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THE EFFECTIVENESS OF A TRAINING PROGRAM IN THE DEVELOPMENT OF MATHEMATICAL CONCEPTS AND SKILLS AMONG SOCIAL STUDIES TEACHERS

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Abstract

The aim of the current research is to prepare a training program to provide social studies teachers with the mathematical concepts and skills necessary to not only teach social studies, but to measure the effect of this training program on the development of their teaching performance. To achieve these goals, the content of social studies books, activity notebooks, and teacher guides from Grades 4 to 6 were analyzed in order to identify a list of the necessary mathematical concepts and skills needed. A test was prepared to measure the acquisition of mathematical concepts and an observation card was prepared to track teaching performance. The instruments were applied to 33 of social studies teachers who were randomly selected from the El-Bagour Educational Administration in Menofia Governorate, Egypt. A quasi-experimental research design was used to identify their weaknesses in mathematical concepts and skills and to determine their teaching performance. The results of this study showed that social studies teachers possess the mathematical concepts and skills necessary associated with teaching social studies at the elementary school stage.There is also a statistically significant difference (0.01) between the mean scores of the teachers in the results of the pre- and post-tests of mathematical concepts, and also in the results of the pre-

and post-tests of the performance observation card. Finally, there is a positive correlation between the mastery of the mathematical concepts and skills needed to teach social studies among social studies teachers in the primary stage and their teaching performance.

Keywords: Training needs; Training program; Professional development; Social studies teachers; Mathematical concepts; Mathematical skills

1.Introduction

A social studies teacher needs many mathematical concepts and skills to be able to teach many topics related to maps, industry, economy, and human activities that are emphasized in the social studies topics in schools. Integration between the various academic subjects is an urgent necessity in this era. Mathematics is one of the central subjects that is fundamentally related to our lives. It is considered a vital requirement, and as such it is related to different fields of knowledge. Mathematics differs from other subjects only in the degree of its importance. Numbers and operations, geometric shapes and measurements, and collecting and organizing data are all related to mathematical concepts and skills necessary in our daily life.

There have been many studies that deal with the roles of mathematics and its relationship to other subjects, which can be classified into the following categories:

1. Interdisciplinary studies, which deal with the necessity of integration between materials in building and display.
2. Studies that deal with the difficulties teachers face related to teaching mathematical concepts and skills.
3. Studies that deal with mathematics within programs that prepare student teachers and the difficulties associated with the process.
4. Studies that emphasize the need for teachers of different subjects, including social studies, to be aware of mathematical concepts and skills.

Several studies (i.e., Al-Jheklab, 2019; Farajallah, 2014; Fredua-Kwarteng, 2020) have confirmed that mathematical concepts help to make the subject matter easier for students by being able to understand concepts in a logical

way. The benefits of mathematical concepts do not stop at this point. They also help students to explain phenomena and develop their research and inquiry skills in order to solve the problems they face. Furthermore, the concepts help teachers deal with the increasing amount of mathematical knowledge they acquire and help them to be more capable when solving problems. This is all achieved when teachers have a deeper understanding of mathematical concepts (Dweikat, 2016).

Eid (2005) pointed out the importance of mathematics in social studies courses which enable students to explain different phenomena. This is confirmed by Labban's study (2006) that mathematical concepts and skills help students learn geographical skills faster. Thus, teaching geography in particular and social studies in general requires the acquisition of mathematical concepts and skills. These concepts and skills are necessary for any social studies teacher because they help them to understand many concepts that may seem difficult, such as longitude and latitude; scale drawing; data, tables, and graphs; and chronology of events (Guerra & An, 2016).

Teachers have difficulties with the cognitive areas related to mathematical concepts. There are difficulties with verbal problems that contain numbers or percentages which required the following skills: converting verbal problems into mathematical symbols, creating a visual, identifying data and information related or unrelated to the problem, applying steps to solve the mathematical problem, and deriving generalizations related to the solution of the problem (Guerra & An, 2016).

It is noted through a review of literature and previous studies that are related to the professional development of teachers at the international (Adgeret al., 2004; Frankeet al., 2001; Walker, 2003) as well as the local level (Ministry of Education, 2015), that there is a necessity to focus on a set of foundations as follows:

1. Professional development for teachers is a necessity under the changing times, and the teacher's need for advanced skills that benefit them in thinking and dealing with content is imperative.

2. Professional development is related to a range of areas including cognitive mastery, planning, learning strategies, classroom management, evaluation, and professional ethics.
3. Professional development is related to a set of methods and work strategies, including orientation meetings, workshops, self evaluation, and research lessons.
4. Professional development for teachers is a necessity imposed by the constant change in the educational needs of students and society.

The current research stems from the problem of the teacher's cognitive mastery of mathematical skills that may affect teaching and other aspects such as planning, learning strategies, and evaluation. Therefore, the aim of the current research is to equip social studies teachers with the mathematical skills necessary for teaching with an indication of the impact of this development on their teaching performance.

2. Identifying the Problem

The need to study this research problem was determined after reviewing some previous studies, which emphasized the need for social studies teachers to be familiar with mathematical concepts related to their content. In addition, the social studies textbooks for the upper three grades of the primary stage were checked (Ministry of Education, 2019a, 2019b, and 2019c) and were found to contain many mathematical concepts and skills.

A pilot study was conducted on a random sample of 27 social studies teachers in the El-Bagour Educational Administration in Menofia Governorate, Egypt. A test was applied in mathematical concepts and skills related to the content of social studies at the elementary school level. The test consists of 30 items distributed in the following domains: numbers and operations, measurement and engineering, and collecting and organizing data. Emphasis was placed on mathematical concepts related to social studies courses at the elementary school level. The results of the test are as shown in Table 1:

Table 1. Pilot study results to the mathematical concepts test (n = 27)

Domain	PossibleMax Score	Max	Min	Mean
Numbers & operations	10	6	2	4.686
Measurement & engineering	17	8	3	8.158
Collecting & organizing data	3	3	1	1.950
Total	30	16	4	14.794

Table 1 shows the low level of skills in some mathematical concepts related to the three domains. After analyzing the teachers' responses to the test items, the following can be concluded:

1. The teachers performed poorly in many mathematical concepts such as drawing to scale. Teachers had confused the use of drawing to scale with zooming in and out. Likewise, there was confusion between the ratio and the rate, and the interpretation of both terms.
2. The teachers performed poorly in the implementation of some mathematical operations, especially complex operations, which require awareness of priorities in their implementation.
3. The teachers performed poorly in skills such as mental arithmetic, and the approximate estimations that the teachers need in the class when talking about ratios, results of operations, and predicting population numbers and population density, for example.
4. The teachers lacked awareness of the concept of dimensions and its consequences, especially in points and lines, shapes and volumes.
5. The teachers lacked awareness of their ability to perceive cognitive integrations and interconnections between branches of knowledge within fields and between different fields.
6. It was noted that there was a deficiency in teaching performance in general, which may be attributed to the previous deficiency in acquiring mathematical concepts and skills.

3. Research Problem

Through the above examples, it becomes increasingly clear that the current research problem is evidenced in the poor performance of social studies teachers in acquiring mathematical concepts (as the pilot study showed),

which is reflected in their performance of the associated skills necessary for teaching social studies in elementary schools. The main research question was: what is the proposed program to develop some mathematical concepts and skills necessary for social studies teachers at the elementary school level, and how to indicate its relationship to their teaching performance? The study addressed the following sub-questions:

1. What are the mathematical concepts and skills required for elementary social studies teachers?
2. What is the impact of the proposed program on developing mathematical concepts and skills among social studies teachers at the elementary school level?
3. What is the effect of the proposed program on improving the performance of social studies teachers at the elementary schools?
4. What is the relationship between social studies teachers' acquisition of mathematical concepts and skills and their teaching performance at the elementary school level?

4. Research Importance

The following categories may benefit from the current research:

1. Teachers: This study may help social studies teachers at the elementary school level to acquire some mathematical concepts and skills necessary to improve their teaching performance.
2. Curriculum designers: Curriculum designers must realize the necessity of integration between fields of knowledge, and the intersections should be outlined in a clear manner that is perceived by both the teachers and the students.
3. Directors of training departments in administrations: Benefit from using the program proposed in this study as a program for training social studies teachers.
4. Researchers: Researchers can benefit from the content and procedures of the current research in building other programs for social studies teachers in middle and high schools, and the same idea can be applied to other subjects.

5. Research Objectives

The current research aims to:

1. Determine the list of mathematical concepts and skills necessary for social studies teachers at the elementary school level.
2. Prepare the proposed program to develop some mathematical concepts and skills among social studies teachers at the elementary stage.
3. Measure the impact of the proposed program on developing mathematical concepts and skills among social studies teachers at elementary schools.
4. Explain the relationship between the development of mathematical concepts and skills of social studies teachers and their teaching performance.

6. Research Postulates

The current research started from the following postulates:

1. Empowerment of social studies teachers through acquisition of mathematical concepts and the skills associated with teaching them is an indispensable necessity.
2. The social studies curriculum contains mathematical concepts and skills that the teachers need to instill in their students.

7. Research Delimitations

1. The sample comprised a group of social studies teachers in the El-Bagour Educational Administration in Menofia Governorate, Egypt.
2. The researchers adopted social studies courses for the upper three grades of the elementary stage (Grades 4 through 6 in the academic year 2019/2020).
3. Mathematical concepts and skills were used in this research from the analysis of textbooks of Grades 4 through 6.

8. Research Methodology

Since the current research represented is field research, the descriptive approach was relied upon to answer questions related to identifying the mathematical concepts and skills necessary. In addition, the training

program was prepared based on previous studies and literature in the field of social studies and mathematics. A one-group pre-test–post-test design was applied to the program. This research design is a type of a quasi-experimental design. The first advantage of this design is that it uses one group of participants, which means that all participants receive the same treatments and evaluations. The second advantage is that the participants in the group receive the pre-test first, then treatment, and finally undertake the post-test. The treatment effect is calculated by observing the difference between the two tests (Allen, 2017; Privitera & Ahlgrim-Delzell, 2019). 33 teachers were selected from 20 elementary schools in the El-Bagour Educational Administration in Menofia Governorate, Egypt, to implement the training program. All teachers who participated in this study are teachers of social studies for Grades 4 through 6, and have a bachelor's degree from the College of Education in Basic Education. The training program was implemented online due to the teachers' working conditions after they were convinced of the importance of training and the appropriate time was determined for them to apply for the program.

9. Hypotheses

To answer the third, fourth and fifth research questions, the following hypotheses were formulated:

1. There is a statistically significant difference between the mean scores of teachers in the results of the pre- and post-test of the mathematical concepts test.
2. There is a statistically significant difference between the mean scores of the teachers in the results of the pre- and post-test of the social studies teachers’ performance on the observation card at the elementary school level.
3. There is a positive relationship between the ability of social studies teachers at the elementary school level to implement the mathematical concepts and skills that are required to teach social studies and their teaching performance.

10. Research Procedures

10.1 Answer to thefirst research question

To answer the first research question, the following was done:

1. Determining the list of mathematical concepts and skills needed for social studies teachers.
2. Preparing research tools, including mathematical concepts test and the social studies teacher performance observation card.

10.1.1 The mathematical concepts test necessary for teaching social studies

The test was created using the following steps:

10.1.1.1 Test objectives

The aim of the test is to measure the extent to which social studies teachers are able to use the mathematical concepts related to social studies that enable teachers to improve their performance in the classroom. Table 2 illustrates a set of concepts and skills included in social studies textbooks for Grades 4 through 6.

Table 2. List of concepts and skills are formulated in the form of cognitive and psychomotor objectives

	Cognitive Objectives	**Psychomotor Objectives**
1	Define the perimeter of geometric shapes.	Count the perimeter of some grounded pieces that make different geometric shapes.
2	Distinguish between lines and circles.	Plot longitude and latitude.
3	Remember the formula used to calculate the perimeter of geometric shapes: rectangle, square, and circle.	Apply the formulas of the perimeter of geometric shapes.
4	Realize the concept of areas.	Mentally distinguish the difference between

		perimeter and area.
5	Deduce the area formula of geometric figures.	Calculate the area of geometric shapes.
6	Estimate perimeter and area of geometric shapes.	Mentally calculates the perimeter and areas and determine the accuracy of the estimate.
7	Recognize the technological tools used in calculation and measurement.	Use a calculator to calculate and verify complex issues.
8	Recognize the terms: lengths, line segment, beam, straight lines, curved lines, and broken line.	Divide a straight line into small pieces by drawing lines and curves
9	Recognize some regular and irregular figures.	Provide models for the figures during cutting and pasting, or disassembly and installation.
10	Deduce the volume formulas of Shapes.	Calculate the volume of a cube and a cuboid.
11	Understand the concept of capacity, and its units of measurement: liters and others.	Estimate the capacity of some shapes or natural phenomena in the form of famous shapes.
12	Recognize the terms of depth and height.	Calculate the height of the building or the depth of water bodies.
13	Recognize the concept of time and its units.	Identify differences in timing between countries and converts between units.
14	Distinguish between time and date.	Convert between units: centuries, decades, or years into months.
15	Recognize the time sequence and its various measurements in history.	Arrange historical events in a linear time sequence.
16	Recognize the concept of speed.	Explain the relationship between distance and time

17	Recognize the original and secondary directions.	Plot directions on a map.
18	Read and write large numbers.	Use the large numbers in class discussions.
19	Explain the relationship between numbers (larger than, smaller than, and equal).	Compare the large numbers.
20	Realize the impact of mathematical operations.	Calculate the mathematical operations in paper and pen.
21	Realize multiple computation methods.	Estimate the outcomes of operations, calculates them mentally, and demonstrates the accuracy of the estimate.
22	Recognize other numbers, such as fractional and decimal numbers.	Perform mathematical operations using fractions and decimal numbers.
23	Recognize the concept of ratio and proportions.	Calculate the ratio between values and quantities.
24	Recognize the scale drawing.	Using the scale drawing in map
25	Interpret the scale in maps, and in zoom in and out.	Calculate actual distances using the scale and map.
26	Recognize the concept of proportional division.	Distribute quantities in specific proportions.
27	Realize the percentage.	Read and write percentages and convert them into fractions.
28	Read tables, figures, and graphs.	Draw tables, figures, and graphs.
29	Collect data about a particular phenomenon.	Organize the data that was collected in different ways.
30	Explain phenomena using tables,	Compare phenomena using tables, figures, and

	figures, and graphs.	graphs.

By reviewing the list of objectives and the main and sub-concepts, it is possible to develop a matrix of content consisting of three main domains related to mathematics. Table 3 shows these domains.

Table 3. Content matrix

Domains	**Key concepts & objectives**	**%**	**Items in exam**	**Cognitive levels**		
				Remember 30%	**Understand 30%**	**Application 40%**
Numbers & operations	10	33.3	13	4	4	5
Measurement & engineering	17	56.7	17	5	5	7
Collecting & organizing data	3	10	10	3	3	4

10.1.1.2 Formulation of test paragraphs

An electronic test for mathematical concepts is designed as follows:

1. Test title.
2. General information for the teacher and the school.
3. Exam instructions page.
4. Test content.

10.1.1.3 Test validity

The tests were presented to four professors specializing in social studies, eight supervisors of mathematics, and nine supervisors of social studies in order to express their opinions on the amendment, deletion or addition of the test items in the following points:

1. The phrasing of test items.
2. The accuracy of mathematical concepts.
3. The association of mathematical concepts with social studies.

The test validity means that the test measures what it is designed for. It was found through the opinions of the experts that the mathematical concepts test of this study was valid.

10.1.1.4 Pilot study

A pilot study that included 27 social studies teachers from 15 elementary schools in the El-Bagour Educational Administration in Menofia Governorate, Egypt, was conducted. The following statistic was calculated to investigate the test:

1. Difficulty index (DI) of test items: The test difficulty index was determined by using the mathematical equation (Al-Sarraf, 2018):

$$DI = \frac{number\ of\ correct\ answers\ in\ upper\ group + number\ of\ correct\ answers\ in\ lower\ group}{number\ of\ examinees\ in\ the\ upper\ group + number\ of\ examinees\ in\ the\ lower\ group} \times 100$$

The difficulty index of the test ranged between (0.34, 0.67). High difficulty was observed in some items related to ratio division and the use of scale drawing for zooming in and out. In general, the test items were acceptable.

2. Discrimination index (DX) of test: The test discrimination index was determined by using the mathematical equation (Al-Sarraf, 2018):

$$DX = \frac{number\ of\ correct\ answers\ in\ upper\ group + number\ of\ correct\ answers\ in\ lower\ group}{number\ of\ examinees\ in\ the\ upper\ group\ or\ in\ lower\ group}$$

The discrimination index of test items ranged between 0.64 and 0.87. These results are considered suitable for distinguishing between the categories of targeted teachers because the discrimination index is considered good when the cases is greater than 0.3.

10.1.1.5 Test reliability

The Cronbach's Alpha Coefficient was calculated to determine the reliability of the test. The Cronbach's Alpha was 0.87, which is an acceptable reliability coefficient, therefore the test could be used (Mills & Gay, 2018).

10.1.2 Building the observation card of teaching performance for socialstudies teachers

The observation card aimed to observe the teachers' mastery of mathematical concepts and skills within the educational setting and during discussions with students while teaching geographical topics related to maps.

10.1.2.1 Domains and vocabulary of the observation card

The observation card focused on the teachers' use of mathematical concepts and skills (the three areas: numbers and operations, measurement and engineering, and collecting and organizing data) inside their classroom and observed that throughout the class and in all teaching processes. Teachers were observed in the planning stage for the lesson by reviewing their preparation books and tools. In the implementation stage and the evaluation stage they were observed through direct observation. The observation card consists of 30 items corresponding to the mathematical concepts and skills matrix. The five-point Likert scale was used in the development of this card.

10.1.2.2 Validity of observation card

The observation card was presented to the same experts that evaluated the test in order to determine the card validity while ensuring linguistic accuracy and the possibility of application inside the classroom. The experts made some subtle changes associated with clarity of phrases and linguistic errors. All suggestions of the experts were taken into account and adjustments were made.

10.1.2.3 Reliability of observation card

The researchers used a test-retest method to ensure the reliability of the observation card on the same sample. The mean reliability coefficient was 0.88, which is an acceptable reliability coefficient; therefore we know the observation card is reliable and valid (Mills & Gay, 2018).

10.1.3 Apply research instruments

The pre-test was used on a group of teachers to determine their level, the extent of their mastery of mathematical concepts and skills, and the impact of those concepts on their teaching performance.

10.2 Answer to the second research question

To answer the second research question, the proposed program was built based on the results of applying the instruments to the list of mathematical concepts and skills in following steps:

10.2.1 The program basis

Hayden (2002) asserts that professional development is one of the vital factors for educational renewal and quality assurance within schools. Professional development is an active ongoing process. This process ensures the teachers' continued ability to work in the classroom to meet student needs.

Shimahara (2002) indicates that the training programs within schools are considered a form of professional development. The most important concept that these programs should start from is the idea that they depend on innovations, teacher needs, technology and performance (Lieberman & Miller, 2001).

Abd al-Mawjud (2005) considered that one of the problems facing today's curricula is that these curricula do not help the learner to realize the unity of knowledge and its integration. These curricula usually take the approach of using separate materials that create barriers between the branches of knowledge. The learner does not know how to use knowledge to solve real

life problems. The effect of these curricula can be seen in the teachers' performance. Today, teachers are working separately. Therefore, the benefit to curriculum development is contingent on developing the professional performance of teachers to become more keen on innovation and commitment to professional growth. This is what the professional development process focuses on.

One of the most important characteristics distinguishing teachers in the modern era is their interest in developing themselves professionally. Personal development of the teacher is a step in professional development. Teachers know their own needs, learning styles, and how to benefit from the knowledgeable resources presented. Many studies (Huffmanet al., 2003; Sparks, 2002) have confirmed the necessity of linking professional development to field work and training within work and schools as much as possible, which enables the teachers to benefit from the knowledge presented to them.

Based on the above, the proposed program was developed through a set of basic requirements:

1. Professional development is based on the needs of teachers.
2. Identifying teachers' needs and challenges and their professional requirements is a necessity.
3. New technologies must be utilized and teachers must be trained in their use.
4. In-service training correlates with current teacher performance. Therefore, it is imperative that the training be within the school so that teachers can benefit from what is presented to them and identify the associated challenges.
5. Planned self-learning is part of professional development.
6. Self-evaluation represents a kind of diagnosis of a teachers' professional developmental level.
7. Integration between fields of knowledge is necessary to improve performance.

10.2.2 Program objectives

After applying the instruments and diagnosing the weaknesses in mathematical concepts and skills, it became clear that it was necessary to focus on the following objectives:

1. Mathematical concepts: The goals focused on the teachers' acquisition of mathematical concepts in three main domains: numbers and operations, measurement and engineering, and collecting and organizing data.
2. Mathematical skills: The goals in this aspect of the study focused on ensuring that teachers acquire the mental and manual mathematical skills related to the mathematical concepts.
3. Teaching performance: Based on the teachers' acquisition of the necessary mathematical concepts and skills, attention was given to emphasizing the possibility of the teachers using those concepts and implementing those mathematical skills with precision and mastery within an educational setting.

10.2.3 Program content

The program contained three basic modules:

Module 1: Numbers and operations.

Module 2: Measurement and engineering.

Module 3: Collecting and organizing data.

Each module is built with the following steps:

1. Cover page including the module name
2. Objectives page
3. Pre-test
4. Concepts and terminology
5. Educational activities
6. Relationship of mathematical concepts to social studies
7. Enrichment activities and learning resources
8. Post-test.

10.2.4 Activities and training strategies in the program

The following strategies were adopted:

1. Online open meeting with teachers using the Zoom program by the principal investigator. The meeting took place in the introductory week of the training program. The first aim was to communicate between teachers and researchers. The second goal was to link what was presented in the program and the teachers' needs, with an explanation of the importance and necessity of the proposed training program.
2. Once given the program instructions (where each module was allowed to be worked on for one week), the teachers started with the pre-test before reading each module. An online open meeting for each module with the teachers at each school was held by one of the researchers to provide assistance or discuss difficult aspects.
3. The co-investigator attended one of each teacher's classes on the same open meeting day, took notes, and discussed those notes with the teacher.
4. When finished with the module, the teachers took the post-test.
5. Finally, participants performed the same steps with the second and third modules. It was noted that there was a difference in the number of days allocated to each module according to the teachers' needs.

10.2.5 Methods of performance evaluation

The researchers adopted the following methods of performance evaluation:

1. Discussion during the online open meeting.
2. Observation during the open meeting day and discussion of the notes.
3. Activities within each module.
4. Pre- and post-test for each module.
5. Pre- and post-test for the conceptual test and observation card.

10.3 Answer to the third and fourth research questions

To answer the third and fourth questions, a set of procedures was carried out as follows:

1. Applying the proposed program to the social studies teachers: The training program was implemented during the first semester of the 2019/2020 academic year. First, the pre-test was initially done for the mathematical concepts test and the observation card. Teachers were given the opportunity to specify the number of days during which they would be interviewed to discuss difficult points, or to provide them with resources such as books, websites, or general information.
2. Post-test of the instrument: After the teachers' training period ended in the program (which took three weeks, one week for each module) the post-test of the mathematical concepts test and observation card were applied, calculated, and prepared for statistical treatment.

11. Statistical Methods, Results, and Discussion

11.1 First hypothesis (mathematical concepts test: pre-test and post-test)

The first hypothesis stated that *"there is a statistically significant difference between the mean scores of teachers in the results of the pre- and post-test to the mathematical concepts test"*. Table 4 provides the descriptive statistics for the first hypothesis.

Table 4. Description of the research group's results in the post-test to the mathematical concepts test (n = 33)

Whole score	Max score	Min score	Mean	SD	Teachers with 85% or more
30	30	24	26.666	2.723	28

Table 4 shows the social studies teachers' mastery of mathematical concepts in the post-test. 28 of 33 teachers obtained a high degree of mastery (85% or more of the total score). A mean score that exceeds the percentage of mastery confirms the teachers' mastery of mathematical concepts.

To determine the significant differences between the pre- and post-test scores, the t-test was used (See Table 5).

Table 5. t-test the results of pre- and post-test to the mathematical concepts test (n = 33)

	Test	n	Mean	SD	t	df	p
Mathematical concepts test	Pre	33	12.242	2.739	25.677	32	.000**
	Post	33	26.666	2.723			

**p-value is statistically significant at 0.01

It is evident from Table 5 that the statistically significant differences were found (t (32) = 25.677, p = .000). This result means that there is a statistically significant difference between the teachers' scores in the pre- and post-test of the mathematical concepts test. Therefore, the first hypothesis was proven. With this outcome, the third research question that related to the impact of the program on developing mathematical concepts was answered.

11.2 Second hypothesis (observation card: pre-test and post-test)

The second hypothesis stated that *"there is a statistically significant difference between the mean scores of the teachers in the results of the pre- and post-test of the teachers' performance using the observation card at the elementary school level"*.

Table 6 illustrates that the statistically significant differences were found (t (32) = 17.546, p = .000). This result shows that there is a statistically significant difference between the teachers' scores in the pre- and post-test of teaching performance using the observation card. Therefore, the second hypothesis was accepted. With this result, the fourth research question that related to the impact of the program on improving teaching performance was answered.

Table 6. t-test applied to the results of pre- and post-test to the observation card for teaching performance (n = 33)

	Test	n	Mean	SD	t	df	p
Observation card	Pre	33	62.212	20.368	17.546	32	.000**
	Post	33	133.818	7.125			

**p-value is statistically significant at 0.01

11.3 Third hypothesis (the relationship between mathematical concepts and teaching performance)

The third hypothesis stated that *"there is a positive correlation between the ability of social studies teachers at the elementary school level using the mathematical concepts and skills that are required to teach social studies and their teaching performance"*.

Table 7 indicates the value of the correlation coefficient and its significance were high, which means that there is a positive significant relationship between the teachers' mastery of mathematical concepts and their teaching performance. Therefore, the third hypothesis was accepted. With this result, the fifth research question that related to the type of relationship between the teacher's acquisition of mathematical concepts and their teaching performance, which is attributed to the program, was answered.

Table 7. Correlation coefficients between teachers' score in mathematical concepts test and on observation card (n = 33)

Correlation	Correlation Coefficients	p
Mathematical concepts × teaching performance	0.696	.000**

**Correlation is statistically significant at 0.01

11.4 Calculate the educational significance of the program and determine the statistical power of the study

El-said (2009) indicates that the statistical significance is insufficient to determine the importance of the research, and it is necessary to rely on other methods to clarify the practical significance and educational importance. One of the methods for determining practical significance and educational significance is effect size. Table 8 shows the effect size value for the proposed program based on the results of the t-test, using the law of twice the value of the t divided by the square root of the degrees of freedom.

Table 8. Practical significance using effect size

Dimensions of practical significance	**t**	**df**	**Effect size**	**Level and practical significance**
Program × mathematical concepts	25.677	32	9.078	Large and practical significance
Program × teaching performance	17.546	32	6.203	Large and practical significance

Table 8 shows the large effect size (greater than one), which indicates the practical significance and the educational importance of the program on the development of mathematical concepts of social studies teachers and the improvement of their teaching performance (Murad, 2011).

12. Recommendation

For those responsible for teaching social studies, writing textbooks, and creating teacher guides at the elementary school level:

1. Take advantage of this proposed program to refer to the mathematical concepts and skills when preparing teacher guides for social studies.
2. Refer to mathematical concepts as requirements for studying some topics in social studies when preparing textbooks.

3. Prepare training programs to improve the teachers' performances in teaching topics related to mathematical concepts in social studies curricula.
4. For elementary school social studies teachers:
5. Develop knowledge and understanding of mathematical concepts because of their effect on the teaching performance inside the classroom.
6. Engage in various mathematical activities and use resources for continued self-enrichment.
7. For researchers in the field of mathematics education at the elementary school level:
8. Focus on the different requirements for teachers of other subjects, usually related to mathematical concepts, especially in social studies and science.
9. Rely on a clear model when trying to improve the teachers' performance, such as self-learning.
10. Benefit from international experiences and professional development projects.

13. Suggestion

Based on the results of the current research, the following research may be proposed:

1. Create a program for social studies teachers to develop their mathematical concepts and skills and track its impact on teaching performance at the middle school level.
2. Document mathematical difficulties for social studies teachers at the elementary school level (qualitative study).
3. Develop the mathematical culture of elementary school teachers in different disciplines.

14. What did the current research present?

The current research presented a set of important points, including the following:

1. A proposed program for the professional development of social studies teachers specifically referring to mathematical concepts and skills.

2. Educational modules in mathematical concepts and skills applied to different fields that can be used to develop mathematical concepts and the teaching performance of social studies teachers.
3. A mathematical concepts test and an observation card for evaluating teaching performance.
4. The practical or pedagogical significance of the proposed training program for social studies teachers at the elementary school level in order to enable them to understand the mathematical concepts that are included in academic curricula and that are reflected in their teaching performance.

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