

*The Effect of Using Games and Puzzles on the Achievements
of Mentally Retarded Pupils in Multiplication Tables*

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Abstract

The mentally retarded pupils face a big problem to remember multiplication facts. For that reason, this research tries to measure the effect of using games and puzzles on their achievement in multiplication tables.

This research tries to answer these questions:

- What are the games and puzzles that can be used in the teaching multiplication table for mentally retarded pupils?
- What is the effect of using it on their achievement in multiplication table?
- Which one has a greater impact on pupils' achievement of the multiplication table?

The results showed that:

- Each of the games and puzzles has an impact on increase students' achievement in multiplication table.
- There was no significant difference between the mean of two experimental groups in posttest.
- But the pupils loved Puzzles more than games because the puzzles depending on drawing art.

Keywords: (Games, Puzzles, Mentally Retarded, Multiplication Table)

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Introduction

The progress of any nation can be measured by the amount of care for the pupils with special needs such as mentally retarded pupils. Mentally retardation problem faces all nations, but in different levels. In Egypt, this kind of pupils have special schools. They have also special curriculum.

Students with mental retardation have difficulty remembering information. As would be expected, the more severe the cognitive impairment, the greater the deficits in memory (Heward, W. L.: 2014). These Characteristics affect deeply in their learning ability, especially when they study multiplication tables. This problem will lead to more problems when they study other topics such as multiplication of decimal numbers (Watarai, Y., 7403:2012), or study measurements (Rahaman, J. and others, 1965:2012).

A systematic search of the literature from 1989 through 1998 was conducted to identify and analyze mathematics interventions for students with mild-to-moderate mental retardation. It was found that the focus of instruction has shifted from basic skills instruction to computation and problem-solving instruction. Techniques such as constant-time delay, peer tutoring, time trials, and direct instruction proved beneficial in improving mathematics skills. Further, students with mental retardation learned to employ cognitive strategies successfully when these techniques were included (Butler, F. M. and Others, 2001: 20-31).

There is an importance to use art approach for mentally retarded pupils teaching because this approach can help these pupils to develop their visual awareness and their ability to think independently (Kelchner, 1991:141). Bonsangue suggested that the teacher can teach multiplication operation to mentally retarded pupils by using practical activities which called wrap-up activities (Bonsangue, P. and Reymond, A., 1996:36-38)

There are many studies in teaching multiplication to mentally retarded pupils such as:

- Singh and Agrawal study (2013): It investigated whether computer games help in teaching mathematics to children with mental retardation and whether computer games help equally both boys and girls. The results showed that computer games are useful for both boys and girls. But the boys seemed to benefit more from computer games.
- Kroesbergen, E. H. and Johannes, E. H. study (2005): It examined the effects of a constructivist mathematics intervention for students with mild mental retardation as compared to direct instruction. Multiplication automatically and ability tests were administrated before and after the four month training period. The results show that students in both conditions improved significantly during the training period. But the students with mild mentally retardation can profit from constructivist instruction, although direct instruction seems more effective.

According to the above, some considerations can be taken such as:

- The importance of using art with mentally retarded pupils.
- Games are useful with these kind of pupils.

Problem

The mentally retarded pupils face a big problem to remember multiplication facts.

This research tries to measure the effect of using games and puzzles on their achievement of learning multiplication tables.

The research questions are:

- What are the games and puzzles that can be used?
- What is the effect of using them on learning multiplication table?
- Which one has the greatest impact on pupils learning of multiplication table?

Limitations

The research limitations are:

- Research applied on sixth grade mentally retarded pupils.
- Games and puzzles are used for teaching multiplication tables 2-5.
- All puzzles depend greatly on drawing familiar shapes for the pupils.

Importance

This research can:

- Offer some educational games and puzzles which can help mentally retarded pupils to learn multiplication facts.
- Help mentally retarded pupils to enjoy learning math.
- Normal pupils could be benefited from using these educational games and puzzles

Hypotheses

This research tries to satisfy the following hypothesis:

1. There are statistical, significant differences between the mean scores of the first experimental group and control group in post achievement test in favor of the first experimental group.
2. There are statistical, significant differences between the mean scores of the second experimental group and control group in post achievement test in favor of the second experimental group.
3. There are statistical, significant differences between the mean scores of the first experimental group and second experimental group in post achievement test in favor of first experimental group.

Definition of Terms

1. **Mentally retarded pupil:** The pupil who have IQ between 50-70.
2. **Game:** It is a kind of activity which have these characteristics:
 - Played by two or more players.
 - Have some rules must be followed.
 - Can be played several times.
 - One player must be winner.

- Enjoyable.
3. **Puzzle:** It is kind of activity which have these characteristics:
- Have a problem.
 - End by solve the problem.
 - Practices individually or in group.
 - Practice is done one time.

Method

The research method can be described in the following steps:

1. Determine the objectives of teaching multiplication tables unit in sixth grade textbook.
2. Develop the following educational materials:
 - Design 25 games with rules in multiplication tables until 5.
 - Design 29 puzzles in multiplication tables until 5.
3. Carry out a pilot study for these games and puzzles on a sample of mentally retarded pupils.
4. Modify the games and puzzles according to the results of the pilot study .
5. Develop achievement test in multiplication facts until 5.
6. Choose three equivalent groups from sixth grade of mentally retarded pupils .
7. Apply an achievement test in multiplication table on the three groups (pre-test).
8. Teach multiplication table to the three groups as following:
 - Teach the first experimental group by using the games.
 - Teach the second experimental group by using the puzzles.
 - Teach the control group by using ordinary method.
9. Apply the same achievement test in multiplication table on the three groups (post- test) .
10. Analyse the results.

Overview on games:

All the games (25) was built with the following considerations:

- It should be similar to familiar games.
- Simple rules.
- No costs.
- Attractive

The following table shows the different kinds of these games:

Table (1) shows the different kinds of games

The name of game	Dominoes	Ladder and snake	Monopoly	Cards	Tic Tac toe
Multiplication- Table 2	1	2	3	4	5
Multiplication- Table 3	6	7	8	9	10
Multiplication-	11	12	13	14	15

Table 4					
Multiplication- Table 5	16	17	18	19	20
Review	21	22	23	24	25

The previous table shows that 25 games can be divided into five kinds of familiar games for pupils. These kinds are: dominoes, ladder and snake, monopoly, cards and tic tac toe.

Sample of one game:

This game is tic tac toe game with some modifications to be suitable for help pupils to remember multiplication facts.

Game objective:

After the pupils playing this game many times ,they will be able to memorize the multiplication facts of table 2.

Game tools:

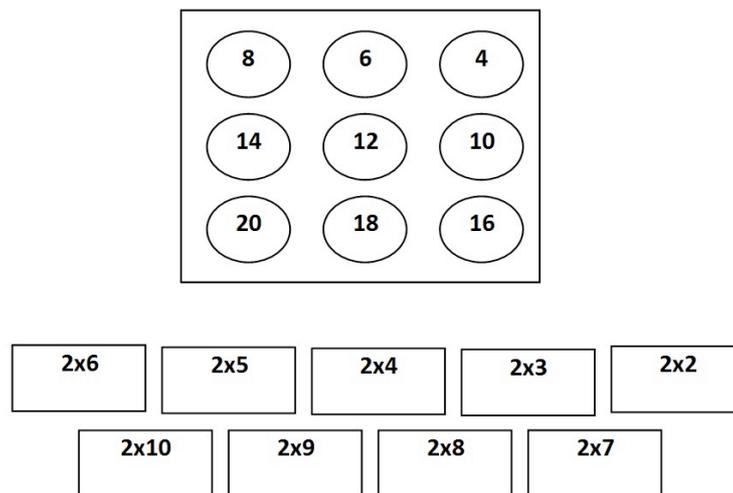


Figure (1) show tools of Tic Tac Toe game after modifications

The tools of this game are:

- One board contains 9 cells which have the results of multiplication facts of table 2.
- 9 cards contain some problems of multiplication table 2.
- Two crayons with different colors.

Numbers of players:

Two players.

Game steps:

- Each player chooses one color crayon.
- First player choose one card randomly.
- Calculate the result of multiplication problem.

- Colored the cell, which contains his result with his crayon color.
- The second player follows the same steps.
- The two players exchange the roll.

Winner player:

The winner player is the first player who can colored row or column or diagonal with his color.

Overview on puzzles:

All the puzzles (29) in multiplication tables was built with the following considerations:

- Should use drawing shapes.
- Shapes should be familiar.
- No hard thinking.
- Short distance between drawing points.

Sample of one puzzle

puzzle steps:

1. The teacher ask his pupils the puzzle question such as:
"Something we cannot walk in the street without it?"
2. All responses of the pupils were accepted and wrote in the black board without any comment and the pupils will know the solution of this puzzle after follow these procedures:
 - The teacher ask his pupils to solve all these problems:

(1) $3 \times 6 = \dots$	(2) $4 \times 10 = \dots$
(3) $3 \times 5 = \dots$	(4) $2 \times 7 = \dots$
(5) $3 \times 9 = \dots$	(6) $4 \times 6 = \dots$
(7) $5 \times 9 = \dots$	(8) $4 \times 8 = \dots$
(9) $2 \times 9 = \dots$	(10) $5 \times 6 = \dots$
(11) $4 \times 9 = \dots$	(12) $5 \times 8 = \dots$
 - The teacher distributes this card for each pupil:

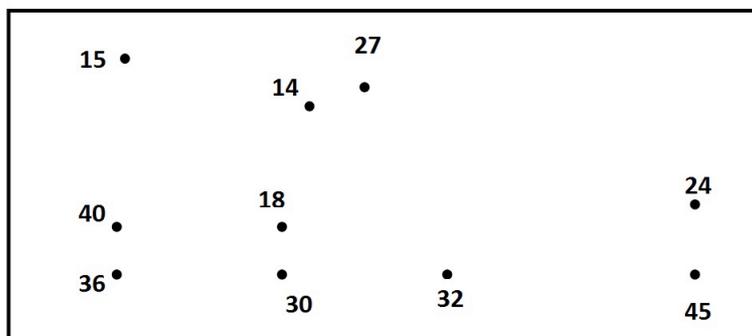


Figure (2) show the puzzle card

- The teacher asks them to connect the dots according to the order of the problems results.
- If the problems results is right and his connecting right, the pupils will get the shape of the puzzle solution as follows:

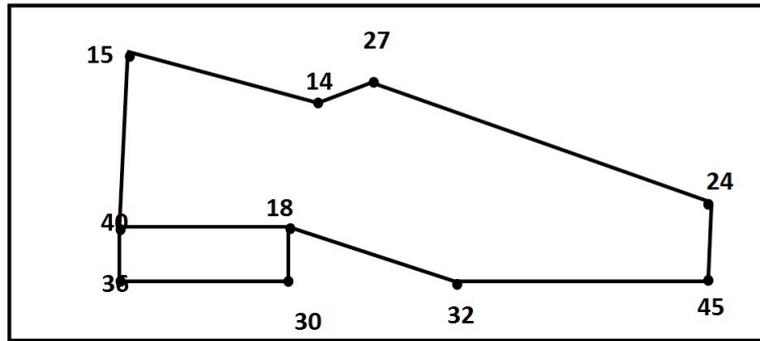


Figure (3) shows the puzzle solution

- All the pupils will know that the puzzle solution is shoes.

Results

- To satisfy the significant differences between the score means of the post test for the three groups, one way analysis of variance (ANOVA) was made for the three means. The results can be shown in the following table:

Table (2) shows the one-way ANOVA of score means for these three groups

Source	Sum of squares	df	Mean Square	F	Sig.
Between groups	637.544	2	318.772	5.71	0.009
Within groups	1339.435	24	55.81		
Total	1976.979	26	374.582		

The previous table shows that There were statistically significant differences between group means as determined by one-way ANOVA ($F(2,24) = 5.71, p = 0.009$) in post-test which can be traced to games and puzzles.

- To satisfy the first hypothesis, Mann–Whitney U test was carried out to know the significant differences between mean scores ranks of first experimental group and control group in post-test. As shown in the following table:

Table (3) shows the significant differences between mean Rank scores of first experimental group and control group in post-test

N1 Control	N2 First experimental	U_1	U_2	U	Critical value at $P = 0.05$	significant
8	9	58	14	14	15	significant

The previous table shows that the smallest U value is less than the critical value at $P = 0.05$ and therefore there were significant difference between the two groups in favor of the first experimental group.

- To satisfy the second hypothesis, Mann–Whitney U test was carried out to know the significant differences between mean scores ranks of second experimental group and control group in post-test, as shown in the following table:

Table (4) show the significant differences between mean Rank scores of second experimental group and control group in post-test

N1 Control	N2 second experimental	U_1	U_2	U	Critical value at $P = 0.05$	significant
8	10	68	12	12	17	significant

The previous table shows that the smallest U value is less than the critical value at $P = 0.05$ and therefore there were significant difference between the two groups in favor of the second experimental group

- To satisfy the third hypothesis, Mann–Whitney U test was carried out to know the significant differences between mean scores ranks of first experimental group and second experimental group in post-test, as shown in the following table:

Table (5) show the significant differences between mean scores of first experimental group and second experimental group in post-test

N1 First experimental	N2 second experimental	U_1	U_2	U	Critical value at $P = 0.05$	significant
9	10	59	31	31	20	Not Significant

The previous table shows that the smallest U value is greater than the critical value at $P = 0.05$ and therefore there were no significant difference between the two groups; first experimental group and second group.

Although there were no significant difference between the two groups, but through the responses of the pupils during their practice, the researcher noticed that the pupils loved the puzzles more than games. May be they loved puzzles because it depended deeply on drawing art. (some pupils says: Oh we are artist).

Conclusions

According to the results of the present research, the following conclusions can be made:

- Using games and puzzles helped the mentally retarded pupils to learn multiplication tables.
- There is no difference between using games and puzzles in learning multiplication tables.
- Both games and puzzles have the same effect on the achievement of mentally retarded pupils when learning multiplication tables.
- The pupils loved the puzzles more than games because it depends on drawing art.

Recommendations

According to the results of the present research, the following recommendations can be made:

- All these games and puzzles should be included in the teachers guide mathematics textbooks in elementary stage as enrichment activities.
- The teachers should use these kinds of activities as a tool to teaching mathematics.
- Since these games and puzzles are effective for the sixth grade mentally retarded pupils, then it will be effective also for the normal pupils.
- The teachers in elementary stage need to get some training to design similar games and puzzles in different mathematical concepts.

Suggestions for Further Research

Following up on the results of the present research, the following researches are suggested:

- Studying the impact of these games and puzzles on the attitudes of the pupils toward learning mathematics.
- Developing more games and puzzles to help pupils learn mathematics in advanced level.
- Measuring the effectiveness of using games and puzzles for teaching other mathematical concepts.

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