Research Article

The Impact of Using Real Life Situation in Solving Linear Equations by Seventh Graders

Nabil Assadi

Department of Mathematics Education,
Sakhnin College, Sakhnin, 2173, Israel, IL
Corresponding and First Author

Wafiq Hibi

Department of Mathematics Education,
Sakhnin College, Sakhnin, 2173, Israel, IL

Abstract

The study aims to examine the impact of using real life situation in solving linear equations by seventh graders. In order to achieve the designated aim of the study, the study was conducted in one of the Arab schools in Israel. A sample of 20 average students was deliberately chosen depending on their educational achievement. Two approached were employed within the study; the qualitative approach and its quantitative counterpart. Results of the study clearly exhibit that student have undergone three stages: in the first stage, a development in the concept of "similar terms" was noticed. The second stage showed a development in the concept of "quantity comparison." In the final stage of the study, the students became familiar with the concept of parity in the linear equations. In light of the researchers' findings, the study could be concluded with some important recommendations and suggestions. Namely, to review the mathematics curriculum for the middle school students and recreating one that seriously tackles real life situations. Implementation of advanced technology and software within the mathematics class, and working on further research on the topic of the study are also highly encouraged.

Keywords: linear equations, real life situations, seventh grade mathematics, mathematics curriculum

1. Introduction

The equation consists of two algebraic expressions between them the mark equal (=) is present. The expression on the left of the mark equal is called the left side of the equation whereas, the expression on the right of the equal mark is known as the right side. The unknown in a particular equation is a letter that represents an unknown numerical value and we want to find. Solving the equation is a set of all the numbers you put in the equation that creates a correct set, i.e. the value of the expression on the left side is equal to the value of the expression on the right side. Algebraic equations in general and linear equations are particularly gatekeepers between school mathematics, higher education and employment and a subject that breaks the boundaries between tangible, inductive

mathematics and its abstract counterpart (Alibali et al., 2007).

The importance of dealing with algebraic expressions, and the importance of learning the procedures they are working on, is an essential of mathematics. Recently, there has been a trend that requires treatment but lately there have been more and more voices claiming that algebra is much further away. The argument is that instead of focusing on the skills that are involved within expressions, one should focus on attitudes, which will stimulate the need to deal with them, and give context and meaning to learn the necessary mathematical skills. For example, finding legitimacy and popularizing structures using mathematical models to represent and understand quantitative relationships, and search for and analyze phenomena of change in different contexts and the like. There are also claims that the importance of mathematical processes in learning must be emphasized, for example: thinking, hypotheses, research, linking different representations of mathematical concepts, mathematical discourse, choosing the right tools, and more (Alibali et al., 2007).

We live in a changing world that needs to be adapted by preparing individuals with 21st century skills to suit the needs of society. Linear equations are an integral part of mathematical problems at large. However, they were not rendered adequate research attention similar to other mathematical discipline and fields despite the fact that they are as common as any other mathematical topic (Abu Raya, 2013).

In many traditional curricula, algebraic equations are presented very quickly, resulting in solving equations without thorough understanding of the symbols, since during the learning process of an individual must take all the time necessary to develop the concept of equations and link them to real life problems that are related to the cognitive skills needed to learn mathematics. Linear equation, measurement of quantities and the use of related symbols are especially important in the prior context. Comparison involves realizing the distinction between "big and small," "one thing-many things", "few-many, more-less" etc.

Naming quantities includes knowing the names of the numbers in order, and counting things. As for the use of symbols related to quantities, it includes linking the name of a number to its written code, matching the written code of a number to the number of objects. Students are also expected to learn the concepts of linear equations in the best form when the education is carried out in a sequence of perceptible, semi-perceptible, and finally abstract stages. What this means is that concepts should be taught using real tools. In the semi-perceptible stage of education, real tools are represented by drawings or symbols. In the last stage, numbers are used instead of graphics or symbols. Mathematics is one of the most important subjects that are concerned with life issues and are directly related to them; from the simple processes practiced by the students in their daily lives such as selling and buying, through the general life commitments they face to the higher processes of problem solving and decision-making. Therefore, there is an absolute need to strengthen the use of life-related issues to strengthen the conceptual meaning of equations and their relevance to reality, and therefore students can understand and solve symbols within the equations (Mina, 1999).

Many students face problems and difficulties when solving equations when a particular component is missing. Therefore, it is very important to know and understand the problems and difficulties students face when learning equations at once. Therefore, the purpose of this work is to study the impact of real life situations in solving equations with one unknown for students in the seventh grade in Israel.

2. Literature Review

In this part of the study we review the theoretical background on which the study is based, which includes the theoretical framework of previous studies and studies, and the theoretical background of the study in general.

There are different definitions of first-degree equations prevalent among the scientific community. A first-degree equation with one unknown: this unknown is always of a first-degree, and no unknown of a higher degree could be included (Kramarski, 2004). Examples of equations:

equation ($5x + 3 = 13$)the equation on the right side of a number and on the left side of an algebraic expression and between them the symbol (=) is present, and the equation ($x + 3 = 1 + 6x$) the equation consists of two algebraic expressions and between them and between them the symbol (=) is present.

The topic of "solving equations" in mathematics curricula occupies a central position as the basis for understanding more advanced mathematics and is therefore of great importance in its more effective transmission. The objectives of the curriculum in learning "equations" can be summed up as follows: (1) the practice of simple equations is carried out, students solve problems through simple linear equations. (2) Among other things, the use of algebra is also possible when teaching engineering. (3) The study of problems and equations also deals with completing, expanding and establishing an understanding of natural numbers and fractures. (4) The understanding and meaning of solving equations is based on the study of functions (Israeli Ministry of Education, Department of Curriculum Planning and Development, 2010).

Solving equations at once is an essential part of students' mathematical work of middle school curriculum. This is an essential part of algebra studies, which concerns a good number of mathematics teachers. The difficulties of learning the linear equation require looking at the nature of the laws on which this topic depends, and it lies as a symbolic language, so efforts are directed at teaching students to solve problems in practice, regardless of strengthening the mental abilities of the students (Abdelkader, 2013).

In answering the question, what is the equation? (Yerushalmy & Chazan 2008) replied that in the standard learning approach, the equation contains many meanings: it can be defined as evidence on numbers, a comparison between algebraic expressions so that if the numbers are placed in the correct order, a specific value is obtained. The symbol (=) is complex one and is used in many roles which could lead to change in its meaning cognitively. There are definitions of the numerous meanings, roles and indications of the symbol (=), the priors are explained in the study of (Usiskin, 1988) as follows:

- A=LW model expresses the "formula", where A L and W symbolize the dimensions of space, length and width.
- The $5x = 540$ "equation" to solve when the "x" values are unknown, must find its numerical value to get a valid claim.
- $1 = N \times \frac{1}{N}$ The equation expresses a "feature" of a set of numbers where "N" is any number 1 of the group.

Thus, the multiplicity of meanings of mathematical symbols and symbolic expressions, resulting from the reference to the same mark in different aspects, causes many difficulties in algebra. According to (Usiskin, 1988), the need to know how to relate to a variable according to the algebraic context and to see it more than accepting numerical values causes great difficulties in algebra.

The system of symbols in mathematics allows the mathematician to achieve the level of abstraction required to solve general problems. Using letters to distinguish variables and parameters is the basis of scientific language. Algebraic equations represent a set of equations of the same algebraic expression, as well as general forms of quantitative relations between the two sides. For example, formula $y = 3x + b$ represents a set of linear functions with the same slope. The advent of the symbol system in mathematics enjoys a great importance. It is undoubtedly an integral part of comprehending algebra and other mathematical disciplines. Today, it is impossible and utterly unacceptable to think about mathematics without mainly considering symbols. (Tall et al., 2014)

Solving linear equations, especially algebraic equations, requires students to treat the equation marker as equality between two expressions (Kieran, 2006). Huntley et al. (2007) also point out that solving equation requires the student to understand and be able to maneuver the symbols on which equations are based. Andrews & Öhman (2019) study suggests that the solution of algebraic equations should not only "understand that the expressions on the two sides of the equation, but should also regard the unknown as an entity rather than as number.

The study of equation solving is evaluated according to multiple strategies and the relative effectiveness of these strategies. The prior is applicable when the strategy is defined here as a step-by-step problem-solving measure: first, the main feature of the classis knowledge of multiple strategies, and the recognition and knowledge of more than one solution, allows to know a number of solutions strategies learning from educational interventions. Secondly, knowing the effectiveness of the strategy is an essential feature of problem-solving experience and is also a key common mechanism for educational development (Andrews & Öhman 2019, 2007). To solve linear equations, the student must have the following skills:

a) Cognitive skills needed to learn linear equations: there are certain cognitive skills needed to learn mathematics, particularly linear equation. The skills in this context are connected with comparison, measurement of quantities and use of related symbols. Naming quantities includes knowing the names of numbers in order and counting things.

b) Moving from concrete to abstract: students learn concepts of linear equations in the best way when education is carried out in a sequence of perceptible, semi-perceptible, and finally abstract.

c) Teaching arithmetic vocabulary in linear equations: students should be taught the terminology and the mathematical concepts relevant to linear equations.

d) Learning the rules: learning the linear equation becomes easier if the student knew the basic rules and concepts. For example, the student should know that the equation consisting of two equal-value sides that constitute the full equation.

e) Training students in the dissemination of educational skills: students should also learn to generalize skill into multiple situations and situations. It is known that students face significant difficulties in conveying the impact of training. Generalization does not occur without effective training. In general, training in order to generalize skills requires emphasis on the following:

ea) To provoke motivation to learn, and to help the student master the skill intended.

eb) The students have periodical discussions about the importance of learning and applying skills and are provide him with adequate examples and diverse experience.

f) Developing problem solving skills: Problem solving skills should be a priority in teaching concepts and calculations of linear equation.

g) Developing a positive trend towards learning the topic of linear equations: students' attitudes, motivation and beliefs in relation to mathematics and learning linear equation have a significant impact on their learning.

Mathematics has several characteristics that collectively emphasize its strength and ability to achieve goals related to life issues that students acquire while learning mathematics. There is a great similarity between mathematics subjects and their life applications. Mathematics interferes with the details of our simple and complex daily lives; from something as simple as buying something to complex matters such as organizing the budget related to the house, use mathematical calculations in cooking, driving and operating heavy machinery. Mathematics plays an important role in many hobbies and sports and is a basic requirement for all members of society because it is used in all activities of daily life; in the market, factory, farm, home and commercial field. The mathematics curriculum must contain some real- life problems which contribute to the development of the learners' ability to solve the problems of the society and the environment that they are part of. It is a set of skills and tools that help students successfully interact with everyday situations and community challenges to achieve happiness and fulfillment; including, group work skills and decision-making skills. "Life issues related to mathematics are those skills that help an individual to interact positively with problems in his or her daily life with confidence by making the right decisions and forming positive relationships with others." According to the researcher, life skills associated with mathematics are the set of behaviors and the mental, social and subjective abilities that the student acquires deliberately after going through systematic experience. Mathematics, help him to practice daily life effectively and make him adapt scientifically, socially, intellectually and culturally to the

society and the time in which he lives (Ibrahim, 2000). In his study, (Magdi, 2000) also referred to the importance of life issues in teaching, where schools have in recent years paid great attention to the need to teach these skills and integrate them into the curriculum, and many schools have adopted stable education to develop the life skills of learners at various levels of schooling. The future of mankind depends on the progress of education and the development of its concepts, so the importance of using real-life situations and the need to actively integrate them in the field of education can be determined in accordance with:

a) Teaching real-life situations is one of the main objectives of contemporary education, and one of the new tasks of the teacher in the 21st century.

b) Applying real-life situations seek to help the learner interact with society in particular and with life in general.

c) Real-life situations are diverse, encompassing all aspects of behavior, education and sentimentality and relying mainly on the form and nature of the relationship between the learner and the society.

d) Relating to real-life situations helps achieve the objectives of education by preparing the citizen for life, as they represent the most important outcomes of the human learning capacity.

e) Involvement of real-life situations help the individual to manage his life and adapt to himself, to live with the variables that happen, and to the requirements of life.

f) Real-life situations enable the individual able to take social responsibility and solve the problems he faces.

It is necessary to change the role of the teacher as a source of information and as a speaker to facilitator, mentor and manager; an individual who is creative in the preparation of educational activities for students, a guide to students in the processes of building mathematical ideas and concepts that start in the real world and return as concepts and solutions to the world and life issues as well. When the prior is carried out, the education and learning of mathematics becomes more fun, interesting and close to the needs of students (Kieran, 2006).

Real-life situations in mathematics should include communication and communication skills, problem-solving and decision-making skills, personal and social skills, and time management skills. A learner should be provided with the skills needed to enter the labor market, and deal with society he is part of. One of the general criteria in the teaching and learning of mathematics is to focus on developing a true understanding of mathematical concepts and processes so that education is carried out through real attitudes and offers solutions to the various problems and applications of mathematics in situations related to the life. Real-life situations are diverse and varied, the most important of which are social interaction skills, self-confidence, hobbies, language communication skills, cognitive skills, information management skills, data handling skills, billing, taxation, personal budget, reading skills, research, problem solving and scientific thinking. The life skills associated with mathematics are: the ability to solve problems, making decisions, leadership, and effective cooperation and integration into society (Kamaliyah et al., 2013). In the prior contexts, real-life situations that are directly connected to mathematics could be summarized as the following.

a) Academic skills: Include understanding, application, observation, arrangement, equation, results analysis, research, problem solving, information management, self-learning and thinking skills

b) Social skills: Include collaboration, participation in group activities, correct oral speech, written expression, questions, presentation of written reports to others, correct discussion, opinion, tolerance and persuasion.

c) Personal skills: Include accuracy, order, cleanliness, correct reading, reporting, responsibility, self-esteem and the ability to choose.

The studies of (Mina, 1994) and (Ibrahim, 2000) indicated that the main real-life situations related to mathematics are:

a) Problem solving skills: the ability to find a solution to an issue or issues by taking a number of

successive steps.

b) Higher thinking skills: the ability to analyze information and experiences in an objective way and distinguish and evaluate the factors affecting them flexibly, link causes and results, and generate new ideas about them.

c) Communication and social communication skills: the ability to communicate with other members of society, friends and family where the objective of initiating the communication in the first place is maintaining social relations between the individual and the people around him and sharing ideas, beliefs, customs and traditions prevailing in this society.

d) Personal skills: the ability to develop an individual's personality, achieving independence, gaining self-control and developing real potential in various emotional, social and mental aspects.

e) Time management skill: the ability to plan for a range of work related to the goals we strive to achieve on time.

f) Decision-making skill: the ability to reach a sound decision about a position or problem after collecting information about it.

The objectives of mathematics education have evolved from focusing solely on accuracy and speed in the conduct of calculations, to focusing on understanding and the ability to solve problems. So the ability of students to solve problems has become the scope and domain of numerous researchers in the field of mathematics teaching inn many countries and many councils and institutions concerned with mathematics education, such as the National Center for Science and Mathematics (NMSI) in Britain, and the National Council of Mathematicians (NCTM) in the United States of America (Abdelkader, 2013).

Most individuals, who face challenges while solving mathematical problems, do not have a clear strategy for solving, through which it is possible to know the progress of the student and his ability to acquire concepts, generalizations and skills. Through strategies of problem the teaching of mathematics, the level of achievement can be raised because of its importance in acquiring concepts, skills and generalizations. From the prior, importance of using strategies to solve the mathematical problems is clear, and this study came to show the impact of the use of some strategies to solve the mathematical problems that are in fact life-related (Shamsti, 2007). Indeed, the problem of study emerged through the researcher's observation as teacher of mathematics to the low level of student achievement in mathematics and in all stages of education, especially in solving linear equations (Abu Raya, 2013).

3. Study Problem

The prevailing teaching practices in mathematics education, whoso impact is tangible in the poor students' outcome, low motivation to learn mathematics, and the inability to express their ideas clearly, have led many researchers to call for the importance of developing education strategies that enhance students' motivation and develop their mathematical thinking skills. The perception that achievement is the primary goal of mathematics education must indeed change. Mathematics should be regarded a discipline through which the student can employ the mathematical knowledge he has gained in solving the problems he faces in different situations, and in the service of the society in which he lives (Bani Matar, 2014).

As noted, low educational attainment is a visible problem in many countries of the world, as many students have difficulties learning subjects without exception. The problem of student achievement in mathematics is one of the most important challenges facing the student and teacher simultaneously. Researchers in the field of mathematics education and learning can clearly point out numerous difficulties that have led to lower achievement of students in certain countries as compared to some other countries such as Singapore, the Netherlands and Japan. The results of international examinations have indicated low achievement in mathematics in Palestine; one of the main reasons of may be attributed to traditional teaching methods based on providing the learner

with theoretical skills, and the absence of modern teaching methods that are based on understanding the core concepts and provoking the thinking and motivation of students (Suleiman, 2015).

Through the studies that examined the reality of education in Palestine, the results of which were the marked decline in the outputs of education. Based on the results of the study of international trends in mathematics and science (TIMSS, 2011) Palestinian students received late arrangements in the achievement of mathematics among the countries participating in the (2011) study, indicating allow level of achievement performance for Palestine students in general.

4. Study Goal

The current study aims to examine the impact of the use of real-life situations in solving linear equations by seventh graders.

5. Study question

What is the impact of the use of real-life situations in solving the linear equations by seventh graders?

6. Significance of the study

The importance of the current study is that it provides mathematics teachers with new methods, skills, techniques, and strategies for teaching linear equations, and with ways to overcome the errors that students have in the subject of linear equations at large. This study enjoys a great level of originality and innovation as the studies in this particular subject are still very few.

7. Study terms and procedural definitions

7.1 Linear equations

The "equation" is the equality of two algebraic expressions in which one or more variables appear in one. As with any equality, the two expressions are separated by the "=" sign. In mathematics, the linear equation is an equation in which all variables are first-class, i.e. appear without powers. The variable is a symbol of unsteady numerical value and algebraic expression is a set of variables that have algebraic processes among themselves. There are different definitions of first-class equations that appear in this definition. A first-degree equation with one unknown is an equation that appears in at least one of its expressions. This unknown is always of a first degree, and does not enter into the unknown equation of a higher degree. (Kramarski, 2004)

7.2 Solving the equation

It is the number (variable value) that is placed in the equation instead of the variable to give the equation the real value. The variables that appear in equations, in which one seeks to find the value in which the equation gives the real value, are called "unknowns". There are several types of first-degree equation solutions. It is a set of all numerical values that are put in the place of the unknown in the equation and create equality between the two sides of the equation. This set of values is called the Truth Set of Equation (Kramarski, 2004).

7.3 Real life situations

It is a set of integrated skills, trends and related knowledge acquired by the learner and that enables him to be a person capable of taking responsibility and dealing with the requirements of daily life at the various levels whether social or functional, with the highest possible creative interaction with his

community and surrounding environment. It is also defined by (Al-Zoubi, 2014) as a set of mental, social and subjective behaviors and abilities that the student acquires deliberately after going through systematic mathematical experiences, helping him to practice daily life effectively and make him adapt scientifically, socially, intellectually and culturally to the society and the age in which he lives.

7.4 *Behavioral goals*

The expected educational achievement of the student after the teaching process has been completed and that can be observed and measured by the teacher (Salem, 1998).

8. Methodology and Procedure

8.1 *Study methodology*

The current study is based on integrated curriculum consisting of two approaches. Firstly, the qualitative approach, which is based on qualitative data that appear in the form of scenes, as the study requires the researcher's ability to link all the views of students together in order to come up with results. Secondly, the quantitative approach, where the researchers examine the changes that occur before and after the learning process. The integrated curriculum is based on the collection and analysis of data and the conclusions obtained from the scientific research curriculum.

8.2 *Study sample and community*

The study was conducted at an Arab school in Israel. The school consisted of approximately (40) teachers and (900) students. The study was conducted during the second semester of the scholastic year 2020-2021, and the sample of the study was made up of 20 students who were selected by the researchers according to their educational achievement and school grades.

8.3 *Tools of the study*

a. Views: The study was based on 3 observations recorded by voice and image of three students of the study sample. Four tasks were conducted in the three classes that documented the educational unit.
b. The questionnaire contains 8 questions about linear equations, so that each two questions of the same level were divided gradually from easy to difficult. A pre-questionnaire was based on to the students before commencing the unit, and a post questionnaire was passed on after the educational unit had been completed. Table (1) explains the purpose of the questions answered in each form.

Table 1: Objectives of the questions in forms (A) and (B).

Question in Form A	Question in Form B	Objective
$X + 5X = 24 + 6$	$X + 2X = 6 + 3$	Adding equal expressions, accurately identifying the problem
$X + 3X = 8$	$7X - 2X = 20$	Adding equal expressions, analyzing the dimensions of the problem
$X + 19 = 22$	$X + 6 = 10$	Adding and abstracting equal expressions, suggesting different possible solutions
$6X = 3X + 9$	$7X = 2X - 10$	Subtract and collect equal boundaries, choosing the right method to solve the problem
$4X = 20$	$2X = 110$	Multiplication and division of equal expressions, performing the solution via orderly steps

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Question in Form A	Question in Form B	Objective
$X + 2 = 340.5$	$0.5X - 5 = 20$	Multiplication and division of equal expressions, evaluating the obtained solutions
$24 = -(X + 5) - 17$	$3(X - 2) + 4 = 3$	Using the expansion law, developing proposed solutions
$-(X + 15) + 3(X - 6)$ $= -1 - 2$	$2(10X + 2)$ $- 6(X + 2) = -36$	Use of expansion law, reviewing new situations based on the solved problems

8.4 Course of research

The questionnaire was passed on to all students before and after the intervention. In the first stage questionnaire (A) was passed on, followed by the intervention unit which consisted of the following activities: fruits activity, the purchasing problems activity, and the scale activity. All activities were carried out in a classroom environment prepared and closely monitored in terms of the behaviors and the feelings of the students that took place in the school during the observations, and the researcher recorded observations related to the subject of research, where the students were not informed of the objectives of the research during the educational unit, and in the last stage questionnaire (B) was passed on.

8.5 The intervention unit

The unit will address four tasks related to the subject of linear equations, so that each task begins with a realistic attitude and problems close to the students' own surrounding environment. There is an exchange of concepts involved, so that students use a variety of symbols to provide information related to certain meanings of linear equations. This approach is used as a basis of daily life and as a tool that allows students to define concepts clearly and thoroughly, which in itself is considered a tool to help students achieve the desired goals and contribute to building new knowledge and discover concepts that they have not dealt with before. Here are some of the tasks:

8.6 The first task (fruits) Addition and subtraction of algebraic expressions:
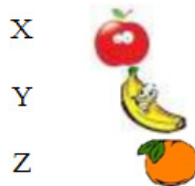

Figure 1: Bananas, apples, and oranges are placed on a table. Then, a symbol is assigned to each

Question1: Find the result of adding the following amounts: ($3x + 4x = ?$) shown in form (2)

Figure 2:

Question 2: Find the result of adding the following amounts: ($4y + 2x + 6y + x = ?$) shown in Figure (3)
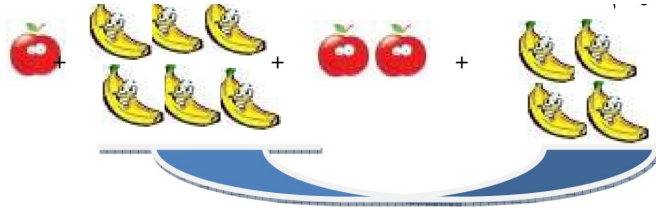
Figure 3:

Students noted our inability to combine two different kinds of fruit together.

Figure 4:

Thus, we conclude that when adding or subtracting algebraic expressions, we group similar factors. Table (2) explains the objectives and content of the fruit activity:

Table 2: Fruit activity

Task	objectives	Content
Adding the amounts of one kind of fruit	The student should add similar algebraic amounts.	First one kind of fruit is used. Tracking the way the student thinks about adding a similar type
Adding the amounts of two kinds of fruit	The student should add various algebraic expressions	Two kinds of fruit are used Tracking the way the student thinks about adding different types

The second task (scale A): it deals with strengthening the comparison of quantities and equations Comparing quantities: a fictional event was prepared for the gradual formation of quantities comparison to provide students with the opportunity to reinvent the mathematics of the unknown and variables and solve the equation system. Here students learn how to find the values of individual element groups when the value of the groups of elements is known. In the first scale, on the left side 10 bananas were placed and on the right one the same was done with two pineapples. In the second scale, there is a pineapple on the left side and two bananas and an apple on the right one. In the third scale, there is only an apple in the left side and an unknown on the right one. Students are required to find the missing fruit and its amount. Figure 5 was taken from the study (Van Reeuwijk, m. 2001).

Figure 5:

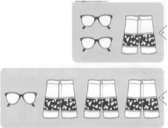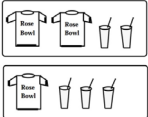Table (3) explains the objectives and content of the scale activity

Table 3: Scale activity

Task	objectives	Content
If we maintain the concept of equality, we will find the answer to the last part.	Defining the concept of equality and balance between two parts	The way students thought throughout the activity to reach a solution was tracked by analyzing and comparing quantities.

8.7 The third activity (clothing items)

Similar terms. Table (4) explains the objectives and content of the clothing items activity

Table 4: The clothing items activity

Activity	Goals	Content
Section1: The activity of Purchasing Problems (Van Reeuwijk, 2001)	To be able to add similar algebraic expression. to be able to link reality to equations	Two pictures were brought, one containing a pair of pants and two pairs of sunglasses, the other containing there pairs of pants and one pair of sunglasses. Both groups have the same value of (250) USD. Students are required to find which is more expensive, a pair of pants or a pair of sunglasses.
Section2: The activity of Purchasing Problems (Van Reeuwijk, 2001)	To be able to add similar terms.	Students have been asked to determine the prices of the sweater and the drink. The students' approach was observed Note that the first group is priced at 44 and the second at 30

8.8 The fourth activity (Scale B)

Converting equations to real-life situations. Table 5 shows the objectives and content of (scale b) activity.

Table 5: Scale activity

Activity	Objectives	Content
With scale and vegetables	• Determining the meaning of the unknown in the linear equation given • Deep thinking about the concept of linear equation • Grouping and subtracting similar terms	An algebraic equation was given to students, and they were asked to convert it to a real-life situation using scales and vegetables, with the use of a viewing tool

9. Validity of the Subject

After the completion of the preparation of the training material, the researcher presented it to a group of arbitrators specialized in the field of mathematics teaching methods. Each arbitrator was

provided with a copy of the training material used in the presentation of the subject to students, and they were to express their opinion on the training material regarding the following aspects:

- The integrity of the formulation of educational objectives from an educational point of view.
- Mathematical skills included in the training material.
- Mathematical concepts.
- Design of life activities prepared by the researcher and how effective they are with the training material.

The researcher modified the content of the training material based on the suggestions and recommendations of the arbitrators. The suggestions included: reformulating some behavioral objectives and some unclear details in order to increase their clarity and bring it closer to the level of students participating in the study.

9.1   The method of analyzing the data

The observations were analyzed in two stages. In the first stage, the researchers tracked the stages of the students' attempted solution before, and during the learning process. Concerning the form, a T-test paired was conducted to examine the change in the students' performance before and after learning where the students' answers were evaluated and divided into three categories: high, medium, and low.

10.   Results and Discussion

This part of the study includes a full and detailed presentation of the final results of the study. The study touched on the presentation of the stages of the development of linear equations as a concept. The prior stages are the ones that students encounter while dealing with activities that involve the conceptual structure of equations. In the first stage, the students' previous ideas and concepts on linear equations were presented while in the second stage their ideas were presented after the objectives of the learning process had been completed. The final results of the study are presented as follows:

1.   Addition of the terms of algebraic expressions (fruit activity):

Description of the activity: the activity is based on the addition of the similar terms of algebraic expressions. The activity was presented through the use of fruit; the students were asked to add three apples to another four. Each kind of fruit was indicated by a symbol (x, y, and z). Later, students were asked to add different kinds of fruit; like apples and oranges, all while students' thinking patterns were closely observed. Sections 1 & 2 below explain the activity.

Section 1:

Salma	I want you to turn the two groups into one group and tell us that we have four bananas, for example.	6
The teacher	I want you to turn the two groups into one group and tell us that we have four bananas, for example.	7
Salma	Now, we have four apples.	8
The teacher	Is it okay to add and subtract items of the same kind?	9
Nagham and Salma	Yes	10

In section (1) we could star to mark the beginning of the concept of similar terms.

Section 2:

Nagham	We have ten bananas and four apples.	12
The teacher	In that case, we can say we have 14 bananas and apples.	13
Lian	That way people might think that we have 13 of each kind.	14
The teacher	So what do we deduce from this activity?	15
Lian	We can't really add different items.	16
The teacher	Good. I want you to assign a symbol to each kind.	17
Nagham	X, Y For instance.	18
The teacher	And now we can add symbols rather than kinds.	19
Nagham	$3x + 4x = 7x$	20
The teacher	Another example.	21
Lian	X for bananas	22
Nagham	No, it's for apple.	23
Lian	$10X + 3X$	24
The teacher	And that's how we conclude that we can add different items using linear equations.	25
Nagham	An easy and useful activity that enables us to add different items together.	26

From section (2) it turns out that students realize the knowledge and purpose behind the activity. The students Nagham (12) and Lian (14) were able to add each fruit type individually, which is called similar terms. What is left to do is change the prior into algebraic expression, where the students Nagham (18) and Lian (24) appeared to be able to code each of these types with a letter in English and add it algebraically as they see in their school textbooks.

2. Comparison of quantity (fruits section B)

Activity description: this activity consists of several small scales with two sides for each (as illustrated). The student must compare the quantity to maintain the balance between the sides of the scale. The first question was "how many bananas do we need for one apple?" In the first scale, two pineapples and 10 bananas were placed as opposed to one pineapple on one side and an apple and two bananas on the other, in the second scale. In the last stage of the question, one apple was placed on one side of the scale, and students were asked to determine the number of bananas on the other side. In the second question, two pineapples were placed on one side of the scale, and four apples were placed on the other side. In the second stage, two apples were placed on one side as opposed to six bananas on the second side. In the final stage, students were asked to determine the number of bananas needed to equal two pineapples. Answers of the students were compared and it is obvious that students did in fact go through the phase of the development of quantity comparison. Sections (3) and (4) explain the prior.

Section 3:

Nagham	That means the right side is equal to the left side.	32
The teacher	I want you to find the number of bananas required to have bananas and apples equal in weight.	33
Salma	It's a difficult problem, it certainly requires much analysis.	34
The teacher	Discuss with each other and tell me.	35
Nagham	For each two of pineapples, there are two bananas.	36
Lian	I don't think so.	37
Salma	I think that is right.	38
Asma'a	I'm confused now.	39
The teacher	Use the balance idea to find the answer	40

Section (3) shows the development of the concept of quantity comparison.

Section 4:

Asma'a	That means every apple is equal to three bananas.	41
Nagham	Correct	42
The teacher	Do you think your answers apply to linear equations?	43
Lian And Nagham	These equations are very similar to real-life situations	44

In section 4, we find that students are fully aware of the concept of quantity comparison; where Asma'a (41) was able to find the amount equivalent to one apple. Nagham and Lian (44) also express how beautiful the subject is when learnt this way.

3. The similar terms (clothing)

Description of the activity: learning quantity comparison and similar terms addition using a work paper to determine whether the pants or the sunglasses are more expensive. In the second question, students were asked to find the price of the sweater and the juice. Students' thinking and analysis patterns were closely monitored, and section (5, 7, and 8) point out the development of the concept of quantity analysis:

Section 5:

Saied	It's a tough subject, and we need help.	4
Rana	I think using equations for a solution would be easier.	5
The teacher	We have to think of several possible ways to solve it, and it isn't enough to follow one way.	6
Muhammad	We have two sets of different items that have the same price, so we can delete, and the result will remain the same.	7

From section (5), we could see that student's perception of the concept of quantity comparison is not apparent; some students found the activity to be complicated to deal with, which could be due to the fact that did not understand its objective sin the first place.

Section 6:

Saied	I'm confident that the sunglasses are more expensive than the pants.	9
Muhammad	Yes, you can buy two pair of pants for the price of one pair of sunglasses.	10
The teacher	Continue, please!	11
Rana	Accordingly, the price of each pair of pants is $50.	12

In section 6, students are aware of the issue at hand, taking into account the difference in abilities. Saied (9) managed to link the real-life situation with the lack of understanding of the activity in depth. Muhammad (10) managed to do the same as his classmate; Rana (12) was able to find the price of each of them separately. Here we could conclude that there has been a development in the concept of quantity comparison. For the second question we show the stages of development among students in section 7.

Section 7:

Rana	I think equations in the traditional way are easier.	16
Saied	But that's more fun.	17
Rana	The prices of items here are different. That's why we couldn't find a solution.	18
Saied	Any of them could be more expensive than the other.	19
Muhammad	The number of things won't help us figure it out.	20
Saied	We can figure out the price of two things combined.	21
Rana	We can use subtraction to find the price of each individual item.	22

Muhammad	And I used the drawing method to get to the solution.	23
Saied	I agree with Mohammad.	26
Rana	Yes, where we can turn things into symbols.	27

Section (7) shows the students full perception of the subjects, and the fact that that are capable of performing quantity comparison successfully, although their patterns of thinking may differ.

4. Transforming equations into real-life situations (the scale)

Description of the activity: students were asked to solve equations by drawing a scale and writing the following expressions on each side, or by switching symbols by drawing fruit. The strategies of equation-solving used by the students were monitored before presenting form (b) to them. In the sections (8, 9) the stage of the development of the concept of equality for linear equations is presented.

Section 8:

Jana	This is how I solve the equations	8
Nagham	4 is the answer	12
Saied	What do I do now?	13
Jana	I don't understand.	14
Nagham	We have to add four more.	16
Saied	The two sides of the scale are not equal yet.	18
Saied	That's a difficult question.	20
Nagham	I think it is a normal question.	21
Lian	What does that mean?	25
Adan	Could the teacher help us?	27

It appears in section (8) that students are unable to perceive the correct concept of equality. So it appears to the student Jana (8) that it is related to the subject of equations. Still, she was unable to understand the objective of the scale activity and the correct meaning of equality. This indicates that she is doing the procedural solution in a robotic method that writes what it has learned with no creativity whatsoever. The student Saied (13) has obviously realized that it is not permissible to work on one side of the scale and ignore the other, as balance will not be achieved. We also noted complaining about the method of solution because the procedural method is easier, faster and does not really call for creativity and over-thinking.

Section 9:

Jana	We have 12 fruits on the right and six baskets. How should I proceed?	35
Saied	Every two fruits should be placed in on basket.	36
Jana	I understand.	37
Saied	Get the extra fruits out of the basket.	40
Nagham	That's how we're going to have an extra fruit.	41
Nagham	It is a complicated question, but it is a certainly fun.	43

Section (9) shows the beginning of the development of the concept of equality between two sides with the difficulty of understanding the meaning of the unknown quantity basket. Student Saied (40) managed to analyze the unknown quantity basket, and student Nagham (43) was able to do the same. The majority of students reached a logical analysis of the concept of equality and its relationship to linear equations.

5. Analysis of a number work papers, where we will present the activity of purchasing problems in table (6), and the activity of the scale in the following table.
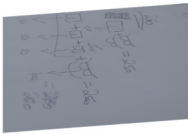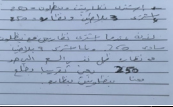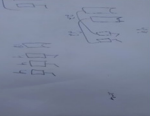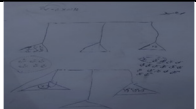
Table 6: The activity of Purchasing Problems

Name	Analysis	Work paper
Rana	The activity was solved by drawing and was closer to linear equations	
Muhammad	The activity was solved by a real-life thinking strategy; he didn't use drawing or linear equations	
Saied	A logical analysis of the event in front of him was done by drawing and concluding	

Table 7: Scale activity

Name	Analysis	Worksheet
Saied	He was able to solve according to the life system with hesitation to the procedural solution	
Jana	She was able to link the correct concept of equations to the balance.	

6. Student results in questions related to the calculation of linear equations (Forms A and B):

The T-test was conducted and the averages and standard deviations of the research sample were calculated. The students' average in the post form was higher than its counterpart in the pre-form. In the latter, it was $(M = 55.7, V = 70.075)$, while it was calculated to be $(M = 85, V = 82)$ in the prior. This shows that there are statistically significant differences in both the pre-form and the post form.

According to the results, we see that the students went through three stages: the first stage is the development of the concept of similar terms; at this stage the students answered the questions asked in the work paper and adopted the conceptual solution in the addition of similar terms. In the second stage, the concept of quantity comparison developed; where students discovered the cause of the mistakes they had previously, and new knowledge was acquired. In the prior, the students overcame the mistake by employing deep-thinking strategies to grasp concept of quantity comparison. In the last stage, however, students were able to exhibit joy and confidence. They even stated that they were able to skip certain steps towards the final solution. Shortcomings of the new strategy were summed up in the fact that it is time-consuming and that it may involve more steps and details.

In the study, the researchers strongly support this strategy of learning, at least, for the first stages of learning. The strategy proved to stimulate students' creativity and employ higher thinking skills. In our time of scientific and technological advancement, traditional methods of thinking, learning and teaching must not be the priority. Breaking the scholastic routine, innovation, and creativity might be the answer to a quality education in the near future.

11. Conclusion

It is obvious by the finding of the research, and the statistical analysis of the available data that the impact of using real life situation in solving linear equations is undeniably of a notable advantage. It has been noted for years, and by numerous researchers of various disciplines, that linking a particular school subject to real-life situations, events, and experiences, renders the subject credibility and malleability that assist both students and educators. According to the data collected and analyzed by the researchers, the introduction of such methods will enrich the educational environment, add a sense of excitement to the subject, and create a higher level of cooperation between students and educators alike.

12. Recommendations

Based on the results and the above discussion, we emphasize the importance of providing students with the opportunity to discover new learning skills, and to link the previous information they have acquired to real-life situations. The prior should be especially applicable to mathematics in general, and to linear equations in particular, without a teachers' direct intervention. A teacher should not exceed being a facilitator of the education process. Thus, teachers are encouraged to place a great emphasis on the students' cognitive and affective sides throughout the educational process.

We also recommend reconsidering the construction of the in-use mathematics curricula for the middle school in light of life skills. Serious attempts towards achieving the principle of balance and sequence of these skills is also highly recommended. The study also recommends the employment of technology as an illustrative means. It has been proved that the proper involvement of technology in mathematics classes can greatly simplify the content and add an element of excitement to the educational environment at large.

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