The Educational Model of Social Constructivism and Its Impact on Academic Achievement and Critical Thinking

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Abstract

The purpose of this study was an educational model based on the social constructivism theory and measuring its impact on academic achievement, critical thinking of elementary school students. This research was carried out with a sequential exploratory approach and using a combined method. First, an educational model based on social constructivism was extracted by inductive qualitative content analysis method. In the quantitative part, the effect of the model on the dependent variables was measured using a quasi-experimental research method with an experimental and control group. The research environment in the qualitative section includes articles from 2003 to 2016. 36 articles were selected by purposive sampling method and content was analyzed. In the quantitative part, the statistical population included the sixth grade students of Lamerd schools. By census sampling method, 64 students were replaced in two experimental and control groups include 32 people. The tools for collecting information in the qualitative section were indexing from related articles and texts where the three main components of constructivist theory were considered. The data collection tool was a quantitative part of a questionnaire that used the researcher-made academic achievement test, Vanson Glaser critical thinking test. The data analysis approach in the qualitative part included thematic analysis through which the main and sub-themes were extracted. In the form of model and method of data analysis and in the quantitative part, the covariance analysis test was one-way. The results of the social constructivism section were drawn. The qualitative part of designing a social constructivism model is based on the three components of knowledge, teacher and learner, and in the quantitative part showed that the social constructivism theory derived from the qualitative part has a significant effect on students' academic achievement and critical thinking.

Key Words: Model. Social Constructivism, Education, Critical Thinking, Academic Achievement.

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Introduction

In this research, social constructivism is discussed from among constructivist perspectives. According to Slavin, the social constructivism theory is still a powerful theory (Seif, 2011). Social constructivism is one of the most popular and effective theories in the field of psychology and education. This theory is based on the principle that learners actively build their knowledge, thus, this theory is opposed to the view that knowledge is a passive transfer from one person to another. Understanding and applying this theory is very important for teachers. Over the past three decades, social constructivism has expanded widely and has been considered as a strong theory of knowledge construction. Textbooks readout makes the impact of social constructivism more apparent. Social constructivism is part of the contemporary cognitive movement that emerged in response to dissatisfaction with traditional education. Education that was strongly influenced by behaviorism. Behaviorists believed in the existence of truth outside the mind and saw knowledge as visual, and the learner as passive. In other words, they considered learning as a One-way road of transferring knowledge from teacher to learner (Sheikhi Fini, 2002).

The constructivism approach is one of the new approaches to learning in educational psychology. This approach supports advances in educational sciences as well as advances in educational technology. Given the novelty of the theory and its application in education, conducting research in this field is justified; because this theory can predict variables such as academic achievement, academic achievement motivation and critical thinking (Swart, 2017). Constructivism theory includes different branches and perspectives, but what unites all of these perspectives is that "learning" is an active and specific process in each person's mind, with individuals building mental relationships between concepts and perceptions on the one hand and information and experiences out of mind on the other hand, they build the world of their mental meanings. Over the past decades, the term constructivism has played an important role in educational texts. Although teachers agree on the generality of this theory, they have very different interpretations, approaches, and perspectives on constructivist teaching and learning (Pfister and Popesco, 2017). One of the most important and newest perspectives on learning and how knowledge is formed is social structuralism. In this approach, the role of personal and social factors and processes along with and in interaction with each other and in relation to the structure or context of learning is prominent (Huang and Zhang, 2009). These approaches have played an important role in educational and psychological developments and have become the origin of new teaching methods and learning. Social structuralism has a great

impact on the success factors related to academic performance and thinking in terms of emphasizing the structure and context of learning and also the construction of knowledge in learners (Sweiler, 2005). Among the education systems, schools for elementary school students face many problems in the field of education of these children in mathematics.

In the education and empowerment of these students, this important issue must be considered more than anything else. Because the real mental capacity and intelligent behavior expected of them can only be shaped when these students have the highest psychological readiness and the highest motivation. Using a constructivism approach can help. From a constructivist point of view, attracting learners' attention to how they construct knowledge is far more important than transferring knowledge to them. Therefore, it is very important that math teachers become fully acquainted with this theory and base their teaching approach on it; In other words, problem-solving education and constructivist approach to teaching are inevitably linked (Askari et al., 2011). Shabani Varki (2016) believes that in the current era, instead of the phenomenon of the spread of science, we are facing it explosion. Thus, if we devote our efforts to providing specific content during the limited time allotted for training, not only will we be helpless to provide the necessary and sufficient content, but we will also lose the little time we can spend learning how to learn (Shabani Varki, 2016). Mathematics is one of the most important and fundamental subjects in the study period, which unfortunately, most students face problems with that. However, it can be seen that traditional methods of teaching mathematics, despite their experience and many years, have not been able to perform the serious task of learning and teaching for the general student body in a satisfactory manner. (Velayati, 2016).

Soleimani, Ahmadi and Ahqar (1397) in a study entitled designing and validating an educational model based on cognitive constructivism for sixth grade elementary students stated that the results obtained from internal accreditation based on the opinion of experts show the educational model based on cognitive constructivism, it has a good credit and has the necessary effectiveness for educating students. Mafakheri (2017) in his master's thesis has conducted a study entitled comparison of the effect of constructivist and traditional teaching methods on learning Thinking and lifestyle lesson and social adjustment of seventh grade male students in Sanandaj in the 2016-2017 academic year. The statistical population of the study included all male students (700 people) in the Seventh grade of 2016 forty people were selected by multi-stage random cluster method and divided into two groups of 20 people with constructivist and traditional training, and completed

a 15-session training course. The results showed that there was a significant difference between the two groups of students trained in the constructivist and traditional methods in terms of both variables of thinking-lifestyle and social compatibility. The scores of the constructive group in both variables were higher than the traditional group. Ayaz and Sekret (2015) in their research concluded that the use of constructivism strategies in educating students increases their learning in different subjects. Although constructivism is a new theory in the field of educational psychology, its historical roots can be traced back to ancient Greece.

The Socratic dialectic is an example of this method in which Socrates' aim in his conversations and debates was to reach the truth by making simple premise, challenging the beliefs and ideas of the other party, and articulating and correcting his errors and contradictions. The founders of modern constructivism theory include John Dewey, Vygotsky, Jerome Bruner, David Azobel, and Jean Piaget. Constructivism approaches have much in common with behavioral and cognitive theories; including actively engaging the learner in learning and organizing situations so that the learner can learn maximum information; thus the learner learns from the superior people; But it also has the freedom to build its knowledge differently. Although the principles of constructivism sometimes seem ambiguous and often do not clarify how educational design is designed, its general framework is usable and emphasizes a wide range of learners' cognitions and beliefs (Devano & Satter, 2014).

Given the features and capabilities that we mentioned about the constructivism approach, it seems that the constructivism approach can be considered as an important step in order to change the mathematics curriculum and it is necessary for the education system to pay attention to the limitations of social processing capacity and to seek effective and practical learning for the real world today by applying appropriate educational models to specific educational situations and positions; Therefore, the uncertainty of the factors affecting education based on social constructivism for students is an issue that this article seeks to answer. This article seeks to answer the following question: What are the categories and components of the educational model based on the theory of social constructivism and what are the relations between them? The emergence of the constructionism theory as an influential theory in the educational system dates back to the second half of the twentieth century. The basics principle of constructivism includes: Understanding perceptions through an individual 's interaction with the environment; cognitive conflict creates learning; knowledge is made through interaction and social negotiation and evaluation of individual understanding and cognition.

Constructivism is a learning philosophy that refers to the construction of knowledge by learners individually or socially. In other words, learners base their knowledge on existing schemas or ideas. Eisner et al. have pointed out that those teaching methods based on learning theories that underestimate the role of the student in learning are not accepted by this generation. As a result, new theories of learning, such as constructivism, have placed their primary emphasis on the role of the learner in learning. In this approach, learners actively construct meanings in the learning process. This means that they own and are responsible for their learning. In this view, each student's learning is based on his or her previous knowledge and experience, the context in which learning takes place, and its application in the real world.

The constructionism theory is based on the Bartlett's research, the psychologists Gestalt, Piaget, Bruner, and Yogotsky, as well as the educational philosophy of John Dewey, who consider the student to be important in constructing and interpreting knowledge. The constructivism philosophy is based on the idea that learners engage in real activities. In other words, they learn the subject matter based on real-world experience.

In the constructivist model, the role of the teacher is more to guide and facilitate learning than to transfer knowledge. There is also a dynamic interaction between the learners' activities of and educators. In this model, it has changed teachers from what they teach to what students learn. A constructive classroom environment teaches students how to discover multiple strategies for completing homework. The most important thing in this process is to create a space in the classroom where students can challenge any problem they face and broaden and enrich their sights. These skills will be developed in students if they are continuously taught to become accustomed to them and to be able to use critical thinking in their thoughts and judgments in various fields.

of course, critical thinking training cannot be completed successfully with just one teacher and in one lesson. This training should be done in all lessons. Because just by training critical thinking by a teacher, the student will not acquire a specific framework.

In order to relate and analyze issues, he/she needs to practice analysis in all areas in order to achieve comprehensive growth. Critical thinking, in fact, requires a continuum, not that the student feels disconnected from what he / she has learned as he / she moves from one grade or course to another. In addition, in order to achieve a clear framework for critical thinking, education must begin in the early years of elementary school so that students have a structure to understand things and organize their experiences. But there are usually pre-determined answers to each problem in our education system,

and students must learn the same answers.

This is in contrast to the way in which students grow and develop their thinking by rethinking different things and coming up with new ideas.

Teachers should be aware that it is not enough to just ask students to report, define, describe and articulate. Students should also be asked to analyze, deduce, relate, combine, critique, create, evaluate, think, and rethink. Therefore, teaching should encourage critical thinking and this way of thinking should be brought to school classroom lessons.

Research history

Rezazadeh (2018) conducted a study entitled "Study of the relationship between constructivism teaching methods and students' academic achievement." The results showed that there is a significant relationship between the teaching method of constructivism and students' academic achievement. Nowruzi, Zamani and Sharafzadeh (2014) have conducted a study entitled "The effect of using educational software on active learning of students in mathematics (with a constructivism approach)". The results showed that the use of educational software has been effective on academic achievement and increase students' motivation for active learning in mathematics. Nowruzi (2014) in his/her dissertation has conducted a study entitled "The effect of constructivism performance test on the academic achievement of elementary students in mathematics." Findings of this study show that mathematics education and evaluation through functional tests has caused students' academic achievement in this lesson. Shafiehzadeh Dizaji (2013) has conducted a study entitled "Feasibility study of the application of constructivism teaching methods in mathematics in high school in Tehran." The results show that the use of constructivist teaching method in high school mathematics is possible according to the target components, content, teaching methods, teaching materials and resources, learning activities, space, time, grouping and evaluation.

Aziz Malayeri (2011) has written his PHD thesis entitled "The effect of guided exploration and traditional teaching methods and learning styles on the level of critical thinking skills of high school students." The results showed that the guided exploration teaching method had a significant effect on students' critical thinking skills in the subscales of inference and deduction at a level of less than 0.05. Sheikhzadeh and Mehr Mohammadi (2004) in a study entitled "Elementary mathematical software based on the constructivism approach and measuring its effectiveness" achieved the results that; Education through constructivism software increases motivation and problem-solving and design skills and increases students' academic performance. Chamanara (2004) in a study entitled "Teaching based

on constructionism" examined the teaching methods based on this view and also their implementation in middle school math class. He achieved good results by implementing and designing class activities, some topics of middle school math textbooks, in order to identify students 'misunderstandings and their weaknesses in mathematics, as well as increase students' ability to learn as a result of the implementation of the teaching method. Izeh and Obidileh and Acamobidi (2019) have conducted a study entitled "The relative effectiveness of structuralism and extra-learning teaching methods on the academic achievement of male and female students in the field of electricity in technical colleges." The result of the study showed that constructive teaching methods are better for improving male and female students of technical college. Nelson (2017) conducted a study entitled "Methods of using mental powers to facilitate critical thinking in nursing students." The results show that mental powers facilitates students' critical thinking in the classroom. Yu, M. Zhang, Si. Zhang and Jin (2017) conducted a study entitled "The effectiveness of conceptual mapping on the development of critical thinking in nursing education: a systematic review and meta-analysis." The results of this study showed that the use of conceptual mapping in comparison with traditional educational methods, can improve the critical thinking skills of research participants.

Ziokwill (2016) conducted a study entitled "A Model for Critical Thinking as an Important Character for Success in the Twenty-one Century." The results indicate that the critical thinking model presented in this study helps students to develop their critical thinking skills and prepare for life in a complex world and society. Ayaz and Secret (2015) have conducted a study entitled "The effects of constructivism learning approach on students' academic achievement: a meta-analytic study". Researchers in this study concluded that the use of constructivism strategies in educating students increases their learning in different lessons. Amybley studied math. The results of this study showed that a large percentage of students mastered in study or discovery of relationships between ideas and mathematical rules, while a very small percentage of them did not.

Wass (2012) wrote his doctoral thesis entitled "Developing Critical Thinkers in Higher Education: A Perspective from Vygotsky's viewpoint." This qualitative research focuses on the learning experiences of zoology students and the development of their critical thinking skills by themselves. Therefore, Vygotsky's socio-cultural theory was used in this study and Vygotsky's approximate regional growth pattern as a theoretical perspective helped researchers better understand students' experiences. Niaz (2008) concluded in a study that teachers believe that student participation is necessary as a

prerequisite for change (educational change) they also introduced social constructionism as a transcendent type of constructionism. De Corte and Verschaffel (2006) conducted research to examine individual and social aspects of teachers' approaches to problem solving. The results of this study, which emphasized the view of social constructivism, showed that the learning environment has been effective in producing lasting and significant positive effects on students' beliefs and reasoning and their ability to solve problems.

Research questions

A) - Qualitative research question
**What is the educational model of social constructivism and its effect on academic achievement, critical thinking of elementary students?
B) Quantitative research questions
1- **How much the effect of the social constructivism educational model on the academic achievement of elementary students in mathematics?
2- **How much the impact of the social constructivism educational model on the critical thinking of elementary students in mathematics?

Methodology

In this research, the inductive type of qualitative content analysis method has been used. To design the model, descriptive-analytical research method was used with the approach of systematic review of research literature. In this study, purposive sampling method was used.

The sample size consisted of 36 articles. Criteria for selecting an article for qualitative content analysis include well-known authors, publication in a valid journal, relevance of the content of the article, newness of the year of publication of the article, and the number of final selected articles for qualitative content analysis by inductive method, was 36. The content analysis unit in this research is the theme. A subject is a unit of signification and refers to a single subject about matter. This method is a kind of review of studies that systematically and scientifically studies the research literature and comprehensively identifies, evaluates and synthesizes all related studies.

Articles and resources were also searched in valid scientific databases and libraries. The results of the research were reviewed by experts and unrelated sources were removed. Articles and texts were categorized and described.

Required and relevant information was extracted from sources, the extracted resources were re-evaluated and the data and results were qualitatively analyzed. According to the design of the present study, "inductive content analysis" in the first stage, which had a qualitative aspect, the qualitative case study method and documentary review was used; t

his research has been phenomenon-based, "social constructivism" and the analysis unit "articles related to 2003 to 2019".

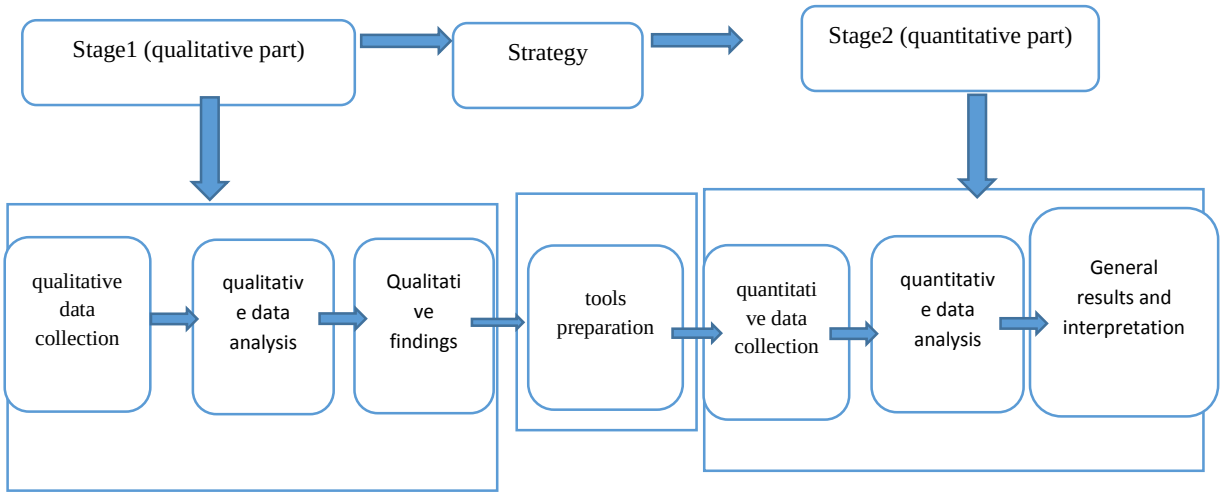

Fig.1.

Research method of qualitative part

The method of qualitative case study and documentary review based on the present research plan, ie "inductive content analysis" was used, this research has been phenomenon-based, "social constructivism" and the analysis unit "articles related to 2003 to 2019".

Research documents selecting method

Document selection was done using a purposeful approach and by sampling the method of critical cases or vital groups and using the theoretical saturation criterion in a multi-level sampling.

Data collection method

Inductive content analysis was used to social constructivism model. In order to collect information from articles, a document review protocol was designed. In which three functions of social constructivism theory were considered. In this protocol, some basic questions were raised: What is the role of the teacher in the social constructivism theory? What is the role of the learner in the social constructivism theory? What is the role of knowledge in the social constructivism theory?

Research method of quantitative part

Research method and plan

This research is part of applied research. And since the researcher could not randomly study the subjects in the study groups, he/she used a quasi-experimental method with a pretest-posttest plan. This plan consists of two groups that were compared before and after the presentation of the independent variable. In this plan, the selection of subjects from the community and their replacement in groups is not done randomly, the following figure shows this plan.

Table 1. Pretest-posttest (Bazargan et al., 2006)

studied groups	amount	pretest	independent variable	post-test
test group	32	T_1	X	T_2
evidence(control) group	32	T_1	-	T_2

Statistical population

Quantitative research: All sixth grade female students in the academic year 2016-2017 in the city of Lamerd are 64.

Statistical sample and sampling method

Due to the limited statistical population and the opinion of the supervisor, the census method has been used to select the sample size finally, the total statistical population of all 64 people is considered as a sample, of which 32 people were in the experimental group and 32 people were in the control group.

Data collection tools

In this study, to determine the effect of the proposed model on social constructivism and to determine the external validity of this model, the researcher-made academic achievement test (pre-test and post-test) was used, and the Watson-Glaser critical thinking test was used on researcher-made critical thinking.

A) Academic achievement test

Test to collect data on the first question of the research, the academic achievement researcher-made test (pre-test and post-test). The questions of this test are designed in 20 questions. These twenty questions are divided into 6 sections.

B) Critical thinking test

The test for collecting data on the second question of the research is Watson-Glaser critical thinking test (pre-test and post-test). This test has five sub-tests. Test takers should read each instruction carefully before answering each subtest. These five sub-tests are: 1) deduction 2) Assumptions recognition 3) Inference 4) Interpretation 5) Evaluation of logical reasoning.

Quantitative research data analysis method

Descriptive and inferential statistical methods have been used to analyze the data of the present study. In this study, in describing the obtained data, frequency distribution table, mean, standard deviation and drawing statistical graphs were used. Regarding the questions of this research, the data were analyzed using one-way analysis of covariance statistical test.

Research findings

Qualitative section findings

Qualitative question: What is the educational model based on the social constructivism theory?

Based on the results obtained from the data obtained from the

relevant documents and texts, the educational model based on the social constructivism theory, which can be drawn in the form of a network of themes, formed after several stages. In the first stage, the relevant documents and articles were carefully examined by the researcher, the main categories and subcategories were compiled and the initial semantic codes were extracted; the characteristics and dimensions of the subcategories were explored and their communication patterns were also examined. In other words, after the naming process, the transcripts of the interviews were reviewed and the general categories and subcategories, their characteristics and dimensions were systematically identified. Finally, the implemented versions of the articles were reviewed and analyzed several times in order to achieve data saturation in order to reach the main categories, sub-categories and their dimensions. Code analysis stopped when, after repeated reviews of the implemented text of the articles, the researcher achieved a meaningful categorization. And subcategories, features, and dimensions were repeated, and no new and relevant information was obtained from the articles. Therefore, at this stage, the researcher reached the final and significant categorization. Therefore the semantic codes obtained from related articles and documents were categorized around basic themes. And in the second stage, similar basic themes were placed in a group and organizer themes were formed. Finally, all these organizer themes were subjected to the pervasive theme of the social constructivist model and were classified.

In qualitative research, first the research question was determined and to determine the content analysis code for the selected articles, we first gave some theoretical definitions of the concept of social constructivist theory. The operational definition of the social constructivism theory was compiled according to theoretical definitions in a more objective, coherent and comprehensive definition. This operational definition was considered as the content analysis code of articles and in order to select articles for qualitative content analysis in databases, first the keywords for article search were identified.

The results showed that increasing the application of educational psychology theories has a profound effect on teacher activities in teaching students. These theories provide opportunities for teachers and students to engage learning in new methods. For example, by facilitating teacher access to educational psychology findings, the role of the teacher, previously considered the only source of knowledge, has become a guide to information acquisition in today's world. An example of the application of educational psychology theories is the use of Vygotsky's constructivism theory for the teaching and learning of elementary school students. The

application of educational psychology theories in the classroom of ordinary students seems to be obvious; but the application of these theories in the elementary school classroom requires attention to separate items that research must determine in advance.

Based on the results of the data obtained from the relevant documents and texts, the educational model based on the social constructivism theory, which can be drawn in the form of a network of themes, has been formed after several steps. In the first stage, the relevant documents and articles were carefully examined by the researcher, the main categories and subcategories were compiled and the initial semantic codes were extracted; the characteristics and dimensions of the subcategories were explored and their communication patterns were also examined; in other words, after the concept naming process, the transcript of the interviews was reviewed and the general categories and subcategories and their characteristics and dimensions were systematically identified. Finally, the implemented versions of the articles were reviewed and analyzed several times in order to achieve data saturation in order to reach the main categories, sub-categories and their dimensions. Code analysis stopped when, after repeated reviews of the implemented text of the articles, the researcher achieved a meaningful categorization.

And subcategories, features, and dimensions were repeated, and no new and relevant information was obtained from the articles. Therefore, at this stage, the researcher reached the final and significant categorization.

Therefore the semantic codes obtained from related articles and documents were categorized around basic themes. And in the second stage, similar basic themes were placed in a group and organizer themes were formed. Finally, all these organizer themes were subjected to the pervasive theme of the social constructivist model and were classified. According to the content analysis performed on the text of 36 articles in the social constructivism theory, three categories of teacher role, learner role and knowledge role were obtained.

At this stage, based on the semantic and conceptual relationship between the basic themes and by studying the relationship between them in depth and after repeated reviews by the researcher and research colleagues, similar basic themes were placed in a category and as a result organizer themes was formed. As a result of further analysis on the conclusions obtained in all three categories, the role of teacher, the role of learner and the role of knowledge, the model components were obtained as follows:

Table 2. Classification of categories components

teacher role	Learner guidance Prerequisites reminding Using different teaching methods Teaching how to learn Using different evaluation methods
learner role	Knowledge builder Gaining meaning from experiences Controlling the learning process Connecting new knowledge with previous knowledge Being active in the learning process
knowledge role	Dependence on the learner Existence of multiple realities of the world Depending on the context Being mental Personal interpretation of the world Provide a model

Research strategy

Transition from qualitative findings of the study towards quantitative survey after extracting and validating the social structuralism model, a tool was developed based on the obtained model and it was used as a "method and model" to connect the qualitative part to the quantitative and further analysis of qualitative findings by quantitative findings. It should be noted that this tool, which is based on the results of the qualitative section, consisted of 15 items that measured 5 questions, the role of the teacher, 5 questions, the role of the learner and 5 questions, the role of knowledge. Other characteristics of research tools in the quantitative stage of research are presented in Table 3.

Table 3. Questions and components of the quantitative research questionnaire factors

row	factors	items number
1	teacher role	5
2	learner role	5
3	knowledge role	5
		Sum=15

All content analysis performed on articles and books and inferences and components derived from them, is presented in the following model:

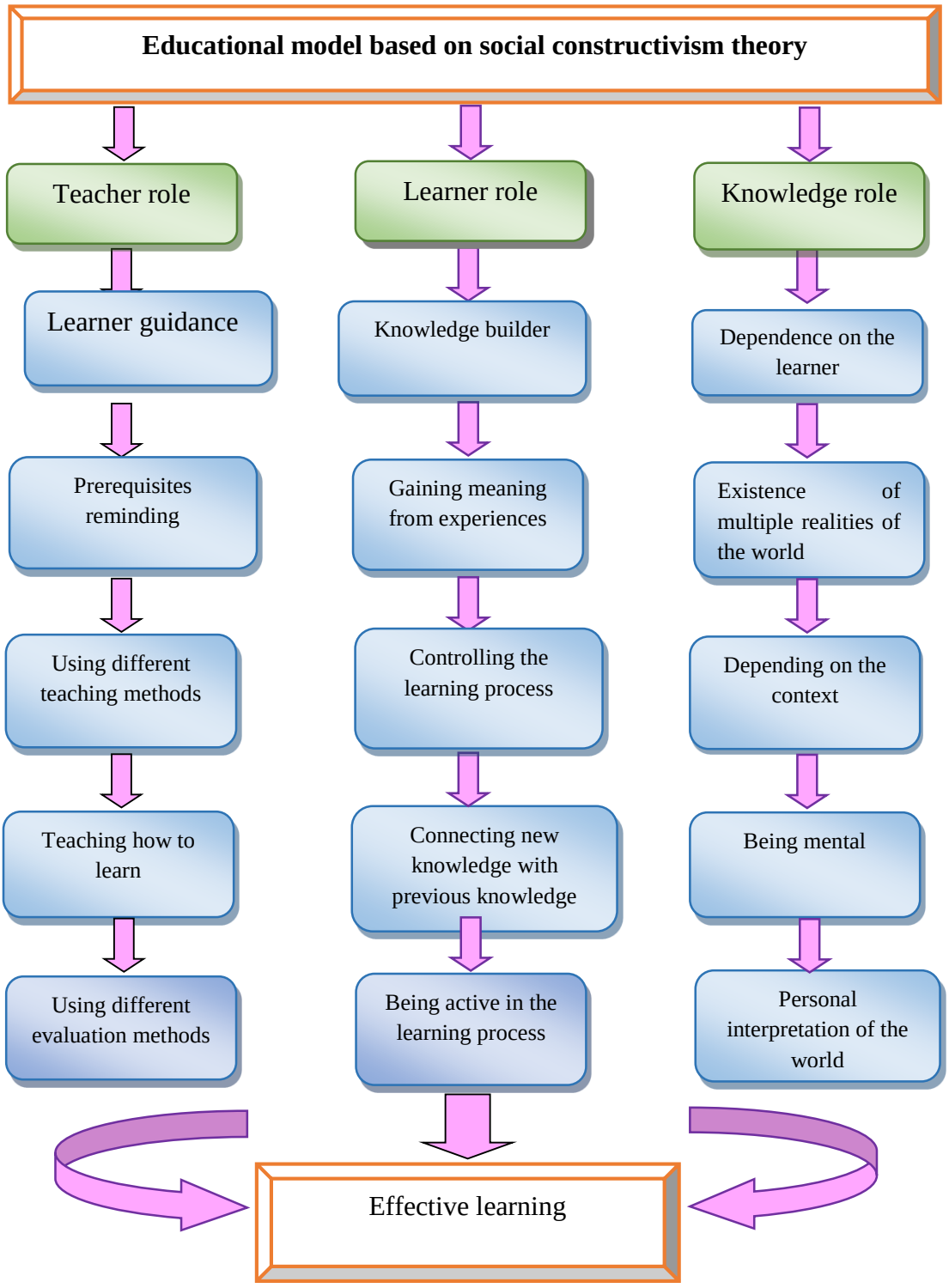
Educational model based on social constructivism theory
Teacher role
Learner guidance
Prerequisites reminding
Using different teaching methods
Teaching how to learn
Using different evaluation methods
Learner role
Knowledge builder
Gaining meaning from experiences
Controlling the learning process
Connecting new knowledge with previous knowledge
Being active in the learning process
Knowledge role
Dependence on the learner
Existence of multiple realities of the world
Depending on the context
Being mental
Personal interpretation of the world
Effective learning

Fig. 2.

The model presented as a result of qualitative research

Quantitative section findings

In this part of the research, the research findings are analyzed. Before analyzing the hypotheses, the results of descriptive statistics of research variables are reviewed. For this purpose, descriptive statistics (central indicators and dispersion) of the raw scores of each group are given here. In Table (4), the mean scores and the deviation of the total score of the academic achievement variable in the two stages of pre-test and post-test are reported separately for the control and experimental groups. Descriptive analysis of research data indicates that the academic achievement scores of the experimental group compared to the control group in the post-test stage is significantly higher.

Table 4. Mean scores and dimensional standard deviation as well as the total score of the academic achievement variable

	Group	Mean	Standard Deviation	amount
Pretest Learning	test	2.3125	1.25563	32
	Control	2.5000	1.41421	32
	Total	2.4063	1.32998	64
Post- test Learning	test	16.5000	2.21439	32
	Control	14.2500	2.38273	32
	Total	15.3750	2.54795	64

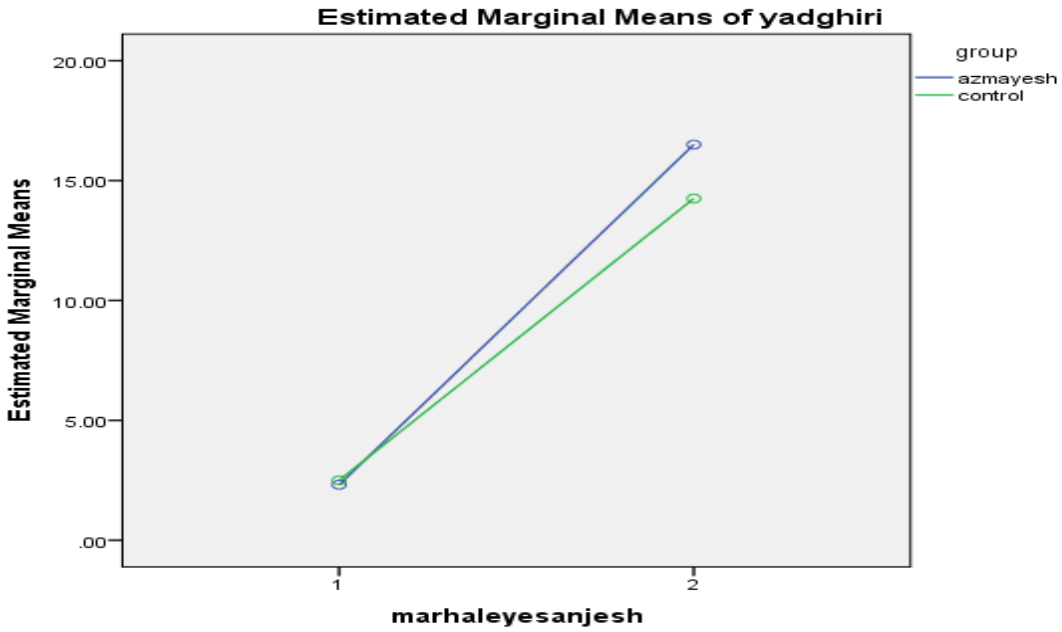

Fig.3. was used to understand the differences between the control and experimental groups in the academic achievement variable.

*graph (3): The trend of changes in the total score of academic achievement in the two stages of pre-test and post-test by two groups.

*Table (4) shows the trend of changes in the total score of critical thinking. According to the mean scores reported in Table (4), it is clear that there is a significant difference between the experimental and control groups in post-test scores.

Table 5. Mean scores and dimensional standard deviation as well as the total score of the critical thinking variable

	Group	Mean	Standard Deviation	amount
Critical Thinking Pre-Test	Test	35.0937	7.35504	32
	Control	35.2812	7.56577	32
	Total	35.1875	7.34388	64
Critical thinking post-test	Test	59.7187	11.70397	32
	Control	35.0000	7.42706	32
	Total	47.3594	15.80272	64

To understand the differences between the control and experimental groups in the critical thinking variable, Figure (2) has been used.

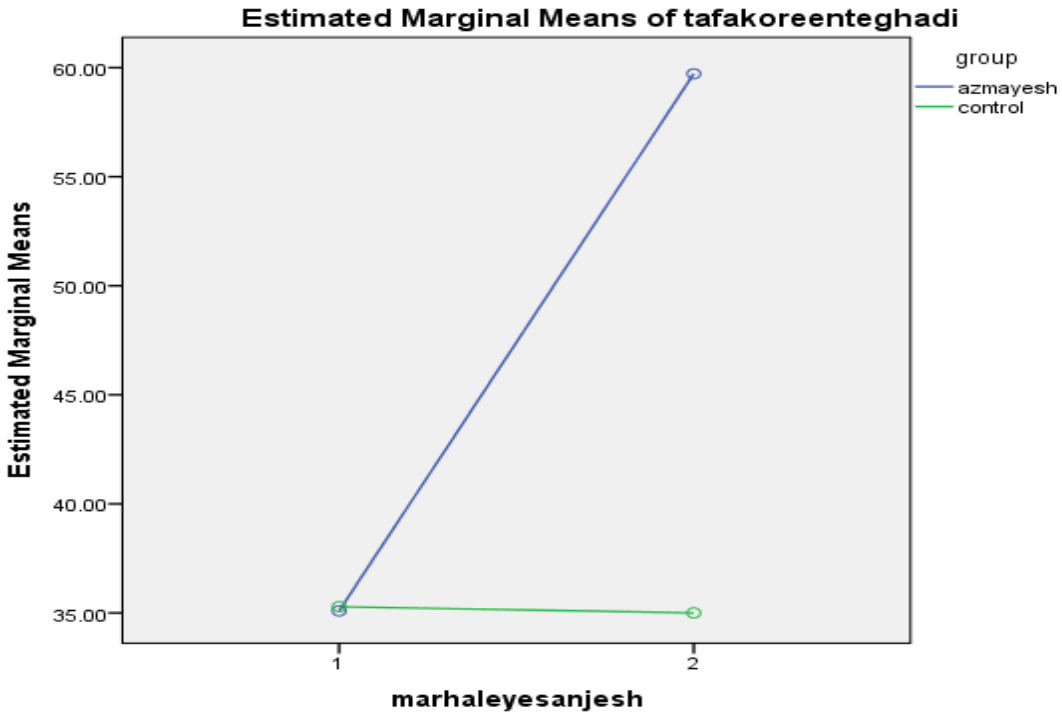

Fig. 2

Examining the first quantitative question of the research

How much the effect of the social constructivism educational model on the academic achievement of elementary students in mathematics?

Shapiro-Wilk test was used to test this hypothesis. The result of Shapiro-Wilk test is shown in Table (4-4). As shown in Table (4-4), the result of this test indicates that the amount of the Shapiro-Wilk test is insignificant for post-test data on academic achievement. In other words, learning post-test data are normal for both experimental and control groups.

Table 6. Shapiro-Wilk test to check the normality of the data.

Shapiro-Wilk				
	group	amount	Degrees of freedom	Significant level
Post-test	test	0.949	32	0.137
learning	control	0.943	32	0.090

The second important assumption of covariance analysis is the equality or homogeneity of error variances that F- Levin test was used to check this hypothesis. As shown in Table (6-4), the insignificant of the hypothesis test is also true.

Table 7: Levin test to check for homogeneity of error variances.

F	df1	df2	Significant level
0.108	1	62	0.743

To test this assumption, interaction between the group and the academic achievement pre-test were used. The result of this test is shown in Table (7-4). As shown in Table (4-6), the interaction between the group factor and academic achievement pre-test is insignificant that indicates the truthfully of this assumption.

Table 8. Interaction between group factor and academic achievement pre-test.

Source	Total squares	df	Average square	F	Sig.
Group interaction and frequent agent	3.532	1	3.532	2.971	0.097

Given that all three of the above hypotheses are true, so the use of analysis of covariance for the first question is free, which is described below. The results of the covariance analysis are shown in Table (7-4). As shown in this table, the average of the total squares of the group factor is equal to 78.54 and the average of the total squares at level 1 is a significant percentage. F was equal to 14.72

and the amount of the F fault test was equal to 5.33 which leads to the size of the effect size test obtained for this effect is equal to 0.194 which indicates the average effect of this educational intervention on academic achievement.

Table 9. covariance Analysis to examine the educational model based on the social constructivism theory on academic achievement.

Source	Total squares	df	Average square	F	Significant level	Effect size
Corrected model	83.607	2	41.803	7.837	0.001	0.204
intercepts	3653.422	1	3653.428	684.89	0.000	0.918
Pre-learning	2.607	1	2.607	0.489	0.487	0.008
group	78.545	1	78.545	14.724	0.000	0.194
fault	325.393	61	5.334			
Total	15538.000	64				
Total corrected	409.000	63				

Examining the second quantitative question of the research

How much the effect of the educational model based on the social constructivism theory on the critical thinking of elementary students in mathematics?

The use of an educational model based on the social constructivism theory increases the critical thinking of elementary students in mathematics. To examine this question, one-way covariance analysis Statistical method before examining the results of one-way covariance analysis, the basic assumptions of this statistical test are first examined.

Shapiro-Wilk test was used to test this hypothesis. The result of Shapiro-Wilk test is shown in Table (8-4). As shown in Table (9-4), the result of this test indicates that the amount of the Shapiro-Wilk test is not significant for critical thinking post-test data. In other words, critical thinking post-test data are normal for both test and control groups.

Table 10. Shapiro-Wilk test for data normality checking (critical thinking).

Shapiro-Wilk				
	group	amount	Degrees of freedom	Significant level
Post-test	test	0.937	32	0.060
learning	control	0.950	32	0.147

The second important assumption of analysis of covariance is the equality or homogeneity of error variances, which F- Levin test has been used to test this hypothesis. As shown in

Table (10), the hypothesis test is also insignificant.

Table 11. Levin test to examine the homogeneity of error variances (critical thinking)

F	df1	df2	Significant level
0.198	1	62	0.589

To test this hypothesis, interaction between groups and progress motivation pretest were used. The result of this test is shown in Table (4-10). As shown in Table (11), the interaction between the critical thinking pre-test and the group factor is not significant, indicating the truth of this hypothesis.

Table 12. Interaction between group factor and critical thinking pre-test.

Source	Total squares	df	Average square	F	Sig.
Group interaction and frequent agent	302.779	1	302.779	3.467	0.067

Given that all three of the above hypotheses are true, so the use of analysis of covariance for the second question is free, which is described below. The results of the covariance analysis are shown in Table (4-11). As shown in this table, the mean of the sum of the squares of the group factor was 9826.47 and the mean of the sum of the squares at the level of 1% was equal to 108.46, which is 90.86 of the error F test, which results in a test size of 0.639. In other words, the result of covariance analysis indicates that after removing the initial effects of the critical thinking pre-test, there is a significant difference between the test and control groups. According to the descriptive table (2-4), it is clear that the average scores of the test group in critical thinking in the post-test stage after controlling the initial effects are higher than the scores of the control group which shows the positive effect of education based on the social constructivism theory on critical thinking.

Table 13. covariance analysis test to examine the social constructivism educational model on critical thinking.

Source	Total squares	df	Average square	F	Significant level	Effect size
Corrected model	10190.204	2	5095.109	56.076	0.000	0.648
intercepts	3237.034	1	3237.034	35.622	0.000	0.369
Pre-learning	413.938	1	413.938	4.556	0.037	0.069
group	9826.478	1	9826.478	108.148	0.000	0.639
fault	5542.531	61	90.861			
Total	159279.000	64				
Total corrected	15732.734	63				

**Considering the effect size obtained for this effectiveness (0.639), it is clear that the effect of intervention based on social constructivism on critical thinking is powerful.

Discussion and Conclusion

Students generally like to gain experience in the teaching and learning process, to learn in new ways, and to critique the world around them. All of this can only be achieved if we use appropriate teaching and learning theories to teach these students. These theories need further research to examine their positive effects on elementary school students. In this research, this work has been done. In this research, the effect of education based on the principles related to the social constructivism theory for teaching mathematics to elementary school students in Lamerd city has been investigated. This is an example of an attempt to use educational psychology theories to better educate students.

In general, looking at the results of the present study, it can be concluded that the increasing application of the educational psychology theory has had a profound effect on teacher activities in teaching students. These theories provide opportunities for teachers and students to engage in learning in new methods. For example, by facilitating teacher access to educational psychology findings, the role of the teacher, previously considered the only source of knowledge, has become a guide to information acquisition in today's world.

An example of the application of educational psychology theories is the use of Vygotsky's constructivism theory for teaching and learning to elementary learners. The application of educational psychology theories in the classroom of ordinary students seems to be obvious; however, the application of these theories in the elementary school classroom requires attention to separate items that research must determine in advance. Also, in order to make the application of educational psychology theories more effective in teaching and learning, teachers must change their attitude towards the category of education.

The social constructivism theory tries to improve students' learning by emphasizing the learner's mind as a tool for acquiring new knowledge. This theory emphasizes the guidance of the learner by the teacher and rejects the role of the teacher as the only source of knowledge. In the social constructivism theory, more emphasis is placed on the learner and the role of the teacher in the learning of learners is less. Therefore, in applying the social constructivism theory, the lesson should be well instructional design based on the principles and strategies of this theory.

In general, the results of the present study showed that the use of the lesson plan produced based on the model presented in the social constructivism theory, on the rate of academic achievement, critical thinking and motivation of academic achievement of elementary students in Mathematic has a positive effect.

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