

An assessment of the Effectiveness of a Training Programme in Enhancing Students' Ability in Mental Mathematics

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Abstract

The study aims at assessing the effectiveness of applying a training programme for teaching mental strategies in promoting students ability in doing mental mathematics. The study sample consists of (166) sixth grade students and included four male and female teachers. Teachers in the experimental group were trained for teaching mental strategies in their classes during the implementation of the experiment, while the other two teachers had been asked to keep using their usual traditional teaching strategies. Quantitative and qualitative methodology was conducted. Pre-post mental ability test was used to assess student initial ability and their progression in doing mental operations during the experiment. Moreover, semi-structured interviews were conducted with teachers and with a sample of students involved in the experiment.

Results show statistical significant differences related to the effect of teaching method and gender as a whole. Results also show statistically significant differences in students mental ability test before and after the experiment in favor of the two experimental female and male groups, and in favor of male students in the control group. This interrelationship and differences have been discussed and explained by analyzing the qualitative data. The effect of teaching students mental mathematical operations in the experimental group has a positive effect in allowing students to practice mental activities in an interesting atmosphere, and give them a chance to challenge the problems and participate in the classroom. Moreover, learning different strategies help them do mathematics faster and save time.

Introduction

The teacher is the person who is responsible for organizing the classroom, providing the information, explaining the concepts and skills, giving examples, evaluating the students and providing feedback to support the learning situation (Burns, 1990). Recent research has taken place and is centered on the constructivist approach. One way in which research on teaching has been linked with research on learning is through a constructivist perspective (Cobb et al., 1991). One of the research techniques is the teaching experiment. Koehler and Grouws (1992) commented that researchers worked closely with an experienced but traditional teacher to develop instructional activities that allowed students to construct their knowledge of important mathematical ideas and concepts.

When applying an experimental research programme to assess the effectiveness of a new teaching strategy on students' ability, it is very important to train teachers in how to implement teaching strategies by using a new method and to develop the skills they need to work more effectively (Reynolds, 1994). This training must be prepared well and take enough time in order to encourage the teacher to apply the new teaching method, present him/her with a good framework to be implemented and, finally, enable the teacher to assess the weakness and the strengths of applying such a new method and evaluate its outcomes in a correct way. Such training programmes affect directly teachers' beliefs, characteristics and attitudes and, in this case, teachers have the benefit of some introductory in-service training (Button, 1981). Therefore, this type of training is considered as professional development for the teachers. In this study, the researcher aims at assessing the effectiveness of applying a training programme for teaching mental strategies in promoting students' ability in doing mental mathematics. Therefore, there was a need to provide teachers with in-service training programmes the content of which should include mental mathematics strategies and how it should be presented.

According to the review of the literature in mathematics education in general, and the researcher's observation based on her own experience about mathematics education in Jordan in particular, the following problems and issues emerged which give rise to the study: (1) weakness

and difficulties in doing mental operations; (2) the need to improve the quality of teaching and learning process in Jordanian mathematics classroom; (3) the need to build positive attitudes toward mathematics.

Theoretical Framework and Related Literature

Mental mathematics is a mental activity and strategy that the student does mentally without the use of recording devices such as computers, calculators, or writing instruments (Reys, 1985). Several researchers draw the attention that developing students' ability in doing mental mathematics is one of the most important skills that should be achieved in the primary years (Patilla, 2002; Cheshire et al., 1999; Abu-Zena and Ababna, 1997; Parker and Widmer, 1992). Moreover, practicing mental skills is considered one of the basic aims in the mathematics education curricula (Department of Education and Science, 1987; National Curriculum for England, 1999; National Council of Teachers of Mathematics, 1989). Charles and Lester (1984) pointed out that the basic goal of mathematics education is to provide students with an appropriate mathematics background to allow them to continue their careers in different areas. Cooper and Dune (2000) found that several research studies show that students usually fail to apply realistic mathematics and maybe fail to demonstrate that they know and understand the mathematics they gained from perspectives in the classroom. Mathematical education as a form of knowledge can cover any application of mathematics in real situations. Cohen and Fowler (1998) draw the attention to the importance to improve mental mathematics skills which are most definitely a real-life experience. Boaler (1997) mentioned that within mathematics education, there is a great belief that many students cannot use the mathematics they learn at school in situations outside the classroom where students cannot easily make the link between theory and practice.

Howard Gardner is a psychologist/educator who proposed that intelligence was more than merely a measure of aptitude in reading and math. He believes that intelligence is more than one aggregate score; rather it is a combination of "intelligences" possessed by an individual. Gardner identifies multiple intelligences (seven intelligences), two of them are related to mental ability: logical-mathematical intelligence and

spatial intelligence (Armstrong, 1994). Logical-mathematical intelligence is the capacity to use numbers effectively and to reason well. This intelligence includes sensitivity to logical patterns and relationships, statements and propositions, functions, and other related abstractions. Mental calculations are one of the kinds of processes used in the service of logical- mathematical intelligence. Spatial intelligence is the ability to perceive the visual-spatial world accurately and to perform transformations upon those perceptions. This intelligence includes the ability to create internal mental images/pictures. Spatial intelligence is triggered by presenting the mind with and/or creating unusual, delightful, and colorful designs, patterns, shapes, and pictures (David, 2006).

Rubenstien (2001) mentioned that mental skills include different subjects in mathematics. These includes number sense, operation sense, symbol sense and graph sense where students should operate mentally and estimate. Moreover, he commented that mental strategies can be used in algebra, pre-calculus programs, and in geometry and measurement. Cheshire & others (1999) identified different fields for the use of mental mathematics such as numbers and algebra, handling data, numbers and measurements, and shapes and space. Fielker (1997) presents information on some aspects of mental mathematics in geometry and algebra.

Applying mental strategies in the mathematics classroom requires successful strategies to build success in mental mathematics. Research introduces samples of mental activities in different fields and provides several learning strategies that might help students to think mentally. Cummans (1997) introduced a real example of a lesson to teach students how to work mentally. The strategy used highlights the importance for teachers to encourage students to do mental mathematics and to start by identifying it as a way to workout mathematics problems in their head without the use of any materials. Then, the teacher introduces the concept of mental math by proving some activities. Rubenstein (2001) introduces some teaching ideas to build success in mental math. The first step is to specify objectives clearly and provide sample items. Secondly, offer frequent, but brief, in-class practice. The third step is to follow the activities by debrief immediately. The students may share strategies in small groups and then with the entire class. This approach usually produces a highly "teachable

moment" when students are surprised by, and often impressed with, others' thinking. For example, on the item "find 80 % of 55" students have shared a variety of responses, including the following:

- I found 10 percent, which is 5.5, then multiplied by 8. To do that, I multiplied 8 by 5 to get 40, then 8 by $\frac{1}{2}$ to get 4. The total is 44.
- I found 10 percent, or 5.5; doubled it to get 11; then subtracted that from 55 to get 44.
- I know that 80 percent is $\frac{4}{5}$. One-fifth of 55 is 11, so, $\frac{4}{5}$ is 4 times as much, or 44.

Rubenstein (2001) commented that the last method (introduced in the previous example) is often an eye-opener for many students. They realize that knowing fraction-percent equivalences permits a shortcut that makes other work much easier. He added, within general instruction he tries to highlight opportunities for students to use mental math in what he calls a "mental math moment" where students find the opportunities to use their "biological calculator".

Research also introduces different learning strategies that might help students to think mentally. Thornton and Jones (1995), Perry (2000) and Betty (2000) suggested the use of 100s chart for help that allow students the opportunities to visualize the calculations. May (1995 (a), 1995 (b)) introduced five activities of mental math problems named by "many names", "what am I", "the easy way", "square number" and "discovery computation". Davies (1999) explains how mental arithmetic can be fun and how to develop mental mathematics by using mechanics of the game called "24 game". Askew (1997) focuses on the mental methods of computation that children use. He highlighted two aspects of mental mathematics used by children in the seven to twelve year old age group and clarifying what children are expected to know at certain stages and how to manage mental mathematics programs. Other researchers introduce several different mental activities and examples for different stages (Parker and Widmer, 1992; Mackerman, 2000; Southerland, 1990; Sherfinski, 2001; Paul, 2001; and Askew et al., 2001).

Carraher, Carraher, and Schliemann (1985) conducted a qualitative analysis of how Brazilian street-market children invoke effective

computational procedures in real life contexts in contrast to traditional school mathematics and abstract computational problems. The Brazilian researchers predicted that participants would often perform mathematics computation differently in informal settings than in school, and this would often be more effective. Results show that participants correctly solved 98 percent of the context-embedded problems in the informal setting, but only 74 percent of imaginary, context-embedded items and 37 percent of abstract items in the formal setting. Results also show that children apply different computational algorithms when presented with problems orally than with the pencil-and-paper test. Interpretation of these results argues that mental computational algorithms may be more effective when applied to a real- life context, but also that the strategies (oral and written) invoked are context dependent. Reference to the views of Mike Askew, Grayson Wheatley, Emma Brown and others; Rooke (1997) concluded that if children are given the opportunity they can develop their mental abilities.

The researcher aims (in this study) at measuring students' ability in doing mental mathematics, and how might the training programmes enhance their ability in doing mental strategies. The teacher and the curriculum play a role in developing students' ability in doing mental mathematics; hence, there was a need to provide teachers with training programme. For the need of this research; the researcher reviewed the literature and modified different mental activities to be implemented within the training programme where the Jordanian curriculum is poor in such activities. The activities were modified to be taught for sixth grade Jordanian students in different mathematics subjects.

Measuring mental ability is one of the most important issues that should be addressed within mental ability subject. Thornton, Jones and Neal (1995) answered the question asking for, why could some students do mental calculations where some older students could not? He referred to different reasons such as: individual differences, the effect of the teacher, and the effect of the curriculum. Cohen and Flower (1998) pointed out the need not only to practice mental mathematics but also to assess it as well. For the need to assess students' mental ability in this study, the researcher uses standardized test for measuring students' mental ability for ages 12 years old where students approximately in the sixth grade (NFER-NESON, 1999). The test is measuring students' mental

ability in the numbers and operations on it, fractions, geometric shapes, measurements, as well as area and volume. The previous subjects are the same as the subjects included in the Jordanian curriculum for the sixth grade. The test is used as pre- and post-test to assess students differences before and after the experiment in mental ability.

Skemp (1989) identified mathematics as a mental tool, and an amplifier of human intelligence. Several researches draw the attention to the importance of teaching mental mathematics. Cummans (1997) commented that using mental strategies creating learning atmosphere full of fun and interesting and helps students to create a feeling of accomplishment. Jones (1988) presented different benefits for the use of mental math such as building self-confidence, encouraging thinking about the method to be used, allowing individuals to choose their own methods, solving problems quickly and accurately in real life situations, and building positive attitudes toward mathematics lessons. Corfield (1999) discussed the importance of teaching mental mathematics among children and adults in developing strategies for solving problems. Rubenstien (2001) pointed that the use of mental mathematics is important where it allows students to solve problems quickly and accurately, facilitates learning many important structural topics and makes easier the understanding of inverse operations. He added that when students have regular opportunities to do mental math, they feel challenged and ultimately, empowered.

For all previous advantages, it was reasonable to conduct such research, which aims at enhancing students' ability in doing mental mathematics and developing teachers' experience in teaching mental strategies.

Objectives of the Study

This study aims at assessing the effectiveness of applying a training programme for teaching mental strategies in promoting students' ability in doing mental mathematics. That is, the study aims to explore the progress of students' ability in doing mathematical mental operations after applying a training programme, taking into consideration the effect of gender differences. Moreover, the study aims to investigate students' and teachers' views about the use of mental strategies.

The study attempts to answer the following questions:

- 1 - Does the training programme enhance students' ability in mental mathematics?
- 2 - What are the students' views about the experiment and the programme effect on their ability in doing mental mathematics?
- 3 - What are the teachers' views on the effect of applying the training programme for teaching mental strategies?

Importance and Need of the Study

The importance of this study lies in the value of the domain, under investigation, and in the educational level of the subject chosen for the purposes of the study. That is, the study attempts to explore empirically the effectiveness of applying a training programme for teaching mental strategies and how it might affect students' ability in mental mathematics. The importance of this study also lies in its theoretical and practical values. The study complies with the aspiration of the developers in the educational field in highlighting the role of mathematics in promoting students mental abilities to acquire other subjects. Moreover, it has been found that few studies were conducted concerning the effect of teaching mental strategies in promoting students' mental skills. With regard to practice, the study may benefit all those who are interested in the methodology of teaching mathematics. The study directs teachers toward using teaching strategies and assessment procedures.

Null Hypotheses

- 1 - There are no statistically significant differences in students' final mathematical mental ability related to the effect of: teaching method, gender, and Interaction between teaching method and gender.
- 2 - There are no statistically significant differences in students' mathematical mental ability before and after the experiment (pre-post test) for all groups: control male, control female, experimental male, and experimental female.

Definitions of Study Main Variables

Mental mathematics: a mental activity and strategy that the student does mentally without the use of recording devices such as computers, calculators, or writing instruments

Training programme: the training programme that had been conducted to train teachers in the experimental group about teaching mental strategies.

Mental ability test: a standardized test for measuring students' mental ability for ages 12 years old where students approximately in the sixth grade (NFER-NESON, 1999).

Students' mental ability: students' ability to do mental mathematics and it was measured by students' scores in the mental ability test.

Sixth grade students: students in the sixth year of the primary stage. Students' age is approximately 12 years old.

Limitations of the Study

The present study uses a mental ability test to assess students' progress in mental skills. It has not used other instruments such as classroom observation in order to get more authentic data, which often help triangulate results in general. It also uses interviews with teachers to explore their views about the training programme. As of the schools selected, it is assumed that they represent the government schools in Jordan. Otherwise, care should be taken in the generalization of findings.

Research Methodology

The research aims at assessing the effectiveness of applying a training program in promoting students ability in doing mental activities in mathematics. In order to construct the methodology used in such experimental research studying a successful way, the researcher reviewed the literature for designing, implementing and evaluating such research and planning to define and discuss the methodology used in the research.

Study Design

The research undertaken used an experimental methodology; a two-group design in which the outcomes in the experimental group are compared with the control one. The experimental group consists of female (n. = 40) and male (n. = 41) students from the sixth grade (approximately 12 years old); those were taught the contents of the Jordanian sixth grade

mathematics curriculum by applying mental activities. The control group consists of female (n. =41) and male (n. =44) students from the same grade; those were taught the parallel contents of the Jordanian mathematics curriculum traditional without applying mental strategies.

The researcher developed mental activities (see appendix (3)) with different strategies (according to the literature review). This is because of the lack in the Jordanian curriculum in introducing mental strategies and how to teach them. The subject material involved in the sixth grade (Ministry of Education-Jordan, 1992) includes subjects in numbers and operations on it, fractions, geometric shapes, measurements, as well as, area and volume. These material activities are developed for the need to be used in the training program. Two parts of research data collection and analysis were involved in the study: the quantitative and qualitative.

a. The Quantitative Part

Pre-post mathematics mental ability test was used to measure and assess the progress of the students within the experiment in mathematical mental ability. This part had been analyzed by using SPSS to assess students' progress in mathematical mental skills. Several types of tests were used. Analysis of Covariance (ANCOVA) was used to assess any statistical differences between students' final achievement in the two experimental groups (Fitz-Gibbon and Morris, 1978; Oqeili and El-Shayeb, 1998; and Robson, 2002). Paired sample t-test was used to assess students progress before and after the experiment and to compare means (Oqeili and El-Shayeb, 1998; Norusis, 2000; and Robson, 2002).

b. The Qualitative Part

Qualitative analysis is used in this part to minimize the vagueness of the quantitative data and to discuss differences that could not be cleared by the quantitative part. These are the instruments used in this part.

- 1 - Interviews were conducted with all teachers involved in the experiment and with a random sample of the students in the two experimental and control groups.
- 2 - Field notes and observations were recorded during the class visits of the fieldwork to evaluate to what extent teachers who are trained in how to apply mental strategies implemented the new teaching method effectively, to assess students' interaction and to evaluate general teaching skills in both groups and how well teachers in the two groups applied their teaching methods and skills.

Sample and Procedures

Students are from two government schools (female and male schools). The schools are representative of schools throughout Jordan which have the same characteristics and facilities. The four classes involved in the experiment were selected randomly and divided to form the two study groups. All four classes sat for pre-test at the beginning of the experiment and a post-test at the end of the experiment. Table (1) summarizes the study sample in the two experimental and control groups.

Table (1): Students Distribution within the Experiment

	Male	Female	Total
Experimental group	41	40	81
Control group	44	41	85
Total	85	81	166

All four teachers involved in the study were observed within the experiment and they were interviewed at the end of the experiment. Twelve students (6 male and 6 female) were interviewed at the end of the experiment drawn from all four classes.

The researcher ensured that the sample was representative of the whole population in the two experimental groups. Variables considered were related either to gender or to level of ability based upon advice from their teachers. It is important to emphasize that the sample was chosen to contribute to the qualitative analysis to explore views and beliefs about the efficacy of different teaching methods. Selected in this manner, the sample size with its 100% response rate was considered adequate for the purpose.

Variables of the Study

This study includes the following of variables:

- The independent variables:
 - 1 - Method of teaching (by practicing mental activities or not).
 - 2 - Gender (female and male).
- The dependent variable: students' mental ability after the experiment in the post-test.

- The covariance variable: students' mental ability before the experiment in the pre-test.

Research Instruments

a - Research Instruments for the Quantitative Part, (Mental Ability Test):

Pre-post mental ability test (for students 12 years old). This is for measuring students' ability in doing mental mathematics and to evaluate the progression of the students within the experiment (see appendices (1) & (2)). The researcher used standardized test for measuring students' mental ability for ages 12 years old where students approximately in the sixth grade (NFER-NESON, 1999). The test measures students mental ability in the following: numbers and operations on it, fractions, geometric shapes, measurements, and area. These constitute the subjects included in the Jordanian curriculum for the sixth grade. The test had been translated into Arabic for the study. The researcher used Arabic names and Jordanian money units, cities, etc. Moreover, a draft of the Answer Booklet was translated into Arabic (see appendix (2)).

Validity of the Research Instrument: To verify the content validity of the test, four drafts were offered to teachers, and other three drafts to experienced professors in the Department of Curricula and Instruction. The aim was to ascertain whether the test is appropriate for measuring Jordanian students' mental ability regarding to the contents of the Jordanian curricula, and to elicit their viewpoints about the clarity of its items. The comments were taken into consideration, and the tool was modified accordingly.

Reliability of the Research Instrument: The reliability of the test was examined by two methods:

1 - The Test Re-Test Reliability.

The test-re-test was employed on 40 of the sample students chosen from the population of the study. Reliability value was 0.86.

2 - The Internal Consistency.

The internal consistency of the research instrument was calculated using the reliability Cronbach alpha method. It was found to be 0.7388.

The previous values (0.86, 0.7388) were enough and satisfactory for the purpose of the study (Oqeili and El-Shayeb, 1998).

Research Questions for the quantitative Part

The pre-post mental ability test was used in this research to answer the following questions:

- 3 - Are there any statistically significant differences in students final mathematical mental ability related to the effect of: teaching method, gender, and Interaction between teaching method and gender.
- 4 - Are there any statistically significant differences in students' mathematical mental ability before and after the experiment (pre-post test) for all groups: control male, control female, experimental male, and experimental female.

b - Research Instruments for the Qualitative Part; (Semi-Structured Interviews)

- 1 - Semi-structure Interviews with students.
- 2 - Semi-structured Interviews with teachers.

Research Questions for the Qualitative Part

A - Questions for Students:

- 1 - What's your opinion about using mental strategies in the mathematics classroom?
- 2 - Have you ever applied such strategies before? (your teacher, at home,)
- 3 - Do you have any suggestions?

b - Questions for Teachers:

- 1 - How important do you think the need to conduct such research? Why?
- 2 - Do you have any previous experience (training programs, books) in how to teach or apply mental strategies?
- 3 - What are the advantages and disadvantages of the program you applied?

- 4 - What are your suggestions about the program you applied?

Procedure of the Study

- Deciding the starting time and the duration of the experiment
- Designing, developing research instruments.
- Writing up the research report.

Results and Discussion

The tables below show the main results in order to answer the study questions. These results will be examined at the standard of ($\alpha \leq 0.05$).

At the beginning of the experiment and after applying the pre-mental ability test, means and standard deviation of the students' scores were calculated to assess students initial mental ability; as shown in table (2).

At the end of the experiment, the Mental Ability Test was re-administered. Means and standard deviations for the students' scores were calculated to be compared and analyzed according to the pre- test.

Table (2): Means and Standard Deviations for the Students' pre-test and post-test scores (total mark = 30) in the control and experimental groups and in terms of gender

Type of group	Number of students	Minimum score		Maximum score		Mean		Standard Deviation	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
Control Male	44	3	3	25	25	11.07	13.20	6.245	6.579
Control Female	41	1	1	18	18	9.34	10.00	3.877	3.647
Control Total	85	1	1	25	25	10.55	11.34	5.156	5.752
Experimental Male	41	2	5	24	28	8.24	16.73	4.247	5.545
Experimental Female	40	3	3	21	24	10.07	13.30	4.531	5.988
Experimental Total	81	2	3	24	28	9.15	15.04	4.458	5.986

Table No. (2) presents in detail all the descriptive statistics values for the female and male control and experimental groups. The study results at the beginning of the experiment indicate the weakness of the students' ability in doing mental mathematics before starting the

experiment where the mean = 10.55 in the control group and 9.15 in the experimental (total score 30). This fact highlights the need of such research. This result agrees with the results of the studies conducted by Cooper and Dune (2000) indicating students usually fail to apply realistic mathematics they gained from perspectives in the classroom. Results also shows that while the mean of the scores in the control group was increased only from 10.55 to 11.34, it was increased from 9.15 to 15.04 in the experimental group. This indicates that students in the experimental group, through applying the mental strategies, get more progress in their mental mathematical ability.

Analysis of Covariance (ANCOVA) was used in the table below to examine if there are statistically significant differences related to the effect of the teaching method, gender and the interaction between teaching method and gender (as an independent variables) on students mental ability (as a dependent variable) and related to the effect of their initial mental ability (as a covariance variable). This part answers the first question of the study.

Q (1): Are there any statistically significant differences in students final mathematical mental ability related to the effect of: teaching method, gender, and interaction between teaching method and gender.

Table (3): Analysis of Covariance of the post-test according to the pre-test, teaching method, gender and the interaction between teaching method and gender of students scores in the control and experimental groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3895.708 ^a	4	973.927	67.680	0.000
Intercept	676.495	1	676.495	47.011	0.000
APRE	2774.005	1	277.005	192.770	0.000
Gender	654.269	1	654.269	45.466	0.000 *
Method	985.918	1	985.918	68.513	0.000 *
Gender * Method	43.325	1	43.325	3.011	0.085
Error	2316.822	161	14.390		
Total	34894.000	166			
Corrected Total	6212.530	165			

Table (3) shows that there are statistically significant differences in students' final mathematical mental ability related to the effect of the

teaching method ($p < 0.05$) and related to the effect of gender. This indicates that the teaching method has an effect on students' mental ability at the end of the experiment. These results support findings reference to the views of Askew, Wheatley, Emma and others (Rooke, 1997) conducted that if children are given the opportunity, they can develop their mental abilities. In addition, results show statistically significant differences in students' mental ability related to the effect of gender ($p < 0.05$), where male students get more progress in their mental abilities and have greater mental skills compared with female students. These results agree with Douglas and Philippe (2006) that males have greater general mental ability than females from 100000 17- to 18- years -olds on an assessment test. Data analysis shows, also, that there are no statistically significant differences between them related the effect of the interaction between teaching method and gender. This indicates significant main effect.

Q (2): Are there any statistically significant differences in students' mathematical mental ability before and after the experiment (pre-post test) for all groups (control male, control female, experimental male and experimental female.)

To explore students' progression before and after the experiment and to compare means, paired sample, t-test (with 2-significance) tailed was used (table (4)). This is to assess if the training programme has a real effect on students' ability to do mental strategies.

Table (4): Paired sample t-test of the pre-test and post-test students mental ability in the control and experimental groups

Paired Differences						
Group	Correlated pairs	Mean	Standard Deviation	T- value	d f	2-tailed sig.
Control Male (N = 44)	Pair 1 PRE & POST	-2.14	3.683	-3.848	43	0.000 *
Experimental Male (N=41)	Pair 1 PRE & POST	-8.49	4.273	-12.720	40	0.000 *
Control Female (N = 41)	Pair 1 PRE & POST	0.66	3.214	1.312	40	0.197
Experimental Female (N = 40)	Pair 1 PRE & POST	-3.23	4.117	-4.954	39	0.000 *

Table (4) reveals that:

- 1 - There are statistically significant differences between the pre-test and the post-test students' mental ability before and after the experiment in the experimental male and the experimental female groups.
- 2 - There are no statistically significant differences between the pre- test and the post-test students' mental ability before and after the experiment in the control female group.
- 3 - There are statistically significant differences between the pre-test and the post-test students' mental ability before and after the experiment in the control male group.

While previous findings illustrated that statistically significant differences were found related to the effect of teaching method and related to gender, results of the study for the paired sample t-test, as table No. (4) indicates, show that there are statistically significant differences between the pre- test and the post-test students' mental ability before and after the experiment in the experimental male, the experimental female and the control male group groups and no statistically significant differences were found for the female control group. For more discussion about these results and by comparing means from table No. (2), it is clear that:

- 1 - Students in the male and female experimental groups have more progress in their ability in doing mental mathematics in the post-test than their ability in the pre-test (mean increased from 8.24 to 16.73 in the male group and increased from 10.07 to 13.30 in the female group) with statistically significant differences ($p < 0.05$).
- 2 - Students' mental ability in the female control group has less progress where the mean increased from 9.34 to 10.00 with no statistically significant differences.
- 3 - Students in the male control group have more progress in their ability in doing mental mathematics in the post-test than their ability in the pre-test (mean increased from 11.07 to 13.20) with statistically significant differences ($p < 0.05$).

Findings in table (4) support the findings in table (3), that there are

statistically significant differences ($p < 0.05$) in students mental ability related to the effect of teaching method (in the female and male groups). In addition, there are statistically significant differences ($p < 0.05$) related to gender. These statistically significant differences arise in the male and female experimental groups with more progress in the male group. Findings also show that, although there were statistically significant differences in the two control and experimental male groups in the students' mental ability before and after the experiment, students in the experimental male group get more progress than students in the male control group (mean increased from 8.24 to 16.73 in the male experimental group and increased from 11.07 to 13.20 in the male control group) with statistically significant differences. This highlights more positive effect for students in the experimental group who applied the mental strategies in their classes within the experiment.

Interviews were conducted with students in the experimental group to investigate their views about the experiment and the program effect on their ability in doing mental mathematics.

Q (1): What's your opinion about the programme of mental strategies in the mathematics classroom? (for students in the experimental group)

Students' responses toward the previous question varied from one to another. All students interviewed in the experimental group agreed that applying such experiment has positively affected their mental ability. Some students pointed out to the positive effect to do mental mathematics in saving time to make the calculations and to find out the solutions faster. Some of these responses are quoted below:

"Well, it's better because I can solve questions faster experimentally in the exams. It saves time".

female student

"the most benefit is in the exam. This method saves my time"

male student

"We can answer faster in the class when our teacher asks us questions"

female student

Other students have different responses. They highlight the positive effect of the program they ran through in doing mental strategies in

different domains. One of them pointed out that the activities included different mathematical operations which were useful for them in different fields.

“It included all mathematical operations like addition, subtraction, multiplication and division, it was useful for us “

male student

Other students pointed to the benefits they had in solving questions in different ways which will help them in the future.

“Some problems could be solved using different methods. This will help us in the next stages”

male student

Most students in the experimental group highlighted the positive effect of applying the experiment in building a learning atmosphere full of fun and interesting enough to encourage them to challenge the problems.

“I felt that maths is fun. Lessons were very interesting”

female student

Most male students pointed out that this learning experience has helped them in applying mental operations in real life situations and outside the classroom.

“It was very useful for me to help me for example in the shop. If I want to buy something “

male student

“At home, there is lot of things I may have to use mental operations”

male student

While findings in the quantitative part highlight the positive effect of the programme implemented, findings from the qualitative part support previous findings and answered the questions how and why such outcomes arise. From the students' point of view, applying mental strategies positively affect in promoting their mental ability but with different response. This was explained with different reasons. Teaching students in how to do mental operations in the experiment allows them the opportunity to do faster calculations in different ways which saving time.

This agrees with Jones (1988) and Rubenstien (2001) where applying mental strategies allow students to solve problems quickly and accurately. Moreover, students explained that the applying mental strategies give them a chance to learn more thinking strategies in different mathematical domains. This result supports Rubensties (2001) where teaching mental strategies facilitated learning many important structural topics and students' points the understanding of inverse operations.

Other findings from the qualitative data analysis were found from the student's point of view in the experimental group. Most students in the experimental male and female groups highlight the positive effect of applying the experiment in building learning atmosphere full of fun and interesting that encourage them to challenge the problems. These benefits have been underlined by several researchers such as Commans (1997), Jones (1988), and Rubenstien (2001). Most male students pointed out that this experiment helps them in applying mental operations in real life situations and outside the classroom. This agrees with Jones (1988) who commented that using mental math allowing students to choose their own methods, and solving problems quickly and accurately in real life situations.

Q (2) Have you ever applied mental operations before? (Your teacher, at home,) (for students in the experimental and control groups)

Students' responses showed that all female students in the experimental and control groups had no previous experience in how to do mental mathematical operations.

"No, at all"

female student

"Not so much, just in doing multiplication and division faster in my mind"

female student

Opposite response was found in the male control and experimental groups. Some students mentioned that their parents encourage them to do mental mathematics by solving puzzles. Other students pointed that they usually do mental operations at shops and markets. Some students

in the control group highlights that their teacher encourages them to make some calculations mentally during class lessons. Some of these responses are quoted below:

“I do mental operations at shops, markets, ”

“My teacher encourages us to do some calculations mentally”

“My father bought to me puzzles book including mental thinking”

male students

Qualitative data analysis also explains the different phenomena found in the quantitative part with statistically significant differences in students' ability before and after the experiment in the control male group with more progression in the experimental male group. This may be related to gender differences as was found by Douglas and Philippe (2006) that males have higher levels in general mental ability. Other reason for such difference in the female and male groups agrees with what Carraher et al. (1985) proposed that male students have a chance to do such operations at shops and markets. Moreover, male students in the control group pointed out the effect of their parents and their teachers to encourage them to adopt such strategies. However, opposite response was found in the female control group where no previous experiences were found either at school or outside the school to practice mental operations. This explains the fact that less progress was found in their ability in doing mental mathematics.

Q (3): Do you have any suggestions? (for students in the experimental group)

The last question explores different suggestions of students. Most students suggested more concern to be taken toward mental mathematics either by adding a unit to the curriculum; concentrating on teaching them how to do mental operations, or by giving them more training courses like the program they applied. Some of these responses are quoted below:

“Why dont they add especial units in the curriculum?”

male student

“I suggested applying more programs like the one we applied”

female student

One student asked if it is possible to keep doing mental ability tests.

Interviews were conducted with teachers to explore their views about the experiment and how the program improved students ability in doing mental mathematics.

Q (1): How important do you think the need to conduct such research? Why? (for teachers)

Teachers who applied the experiment (1 female and 1 male teachers) indicated that they highly support the need to conduct such research. A female teacher commented:

“At the beginning of the experiment I was not satisfied about the effect of applying the mental strategies, actually girls used to make the calculations by paper and pen. But after a period of time I noticed that the program affected students’ performance in doing mental strategies, they became faster and more interested in the mathematics lessons. Moreover, I felt that I got more benefits from applying this experiment and learned something new, which I did not know or apply before.”

A male teacher in the experimental group gave the same response about the positive effect of teaching students in how to do mathematics. He agreed the need exists to help students in doing mental strategies in order to save time, make math faster and easier to be used in daily situations. His response was:

“Well, of course, it is important to teach students all the time, if it is possible, in how to make mathematics calculations mentally. This will help them in their daily situations to deal with math faster, easier and save time.”

Teachers’ responses in the control group (1 female and 1 male teachers) toward their views about the need to conduct research concentrated on mental strategies and differed from one to another. While the female teacher pointed out her little experience about mental mathematics and how to teach or apply such experiment, the male teacher mentioned that he believed that it is useful to encourage students always to do their calculations mentally. Moreover, he pointed out that he sometimes makes mental calculations in his classes. Teachers’ responses toward the previous question in the control group are quoted below:

“In fact, I dont know very well in how to teach or apply the mental mathematical operations in various ways as you expect. I think! I have little experience in that field.”

female teacher

“Actually it is useful always to encourage students to make the calculations mentally if it is easy and possible for them. I sometimes do this in my classes.”

male teacher

Q (2): Do you have any previous experience (training programs, books,) in how to teach or apply mental strategies?

Responses showed that all teachers interviewed did not have any previous training program in mental mathematics. But, some of them commented that they have their own knowledge either from the real life situations or from their experience as mathematicians. Teachers' responses are quoted below:

“Before applying the training programme, no.”

female teacher

“Actually, from my own experience I have some knowledge about it, but during the training program I learned about some strategies in detail, especially in geometry, ratio, and the mathematical operations as fractions and decimals”

male teacher

“No, I dont have any previous experience.”

female teacher

“It is a general information, you know, Im a mathematics teacher. and from our practice in daily situations of course.”

male teacher

Q (3): What are the advantages and disadvantages of the program you applied?

(This question was for teachers in the experimental group)

From the point view of teachers, different advantages have been noted. Students made their calculations faster and in different ways.

Interest and fun in mathematics lessons have been noticed. New students have been encouraged to practice mental operations. Teachers responses came as follows:

“Oh, there is a lot of advantages. Students were interesting in doing mental operations and some lessons were more fun. Moreover, they became faster in calculations. In my opinion, there were no disadvantages.”

female teacher

“I noticed that new students participate in the classes, I notice students challenges to do mathematics and to think mentally in different ways.”

male teacher

**(4): What are your suggestions about the program you applied?
(This question was for teachers in the experimental group)**

Suggestions were either by applying training programs especially in that field or by adding units in the curriculum in different strategies. Providing for specialized books or booklets with various mental activities in different mathematical subjects has also been suggested. Teachers' responses are quoted below:

“Of course there is a lot. For example, adding special units in the curriculum in different stages, providing teachers with booklets or books about mental activities in different subjects.”

male teacher

“The training program was very useful. I suggested applying such training programme. Also, providing teachers with different activities suitable for different stages will be useful.”

female teacher

Analyzing the views of teachers about the use of mental mathematical strategies supports previous findings and explains how the training programme has a positive effect in enhancing students' ability in doing mental operations. They highly support the need to conduct such training programme because of their limited experience in that field as was found particularly for female teachers. This fact discusses the negative outcomes in the female control group and the differences in students' progress before and after the experiment to be compared

between male control and male experimental groups. From the point view of teachers about the effectiveness of the programme, they highlight the advantages of the training programme in introducing different mathematical activities in different mathematical subjects such as geometry, ratio, fractions, and decimals as had been mentioned by several researchers such as Rubenstien (2001), Chesshire et al., (1999), and Fielker (1997). One important fact to be addressed here is that, the effect of applying new programme may have its effectiveness where students and teachers might be strongly motivated and more enthusiastic by applying mental activities. This was noticed and mentioned from the point view of both students and teachers. This supports several researchers (Jones, 1988; Rubenstien, 2001; and Cummnas, 1997) where interest and fun was found during classroom mental activities practicing which encourage students to deal with challenging the problems and pushed other students to participate in the classroom lessons.

Conclusion and Recommendations

The present study shows the following:

- There are statistically significant differences in students mental ability related to the effect of teaching method where applying a training programme for teaching mental strategies in the mathematics classroom positively enhancing students' ability in doing mental mathematics and positive effect was found before and after the experiment with statistically significant differences in the two female and male experimental groups.
- There are statistically significant differences related to gender. The results of the paired sample t-test show that there are statistically significant differences between students' mental ability test before and after the experiment in the male control group and in the male experimental with more progression in the experimental group. In addition, results show that while there are statistically significant differences between students' mental ability test before and after the experiment in the female experimental group, no statistically significant differences were found in the female control group. This was referring to gender differences as a whole. Moreover, the effect of the teacher and parents was clear playing a role in this finding.

- Positive outcomes other than enhancing mental ability was found like fun and interest, which may build positive attitudes toward mathematical lessons that encourage students to participate in the mathematics classroom.
- Limited experience in teaching mental mathematical strategies in different mathematical subjects was one of the results of the study. This may refer to the lack in the training courses provided to teachers to concentrate on teaching mental strategies. Moreover, it may refer to the poorness in the available specialized books, booklets, or curriculum units in mental activities.

In the light of these results, the researcher implies the following:

- It is necessary to apply training programmes concern on teaching students in how to do mental operations that may lead to enhance such ability. Moreover, more research is recommended to search for the effectiveness of applying other training courses for different mathematical abilities.
- Taking more concern about the effect of gender, parents and teachers is recommended for future research.
- More researches are recommended to explore outcomes in the non-cognitive domain.
- It is worthwhile to recommend to the Curriculum and Textbook Authority in the Ministry of Education in Jordan to develop the mathematical curriculum using mental strategies either by adding specialized mental activities or developing special units for mental mathematics and providing teachers with training courses for this issue. Also, it is worthwhile to recommend mathematicians for introducing mental mathematical books or booklets in different mathematical subjects.

تقييم فاعلية برنامج تدريبي في رفع قدرة الطلبة في الرياضيات الذهنية

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قسم المناهج وطرق التدريس

كلية العلوم التربوية - الجامعة الهاشمية

الأردن

ملخص

تهدف الدراسة إلى تقييم فاعلية تطبيق برنامج تدريبي لتعليم الاستراتيجيات الذهنية في رفع قدرة الطلاب في الرياضيات الذهنية. تكونت عينة الدراسة من 166 طالباً وطالبة من طلبة الصف السادس وأربعة معلمين من كلا الجنسين. تم تدريب المعلمين في المجموعة التجريبية لتدريس استراتيجيات الرياضيات الذهنية ليتم تطبيقها في صفوفهم التجريبية خلال فترة تنفيذ التجربة، في حين طلب من المعلمين الآخرين استخدام الاستراتيجيات التدريسية التقليدية. تم اتباع منهجية البحث الكمي والنوعي. تم تطبيق اختبار قبلي-بعدي للرياضيات الذهنية لقياس مقدرة الطلبة الذهنية في بداية التجربة ومدى تطورهم في إجراء العمليات الذهنية خلال التجربة. كما تم إجراء مقابلات شبه رسمية مع المعلمين ومع عينة من الطلبة ممن شاركوا في الدراسة.

دلت نتائج الدراسة على وجود فروق ذات دلالة إحصائية تعزى لطريقة التدريس ولتغير الجنس بشكل عام. كما دلت النتائج على وجود فروق ذات دلالة إحصائية في مقدرة الطلبة الذهنية قبل وبعد التجربة لصالح المجموعة التجريبية لكلا الجنسين ذكوراً وإناثاً ولصالح المجموعة الضابطة ذكوراً. تم تفسير هذه النتائج من حيث الترابطات والاختلافات فيما بينها باستخدام التحليل النوعي للبيانات حيث تبين الأثر الإيجابي في تدريس الطلبة العمليات الرياضية الذهنية في التجربة والذي يسمح لهم بممارسة الأنشطة الذهنية في جو ممتع ويعطي لهم الفرصة للتحدي والمشاركة في الغرفة الصفية. بالإضافة إلى ذلك، فإن تعلم استراتيجيات مختلفة يساعدهم في حل الرياضيات أسرع وفي توفير الوقت.

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Appendix (1)

Pre-Post Mental Ability test

These are the text and questions. Each question is repeated, and the appropriate answer time interval had been allowed after the repeated question.

“Now we are ready to start the test. Please open your answer booklet. We will start with **Part A**. You will have five seconds to answer each question.

1.	Multiply seven by eight.
2.	What is half of negative six?
3.	Look at the equation in box three. What is the value of n?
4.	Write the number three hundred and two thousand, and forty-six. Write it in numbers, not in words.

Now go to the next page.

We are ready to start the questions in **Part B** now

You will have 10 seconds to answer each question.

5.	How many hours are there in one hundred and twenty minutes?
6.	Look at the bar in box six. Twenty percent of the bar is shaded. What percentage is not shaded?
7.	Look at the shape in box seven. Shade in one more square to make a shape Which has one line of symmetry.
8.	Look at the sequence of numbers in box eight. It is going up in steps of nought point one. What is the next number in the sequence?

Now go to the next page.

9.	Six people share thirty J.D. equally. How much does each person get?
10.	Look at the shape in box ten. Lyla drew it on a centimetres square grid. What is the area of the shape?
11.	How many quarter hours are there in three hours?
12.	Divide one hundred and sixty by forty.

Now go o the next page.

13.	Look at the triangle in box thirteen. Fatema drew it on a square grid. How many degrees is angle a?
14.	Look at the nets in box fourteen. Put a ring around the net that will fold up to make a cube.
15.	A bag of sugar weight five hundred grams. Hasan needs four and a half kilograms of sugar. How many bags of sugar is that?
16.	Multiply one hundred and four by four, and then double your result.
17.	Mona has 6 J.D. thirty. She spends four J..D. fifty-five. How much does she have left?

Now go to the next page.

18.	Divide two by a quarter.
19.	Subtract one point four five from six point eight.
20.	What is the square root of fifty to the nearest whole number?

Now go to the next page.

We are ready to start the questions in **Part C** now.

You will have 15 seconds to answer each question.

21.	Look at the tiles in the ring at the top of box twenty-one. Amal puts all these tiles into a bag. Then she picks one tile without looking. Which shape of tile is the most likely to pick? Put a ring around the correct shape of tile at the bottom of the box.
22.	Look at the L-shape and T-shape at the bottom of box twenty- two. Mouhammed is going to fit them together. Draw a ring around the shape that he can make with the L-shape and the T-shape.

Now go to the next page.

23.	Look at the dots in box twenty-three. How many more dots do you need to make a hundred?
24.	The pie chart in box twenty-four shows what sixty pupils had for dinner. How many pupils had salad for dinner?
25.	Look at the calculations in box twenty-five. Use it to help you to work out forty-six times forty-eight.

Now go to the next page.

26.	Look at the table in box twenty-six. It shows the distance in Kilometres between some cities. Ahmad drove from Al-karak to Irbid. How far did he drive?
27.	The T-shape in box twenty-seven is made of four squares. It has a perimeter of twenty centimetres. What is the length of the edge of each square?
28.	Look at the calculations in box twenty-eight. Use it to help you to work out the answer to two point seven multiplied by three point eight.

Now go to the next page.

29.	The prism in box twenty-nine is half of a two by two centimetres cube. What is the volume of the prism?
30.	There are sixteen small rectangles inside the large rectangle in box thirty. Use the diagram to help you to work out one half minus three sixteenths.

Now stop writing. We have finished.

Appendix (2)
Pre-Post Mental Ability test
The Answer Booklet

Student Name:

Class:

Date:.....

Part A:

1.

Answer _____

2.

- 6

Answer _____

3.

$6n = 18$

Answer _____

4.

three hundred and two thousand, and forty-six

Answer _____

Part B:

5.

120 minutes

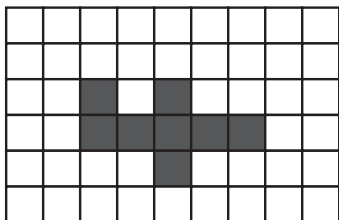
Answer _____

6.



Answer _____ %

7.



8.

12.7 12.8 12.9 ..

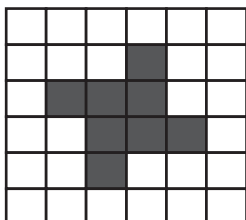
Answer _____

9.

30 J D

Answer _____ J D

10.

Answer _____ cm^2

11.

$\frac{1}{4} \cdot 3$

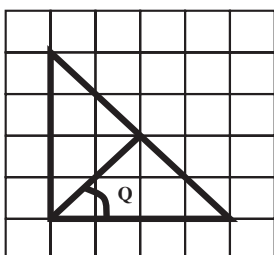
Answer _____

12.

$160 \quad 40$

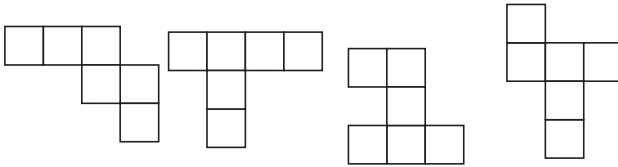
Answer _____

13.



Answer _____ degrees

14.



15.

500 g 4 $\frac{1}{2}$ Kg

Answer _____ bags

16.

104 4

Answer _____

17.

6. 30 J. D. 4. 55 J D

Answer _____

18.

2 $\frac{1}{4}$

Answer _____

19.

1. 45 6. 8

Answer _____

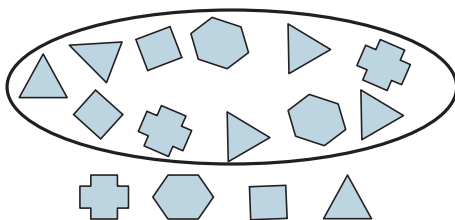
20.

 $\sqrt{50}$

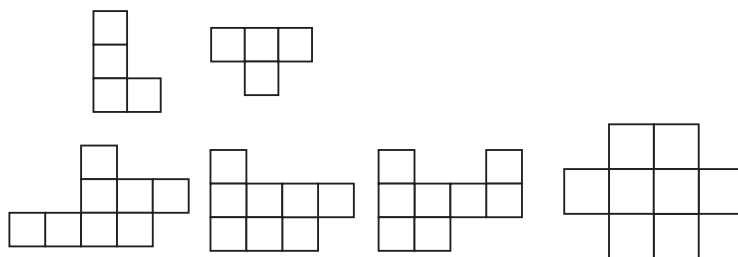
50 Answer _____

Part C:

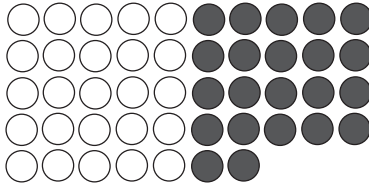
21.



22.

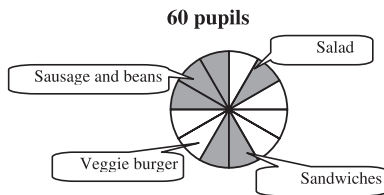


23.



Answer _____ dots

24.



Answer _____ pupils

25.

$$23 \times 48 = 1104$$

$$46 \times 48 =$$

Answer _____

26.

Alzarqa				
47	Irbid			
120	155	Amman		
233	268	115	Madaba	
183	203	169	147	Al-karak
226	246	212	181	60 Al-aqaba

Answer _____ Kms

27.



Perimeter = 20 cm

Answer _____ cm

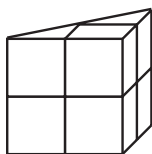
28.

$$27 \times 38 = 1026$$

$$2.7 \times 3.8 =$$

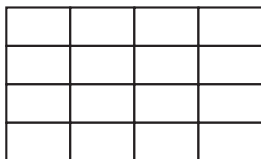
Answer _____

29.



Answer _____ cm

30.



$$\frac{1}{2}$$

$$\frac{3}{16}$$

Answer _____

Appendix (3)

Samples of Activities

***** APPROXIMATION *****

Activity (1): use the approximation to find the value of the following (mentally):

$$7.6 + 4.2 = 8 + 4 - .2 = 12 - .2 = 11.8$$

$$11.8 - 9.2 = (11.8 - 9) - .2 = 2.8 - .2 = 2.6$$

$$9.2 - 7.3 = (9.3 - 7.3) - .1 = 2 - .1 = 1.9$$

Activity (2): give examples of two integers their sum equals 10.

$$3 + 7 = 10$$

$$2 + 8 = 10$$

$$4 + 6 = 10$$

$$1 + 9 = 10$$

$$5 + 5 = 10$$

Activity (3): give examples for two integers their sum equals 100.

$$64 + 36 = 100$$

$$52 + 48 = 100 \text{ (the idea is the sum of ones = 10 and the sum of tens = 9)}$$

$$27 + 73 = 100$$

Activity (4): use activities (2) and (3) to find the value of:

$$1.25 + .75 = (.75 + .25) + 1 = 1 + 1 = 2$$

$$7.2 + .8 = 7 + (.2 + .8) = 7 + 1 = 8$$

$$4.63 + 2.37 = (4 + 2) + (.63 + .37) = 6 + 1 = 7$$

$$7.71 + .29 = 7 + (.71 + .29) = 7 + 1 = 8$$

***** MULTIPLICATION BY 10, 100, 1000 *****

Activity (6): find the value of the following:

$$6 * 50 = 6 * 5 * 10 = 30 * 10 = 300$$

$$17 * 100 = 1700$$

$$17 * 50 = 17 * 100 / 2 = 1700 / 2 = 850 \text{ (} 17/2 = 8 \text{ and } 100 / 2 = 50 \text{)}$$

$$17 * 25 = 17 * 100 / 4 = 1700 / 4 = 850 / 2 = 425 \text{ (} 8/2 = 4 \text{ and } 50 / 2 = 25 \text{)}$$

$$44 * 10 = 440$$

$$44 * 5 = 440/2 = 220$$

$$44 * 15 = (44 * 5) + (44 * 10) = 220 + 440 = 660$$

***** APPROXIMATION AND MULTIPLICATION

Activity (7): find the value of:

$$15 * 19 = 15 * 20 - 15 = 300 - 15 = 285$$

$$50 * 15 = (50 * 10) + (50 * 5) = 500 + 250 = 750$$

$$50 * 23 = (50 * 3) + (50 * 20) = 150 + 1000 = 1150$$

$$37 * 15 = (40 * 15) - (3 * 15) = 600 - 45 = 555$$

$$19 * 8 = (20 * 8) - 8 = 160 - 8 = 152$$

***** FRACTIONS *****

Activity (8): find the value of:

$$1/2 \text{ of } 12 = 6, 1/4 \text{ of } 12 = 3, 1/3 \text{ of } 12 = 4,$$

$$1/6 \text{ of } 12 = 2, 1/12 \text{ of } 12 = 1, 1/10 \text{ of } 12 = 1.2$$

Activity (9): find the value of:

$$1/2 \text{ of } 10 = 5, 1/4 \text{ of } 20 = 5, 1/5 \text{ of } 25 = 5, 1/3 \text{ of } 15 = 5$$

$$1/6 \text{ of } 30 = 5, 1/10 \text{ of } 50 = 5, 1/20 \text{ of } 100 = 5$$

***** MULTIPLICATION AND DECIMALS *****

Activity (10): find the value of:

$$* 4 = (3.5 * 2) * 2 = 7 * 2 = 14$$

$$5.3 * 4 = (5 * 4) + (.3 * 4) = 20 + 1.2 = 21.2$$

$$* 9 = (2.5 * 10) - 2.5 = 25 - 2.5 = 22.5$$

$$* 9 = (2 * 9) + 1/2 \text{ of } 9 = 18 + 4.5 = 22.5$$

$$9.2 * 5 = (9 * 5) + (.2 * 5) = 45 + 1 = 46$$

***** PERCENTAGE *****

Activity (11): find the multiple representations for the following

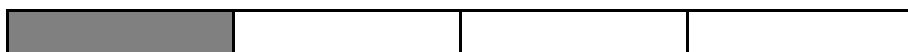
$$50 \% = 1/2 = 0.5$$



$$75 \% = 3/4 = 0.75$$



$$25 \% = 1/4 = 0.25$$



$$20 \% = 1/5 = 0.20 = 0.2$$

Activity (12): use activity (11) to find the following:

$$25 \% \text{ of } 500 = 1/4 \text{ of } 500 = 1/4 \text{ of } 100 + 1/4 \text{ of } 400 = 25 + 100 = 125$$

$$5 \% \text{ of } 500 = 1/20 \text{ of } 500 = 25$$

$$10 \% \text{ of } 500 = 1/10 \text{ of } 500 = 50$$

$$50 \% \text{ of } 500 = 1/2 \text{ of } 500 = 250$$

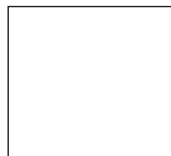
***** **GEOMETRY** *****

Activity no. (13): find the value of the diameter and the area for the following square (mentally):

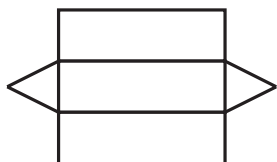
$$\text{Area} = 3 * 3 = 9 \text{ cm}^2$$

$$\text{Diameter} = 3 * 4 = 12 \text{ cm}$$

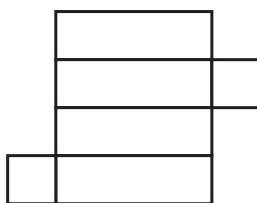
3 cm



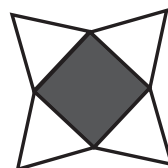
Activity (14): determine the kind of the prism for the following nets:



Triangular Prism



Rectangular Prism



Pyramid