidence in attacking any level of mathematic operations.

Students also seldom enjoyed mathematics and for a student who performed poorly to say he had enjoyed it recently was significant for the researcher. The bond that was created between the student and the researcher was also noted by the researcher's colleagues as they marveled at this positive change.

Unexpected Events

The researcher made numerous journal notes regarding the discoveries that were not anticipated. There was one instance wherein during one session at the whiteboard with group two, the research realized that the time processing was a major factor in achieving multiplication mastery.

The researcher noted via the electronic timer that five out of the twelve students took on average more than 6.3 seconds to respond verbally to a random multiplication problem such as "3x7?"

There was also the impact of counting on their fingers. The researcher did not realize how this approach was still used by the students. The researcher observed that there were at least three students who consistently counted with their fingers during timed tests. Some students were even trying to be inconspicuous with this habit. Nevertheless, the researcher continued to study despite this element, but made the necessary journal entries regarding this discovery or limitation to the study. Several colleagues concurred that the study should move forward as it was but must be noted for credibility and transferability's sake.

Evidence of Trustworthiness

Credibility

The research was conducted over a month. In the month, the researcher was able to meet and instruct the students for 20 days. There was significant time spent with the children

that showed how mnemonic strategies affected them in how they addressed their problems with multiplication. The pre-tests and post-tests were also used to gauge the students according to their ability before and after mnemonic instructions were given.

Researcher also consulted colleagues in the academe when it came to decisions that would provide more credibility for the study. Other than that, a statistical tool was used with the t-test to measure the results of the evaluations.

Transferability

The researcher had created the pre-test and post-test used to collect data. However, the researcher had a degree in education by as an elementary school teacher that provided the qualifications to formulate such evaluation. The same evaluation could be used for future researches or more could be formulated according to this research's format.

The teacher selected students who did poorly in their multiplication facts. The group was selected and was given pre-tests to evaluate the levels of mastery they were on. The results were used for the researcher to group them according to their abilities.

They were taught alternately using methods such as whiteboard exercises as well as flashcards. The researcher had employed problems that were orally given for the students to answer. Most of the answers given were timed and evaluated by the researcher.

At the end of the period, the researcher had given a post-test that evaluated the progress of the students' mastery skills. Upon receiving the results for this examination, the researcher compared it with the pre-test results through correlation.

Dependability and Confirmability

However, the researcher noticed how students still counted with their fingers and it must be considered as another method used by the students outside of mnemonic strategies.

Chapter 5: Implications for Teaching and Research

Discussion/Conclusions

The study showed how the students had significant improvement in the test scores as evaluated by their post-test assessment. These twelve students had been selected because of their inactive mastery skills when it came to their multiplication facts. They had low self-esteem and self-confidence when it came to attacking multiplication problems. Half of the group could not go beyond their table of three's and half of them could not go beyond their table of five's.

Mnemonic strategy instruction was presented as a solution to this problem. It was an approach wherein the purpose would be to enhance the memory of the individual. This strategy employed memory storage and retrieval through relation new data information with other information that the individual already had. The key to this strategy's success was making abstract and novel concepts more concrete and meaningful for the individual who suffered from memory retention and retrieval.

Research showed that memory had a lot to do with teacher's instruction. Memory was also enhanced through effective study skills. Educators were held accountable by numerous literature when it came to teaching students with effective strategies to produce study skills for their students. It was also important to enhance the students' knowledge banks or schemata in order to enrich their memory retention with mnemonic strategies.

The research employed basic mnemonic strategy approach through the use of the whiteboard drills as well as flashcards. The more the new information was used by the learner, the more the information could be retained and retrieved when the individual would desire. The drills were proposed in order to train the students with their multiplication facts.

The result of this study was positive. Students were able to advance from the levels of multiplication mastery they were stuck in. They were also able to perform with more

enthusiasm for the subject because of the confidence they had gained from the mnemonic strategy after 20 days of sessions over a four-week period. They were able to perform better and feel better about themselves. It also proved how small group settings were more effective for students who had difficulties coping up in the classroom.

Implications for Teachings

Teachers should consider the power of small group settings when it came to their instruction. It developed a more intimate and more effective approach for the students. It helped them retain the information because of the more emotional allowance of such settings.

There was also the continued effectiveness of mnemonic strategies to enhance the students' performance. A healthy amount of literature had already supported it to be beneficial for elderly learners as well as those with disabilities. In this research, it showed how effective it was for fourth grade students who had difficulties with multiplication.

Teachers must also be vigilant against psychological fears students have against mathematics. They must enable the students to see beyond their fear for the subjects' difficulty and transform the subject into something more engaging and encouraging for the students.

Limitations of the Study

The sample size that the researcher had used was relatively small, although it focused on key students who had the least progress in the class. However, twelve students could still be considered as a small sample size. There was also the time constraint that must be considered. Twenty days in a month could also be relatively short. The gauge of development of the students was only limited to the one month the researcher had worked with them.

Implications for Further Research

Different methods and approaches to classroom instruction must be considered in terms of addressing the problem of multiplication mastery amongst the students. There must

be more strategies that must be developed for them to inhabit the joy for the subject as well as the confidence to solving mathematic problems.

Mnemonic strategies were also very broad. Future research could establish which mnemonic strategy worked best when it came to mathematical problems and for what reasons. It must also be employed over a longer period of time to significantly gauge long-term memory retention of its learners.

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