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Evaluating the Effectiveness of Conceptual Model-Based Learning Design on the Development of Problem-Solving Skills, Creative Thinking, and Self-Regulation Learning in Elementary Sixth Grade Science

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A B S T R A C T

The purpose of this study was to investigate the effectiveness of concept-based teaching on problem-solving skills development, creative thinking, and self-regulation learning in elementary sixth grade science. The quasi-experimental study method was used to design unbalanced groups with pre-test and post-test. 45 students from two classes in one of the primary schools of Kamyaran city (in Iran) participated in this study and were selected through available sampling method (24 experimental and 21 control groups). The experimental group was trained through concept-based modeling and the control group was trained through traditional and conventional teaching methods. This period was eight weeks. Data collection tools included Parker Problem Solving Questionnaire, Torrance Form A Creativity Assessment Image Questionnaire, and ASRQ Self-Regulated Learning Strategies Questionnaire which were used as pre-test and post-test. Both descriptive and inferential statistics (one-way and multi-way covariance) were used to analyze the statistical data. The results showed that students who were trained through concept-based model had higher problem-solving score, creative thinking and self-regulation compared to the traditional-trained students.

Keywords: Concept-Based Model, Problem Solving, Creative Thinking, Self-Regulation.

INTRODUCTION

In today's world, the development and development of societies is due to the purposeful training of human resources, and this concept depends on the correct definition of the goals of each society. The education system, like all other systems, expands around its specific goals, and the goal of education is to share people with new and creative knowledge and skills. In other words, the primary goal that education revolves around is education or training. To this end, learning can be described as the goal that education strives for(Falcão, Ferreira, Rodrigues, Diniz, & Gasevic, 2019; Gašević, Dawson, & Siemens, 2015; Iliou et al., 2019; Maciukiewicz et al., 2018; Patel, Khalaf, & Aizenstein, 2016).

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Although it is abstract and idealistic to push the school and the teacher towards the goals of education and to attempt to explain these goals, the way the teacher acts in the classroom is crucial(Duchesne & McMaugh, 2018; Slavin, 2019).

In the process of educational activities, teachers are one of the key elements in the transformation of the human resource that they should provide with an artistic and contingent vision of the environment that, instead of imparting information and imposing thought, creates a sense of security, self-control and self-development. Students should be empowered so that they can personally be the architects of their education(Pilieci, Salim, Heffernan, Itani, & Khadaroo, 2018; Shabani, 2005; Sivarajah et al., 2019).

Among the activities that are undertaken to educate students, the largest portion is devoted to teacher teaching in the classroom. Teaching is a bilateral activity that runs between the teacher and the student and is aimed at learning. In order to maximize the influence of the teacher during teaching and other educational activities on the students, there must be two dominant factors: one on how to teach the subject correctly and the other on the subject he / she wants to teach(Hills, 2018).

Based on their cognitive, learning environment, and learners, teachers select a teaching paradigm that will satisfy learners' learning needs in the first place and, subsequently, continue their learning in a non-educational environment. Guarantee. The teaching paradigm is an outline or paradigm that assists students in learning a variety of knowledge, attitudes and skills and has a theoretical background or philosophy; it also includes specific stages of teaching. Designed to achieve desirable educational outcomes(Safavi, 2004), teaching methods are based on philosophical ideologies and paradigms. Each paradigm differs from other models in terms of its philosophical logic and purpose. But each template shares with other teaching models the need to motivate students, define expectations, or discuss topics. Joyce, Weil, and Showers (1992), by creating a classification for teaching patterns, generally divide teaching methods into four families: 1- Information processing patterns 2- Behavioral patterns 3- Social patterns 4- Individual patterns. The concept-based teaching model of a family member is the information processing paradigm(Khoobi, Mohammadi, Ahmadi Hedayat, Ghiyasvandiyan, & Varaei, 2017; Nielsen, 2016).

Using its three-dimensional nature as a result of adding meaning to curricula and training and using valuable attention to realities, this model is used as tools to gain a deep understanding of transferable concepts and principles. He does Traditionally the curriculum is designed and edited only in two dimensions of reality and skill, and since students are expected to have a conceptual understanding at the end of each syllabus, achieving this is important without using a concept teaching paradigm. Axis, Students Problems in Learning(Ampartzaki & Kalogiannakis, 2016; Erickson, Lanning, & French, 2017).

Learning the concept actually requires a number of different patterns. The concept-based teaching paradigm is primarily designed to teach key ideas that form the basis of high-level thinking for students and enable them to interact and interact.

Given the aforementioned issues and because of the difficulties in acquiring science knowledge in the early years of education, the need for further applied research and finding ways to reduce problems in this field is felt. This study also examines the effectiveness of concept-based model-based design training on developing problem-solving skills, creative thinking, and self-regulation of learning in elementary sixth grade science.

METHODOLOGY

The purpose of the present study was to investigate the effect of concept-based teaching on problem-solving skills development, creative thinking and self-regulation of learning in science courses in elementary students. Accordingly, this study is an applied research component and a quasi-experimental study with pretest-posttest design and control group, in which the effect of concept-based teaching pattern design (independent variable) is investigated. The development of problem-solving skills, creative thinking and self-regulated learning (dependent variables) in elementary sixth grade science lessons in two control and experimental groups were studied in the academic year 2017-2018 in Kamyaran (in Iran).

The statistical population of this study includes all sixth-grade elementary students of public schools who are studying in the academic year of 2017-2018. To select the statistical sample in this study, available sampling method was used. The selected school had two sixth graders who were randomly assigned to a 24-person class as an experimental group and a 21-person class as a control group. The sample size of this study is 45 people. In order to implement the concept-based teaching model and examine the effect of this teaching method on problem solving variables, creative thinking and self-regulated learning between two groups (experiment and control) of sixth grade elementary students, a researcher attending school The formation of the experimental and control groups provided the students with the information needed to answer the questionnaires and conducted two test stages. It should be noted that in order to achieve the aims of this study, a design based on a concept-based teaching model for elementary sixth grade science lesson was given to the experimental group by the researcher for 8 weeks at the same time as the control group. He was taught using the traditional model. In this study, the results of changing the amount of variables in the two groups were compared. The Parker Problem Solving Questionnaire was used to collect data in this study to measure respondents' perceptions of problem-solving behaviors. Also, to assess the level of creative thinking in students, the form questionnaire of Torrance a creativity assessment questionnaire and ASRQ self-regulation learning strategies questionnaire is used to assess the level of self-regulation. Data analysis was performed using descriptive statistics (mean and standard deviation) and inferential statistics including covariance analysis to investigate the research hypotheses using.

RESULTS

In this section, descriptive statistics indices including mean and standard deviation were calculated for the two groups, then inferential statistics indices were calculated to test the research hypotheses based on statistical tests. The following is a presentation. Descriptive statistics indices including mean and standard deviation of each of the research variables and its components for the two experimental and control groups were calculated in two pre-test and post-test stages, the results of which are presented in the following tables.

Table 1. Mean and standard deviation of the problem-solving variable in the two experimental and control groups

Variable		Group	Number	Pre-test		Post-test	
				Mean	Std. deviation	Mean	Std. deviation
Problem Solving		test	24	64.29	10.17	75.04	7.89
		control	21	69.14	7	67.81	7.76
Problem Solving Scale Components	feel	test	24	15.04	3.49	18.63	2.71
		control	21	16.48	2.36	15.48	2.06
	Intuition	test	24	16.46	2.65	19.12	1.18
		control	21	16.66	3.95	18.14	2.97
	Feeling	test	24	16.79	3.61	19.17	3.18
		control	21	18.95	3.15	17.33	2.95
	Thinking	test	24	16	4.18	18.12	3.3
		control	21	17.04	2.42	16.85	2.85

Table 1 shows the mean and standard deviation of the problem-solving scale and its four small-scale scales at each test step in the two experimental and control groups.

Table 2. Mean and standard deviation of the creative thinking variable in the two experimental and control groups

Variable		group	Number	Pre-test		Post-test	
				Mean	Std. deviation	Mean	Std. deviation
Creative Thinking		Experiment	24	131.66	22.91	141.66	23.27
		Control	21	96	34	99.14	18.16
Problem Solving Scale Components	innovation	Experiment	24	32.66	7.06	35.96	8.86
		Control	21	22.66	7.04	23.62	5.65
	Expand	Experiment	24	44.42	9.18	48	8.52
		Control	21	27.28	13.57	27.38	8.06
	flexibility	Experiment	24	20.63	3.63	22.08	3.41
		Control	21	17.48	6.59	17.19	4.02
	Psychological	Experiment	24	33.96	7.24	35.58	6.56
		Control	21	28.57	10.82	30.95	7.18

Table 2 shows the mean and standard deviation values of the Creative Thinking Scale and its four micro-scales at each test stage in the two experimental and control groups.

Table 3. Mean and standard deviation of the self-adjusting variables in the two experimental and control groups

Variable		group	Number	Pre-test		Post-test	
				Mean	Std. deviation	Mean	Std. deviation
Self-regulatory		Experiment	24	124.46	23.99	142.79	23.92
		Control	21	131.09	25.28	130.05	27.34
Self-regulation scale components	Memory strategy	Experiment	24	19.25	4.7	20.5	6.11
		Control	21	21.9	5.5	20.29	48.5
	Targeting	Experiment	24	10.79	3.71	13	3.44
		Control	21	11.9	3.9	12.33	4.67
	Self-assessment	Experiment	24	24.96	5.99	28.25	5.64
		Control	21	26.43	4.69	26.05	4.61
	Need help	Experiment	24	25.96	5.36	30.5	5.24
		Control	21	25.33	6.21	25.76	6.43
	Responsibility	Experiment	24	17.75	4.64	20.54	3.78
		Control	21	18.96	3.57	19.81	3.46
	Organize	Experiment	24	25.75	5.13	30	5.59
		Control	21	26.75	7.63	25.81	7.93

Table 3 shows the mean and standard deviation values of the self-adjusting scale and its six minor scales at each test step in the two experimental and control groups.

Research hypothesis: There is a significant difference between the ability of problem-solving skills in the science lessons of students who are trained in the concept-based teaching model and the students who are trained in the traditional way.

One-way covariance analysis (ANCOVA) was used to statistically analyze the data. In this analysis, post-test mean of experimental group was compared with post-test mean of control group and pre-test scores were used as covariates.

Table 4. Results of one-way covariance analysis for homogeneity of regression slopes in post-test science problem solving skill test in two experimental and control groups

Source	Sum squares	Df	Mean squares	F	Sig
Problem solving pre-test	1115.864	1	1115.864	32.953	0.001
Group x pre-test	11.511	1	11.511	0.34	0.563
Error	1388.383	41	33.862		
Total	234349	45			

As can be seen in Table 4, the interaction between the group and the pre-test of problem-solving skills was not significant. In other words, the data support the homogeneity hypothesis of the regression slopes. $F_{(1,4,5)}$=.340 P=.563

Table 5. One-way covariance analysis results for homogeneity of post-test differences in problem solving skills of science lesson in experimental and control groups

Source	Sum squares	Df	Mean squares	F	Sig
Problem solving pre-test	1238.347	1	1238.347	37.154	0.001
Method	1075.565	1	1075.565	32.27	0.001
Error	1399.849	42	33.33		
Total	234349	45			

As shown in Table 5, after adjusting for pre-test scores, problem solving skills showed a significant difference between the two groups of students in the experimental and control groups $F_{(1,4,5)}$=32.270 P=0.00. Thus, the research hypothesis is confirmed; that is, students who are trained in the concept-based model have a more problem-solving skills in science lessons than those trained in the conventional way.

The mean and standard deviation of problem-solving skills of the students in the experimental and control groups are shown in Table 6 to compare and examine for the significant differences.

Table 6. Modified Mean and Standard Deviation of Problem-Solving Skills for Students in Experimental and Control Groups

Variable	Experiment		Control	
	Mean	Std. deviation	Mean	Std. deviation
Problem Solving	76.416	1.2	66.239	1.29

As can be seen in Table 6, the mean post-test scores of problem-solving skills in science lessons were significantly higher in the experimental group than in the control group.

Also, data analysis on the components of problem-solving scale (sense, intuition, emotion, and thinking) was performed by multivariate analysis of covariance, the results of which are reported in Table 8. Before presenting the results for the components of the problem-solving scale, a report on the assumption of the equality of variances of the research variables (Levin test) is presented in Table 7.

Table 7. Levine test results on the assumption of equality of variance in the scores of community research variables

Variable	F	Df 1	Df 2	Sig.
To feel	1.877	1	43	0.178
Intuition	4.905	1	43	0.302
Feeling	0.628	1	43	0.432
Thinking	0.131	1	43	0.719

As presented in Table 7, the null hypothesis for equality of variances of group scores in the research variables is confirmed. That is, the assumption of equality of variances of scores in the experimental and control groups was confirmed and the assumptions required for the use of statistical tests exist.

Table 8. Summary of Multivariate Analysis of Covariance (MANCOVA) Results for Post-Test Difference of Problem-Solving Scale Components in Experimental and Control Groups

Source	Variable	Sum squares	Df	Mean squares	F	sig	Effect size
Group	To feel	111.048	1	111.048	18.736	0.001	0.303
	Intuition	10.804	1	10.804	1.835	0.183	0.041
	Feeling	37.644	1	37.644	3.967	0.053	0.084
	Thinking	18.004	1	18.004	1.874	0.178	0.042

As shown in Table 8, after adjusting the pre-test scores of each problem-solving level, only at the sense level (p = 0.000, $F_{(1,43)}$ = 18.736), between the effects of the two groups. There was a significant difference between the experimental group (conceptual model) and the control group (traditional method). That is, the concept-based method was more effective than the traditional method on the level of sensation. Also, in the intuition components (p=0.183 and $F_{(1,43)}$ = 1.835), emotion (p = 0.053 and. $F_{(1,43)}$ = 3.967) and thinking (p = 0.178 and ($F_{(1,43)}$ = 1.874)) did not find a significant difference between the effects of the two methods (L = 0.686; effect size = 0.314; P <0.01, F = 4/ 578).

Second hypothesis of research: There is a significant difference between the ability of creative thinking in the science lessons of students who are trained in the concept-based teaching model and the students who are trained in the traditional way.

One-way covariance analysis (ANCOVA) was used to statistically analyze the data related to this hypothesis. In this analysis, the mean post-test of the experimental group was compared with the post-test mean of the control group and the pre-test scores were used as a covariate. In order to perform this analysis, it is necessary to observe the homogeneity of the regression slopes whose results are reported in Table 9.

Table 9. Results of one-way covariance analysis for homogeneity of regression slopes in post-test Creative Thinking in Science lesson in experimental and control groups

Source	Sum squares	Df	Mean squares	F	Sig
Pre-test of moral thinking	7626.933	1	7626.933	27.832	0.001
Group x pre-test	200.351	1	200.351	0.731	0.397
Error	11235.378	42	274.034		
Total	707140	45			

Based on the information in Table 9, the interaction between the group and the pre-test of ethical thinking was not significant. In other words, the data support the homogeneity hypothesis of the regression slopes ($F_{(1,4,5)}$=.397 P=.731).

Table 10. One-way covariance analysis results for homogeneity of post-test difference of creative thinking skills of science lesson in experimental and control groups

Source	Sum squares	Df	Mean squares	F	Sig	Effect size
Pre-test of moral thinking	7622.177	1	7622.177	27.994	0.001	0.4
Method	5358.404	1	5358.404	19.68	0.001	0.319
Error	11435.728	42	272.279			
Total	707140	45				

As shown in Table 10, after adjusting for pre-test scores of creative thinking, there was a significant difference between the two groups in the experimental and control groups (P = 0.000, $F_{(1,45)}$ = 19.680). Therefore, the research hypothesis is confirmed; that is, students who are trained by the concept-based model have more creative thinking in science than the group trained in the conventional way.

The mean and standard deviation of the adjusted creative thinking of the experimental and control group students are shown in Table 11 for comparison and comparison of the significant differences.

Table 11. Modified mean and standard deviation of creative thinking in students of science and experiment groups

Variable	Experiment		Control	
	Mean	Std. deviation	Mean	Std. deviation
Creative Thinking	133.921	3.673	107.995	3.971

As can be seen in Table 11, the mean scores of post-tests of ethical thinking skills of science lesson were significantly higher in the experimental group than in the control group.

Also, data analysis on the components of creative thinking scale (creativity, elaboration, flexibility and mentality) was performed using multivariate analysis of covariance, the results of which are reported in Table 13. Before presenting the results on the components of the Ethical Thinking Scale, a report on the default observation of equality of variances of the research variables (Levin test) is presented in Table 12.

Table 12. Levine test results on the assumption of equality of variance of the scores of the groups research variables in the community

Variable	F	Df 1	Df 2	Sig.
Innovation	1.829	1	43	0.183
Expand	0.146	1	43	0.705
Flexibility	0.241	1	43	0.626
Mental	0.03	1	43	0.864

As presented in Table 12, the null hypothesis for equality of variances of group scores in the research variables is confirmed. That is, the assumption of equality of variances of scores in the experimental and control groups was confirmed and there are assumptions necessary for the use of statistical tests.

Table 13. Summary of Multivariate Analysis of Covariance (MANCOVA) Results for Post-Test Difference of Ethical Thinking Scale in Experimental and Control Groups

source	Variable	Sum squares	Df	Mean squares	F	sig	Effect size
Group	Innovation	1705.289	1	1705.289	29.98	0.001	0.411
	Expand	4761.625	1	4761.625	68.964	0.001	0.616
	Flexibility	268.129	1	268.129	19.506	0.001	0.312
	Mental	240.192	1	240.192	5.111	0.029	0.106

As can be seen in Table 13, after adjusting the pre-test scores of each level of creative thinking, at the level of initiative ($p = 0.000$, $F_{(1,43)} = 29.980$), expansion ($p = 0.000$, $F_{(1,43)} = 68.964$) , Flexibility ($p = 0.000$, $F_{(1,43)} = 19, 506$)and mental ($p = 0.029$, $F_{(1,43)} = 5.111$) between the two groups of students There was a significant difference between the experimental group (concept-based model) and the control group (traditional method). That is, the concept-based approach was effective on all levels of creative thinking compared to the traditional method (Effect size = 0.842; Landau Wilks = 0.158; $p < 0.0001$; $F = 53.386$).

Third hypothesis of research: There is a significant difference between self-regulated ability in science lessons of students who are trained by concept-based teaching model and students who are trained in traditional way.

One-way covariance analysis (ANCOVA) was used for statistical analysis of data related to this hypothesis. In this analysis, the mean post-test of the experimental group was compared with the post-test mean of the control group and the pre-test scores were used as a covariate. To do this analysis, it is necessary to observe the homogeneity of the regression slopes whose results are reported in Table 14.

Table 14. One-way covariance analysis results for homogeneity of regression slopes in post-test self-regulated science lesson in experimental and control groups

Source	Sum squares	Df	Mean squares	F	Sig
Self-regulation pre-test	18460.761	1	18460.761	79.601	0.001
Group X Pre-test	87.287	1	87.287	0.376	0.543
Error	9508.628	42	231.918		
Total	872641	45			

As can be seen in Table 14, the interaction between the group and the pre-test of self-regulation skills was not significant. In other words, the data support the homogeneity hypothesis of the regression slopes (p = 0.543, F=0.376).

Table 15. One-way covariance analysis results for homogeneity of post-test differences in self-regulation skills of science lesson in experimental and control groups

source	Sum squares	Df	Mean squares	F	Sig	Effect size
Self-regulation pre-test	18511.001	1	18511.001	81.02	0.001	0.659
method	3695.215	1	3695.215	16.187	0.001	0.278
error	9595.909	42	228.474			
Total	872614	45				

As shown in Table 15, after adjusting for pre-test scores of self-regulation skills, there was a significant difference between the two groups of students in the experimental and control groups (F=16.187 , P = 0.000). Thus, the research hypothesis is confirmed; that is, students who are trained using the concept-based model have a higher degree of self-regulation in science than the group trained in the conventional way.

Table 16 shows the comparisons and comparisons for these significant differences, mean and standard deviation of students' self-regulation skills.

Table 16. Modified Mean and Standard Deviation of Self-Regulation Skills in Students of Experiments and Control Groups

Variable	Experiment		Control	
	Mean	Std. deviation	Mean	Std. deviation
Self-regulatory	145.404	3.099	127.062	3.315

As shown in Table 16, the mean post-test scores of science self-regulation skills were significantly higher in the experimental group than in the control group.

Also, data analysis on the components of the self-regulation scale (memory strategy, goal setting, seeking, self-assessment, responsibility and organization) were performed using multivariate analysis of covariance, the results of which are reported in Table 18. Before presenting the results on the components of the problem-solving scale, a report on the assumption of the equality of variances of the research variables (Levin test) is presented in Table 17.

Table 17. Levine test results on the assumption of equality of variance of the scores of the groups research variables in the community

Variable	F	Df 1	Df 2	Sig.
Memory strategy	0.023	1	43	0.879
Targeting	2.823	1	43	0.1
self-assessment	0.365	1	43	0.549
Needing help	1.832	1	43	0.183
Responsibility	0.011	1	43	0.919
Organize	6.629	1	43	0.014

Based on Table 17, the null hypothesis for equality of variances of group scores in the research variables is confirmed. That is, the assumption of equality of variances of scores in the experimental and control groups was confirmed and there are assumptions necessary for the use of statistical tests.

Table 18. Summary of Multivariate Analysis of Covariance (MANCOVA) Results for Post-Test Difference of Self-Regulated Scale Factors in Experimental and Control Groups

Source	Variable	Sum squares	Df	Mean squares	F	Sig.	Effect size
Group	Memory strategy	0.514	1	0.514	0.015	0.903	0.001
	Targeting	4.978	1	4.978	0.302	0.585	0.007
	Self-assessment	54.325	1	54.325	2.022	0.162	0.045
	Needing help	251.435	1	251.435	7.406	0.009	0.147
	Responsibility	6.004	1	6.004	0.455	0.504	0.01
	Organize	196.673	1	196.673	4.277	0.045	0.09

As can be seen in Table 18, after adjusting for the pre-test scores of each self-regulation level, the levels of help ($p = 0.009$ and $F_{(1,43)} = 7.406$) and organization ($p = 0.045$ and $F_{(1,43)}= 4.277$) There was a significant difference between the effect of two groups of students in experimental group (conceptual model) and control group (traditional method). That is to say, the concept-based approach has been more effective than the traditional method of helping and organizing. Also, in the components of memory strategy ($F_{(1, 43)} = 0.015$ and $P=0.903$), goal setting ($F_{(1, 43)} = 0.302$ and $P=0.585$), self-($F_{(1,43)} = 2.022$ and $P=0.162$). Responsibility ($F_{(1, 43)} = 0.455$ and $P=0.504$) No significant difference was found between the two methods. (Effect size = 0.0266; Landa Wilcox = 0.743; p = 0.055; F = 2.293).

CONCLUSION

The overall purpose of this study was to investigate the effectiveness of concept-based design education on problem-solving skills development, creative thinking, and self-regulated learning in elementary sixth grade science courses compared to traditional methods. The statistical population of the study was all male students of sixth grade elementary school in Kamyaran city (in Iran). Among them, 45 education students were selected by convenience sampling method and divided into experimental (24 person) and control (21 person) groups. Parker problem solving questionnaires, Torrance Form a creative thinking, and academic self-regulation were used to test the research hypotheses. In the following we will discuss and explain the findings and also the findings of this study are compared with previous research.

Hypothesis 1: There is a significant difference between the ability of problem-solving skills in the science lessons of students who are trained in the concept-based teaching model and the students who are trained in the traditional way.

One-covariance analysis was used to test this hypothesis. The results showed that there was a significant difference between problem solving skills scores of students who were trained in concept-based method and students who were trained in traditional way. Therefore, concept-based teaching of science has been effective in solving students' problem-solving skills in comparison with traditional methods. Although there is little research in this regard, the present findings indirectly support the existing theoretical and research foundations in the relationship between the use of concept-based teaching model and positive changes in academic performance in Edwards (2015) and Brady (2011) is in harmony with the results of Reza's research The (1396) are counter. In explaining this finding, it can be pointed out that the main purpose of education is to learn thinking skills, reasoning, organizing cognitions and making them meaningful in students, because it is the result of the practice that knowledge Students can better communicate with their environment and organize relevant information. Certainly, one of the most important factors in teaching thinking to learners is the use of proper teaching method.

The concept-based teaching paradigm is primarily designed to teach key ideas that form the basis of high-level thinking for students and enable them to interact and interact. Although these models are not designed to teach students extensive information, however, by learning and applying key concepts within a particular discipline or subject, students will be able to transfer specific learning to higher levels. In fact, it is almost impossible to understand subjects without understanding and understanding certain meanings(Duchesne & McMaugh, 2018).

Traditional curriculum design patterns have generally failed to establish the synergistic contrast between conceptual and real levels of thinking. When curricula and instruction encourage students to process more real-world information through conceptual levels of thinking, they can remember more real-world information; reach deeper levels of understanding and motivation. To find more and more to learn. Traditional curriculum design patterns, on the other hand, lack a strong conceptual database, thus facilitating superficial teaching and learning. More importantly, each discipline has an inherent conceptual structure; as the database is expanded in the discipline, the importance of the role of these conceptual structures in modeling, categorizing and processing new information is becoming increasingly apparent. The higher the level of factual information, the higher the level of abstraction needed to organize and process information.

Problem solving is called higher level rule learning. According to this theory, the learner creates higher level rules by combining simple rules, which in turn leads to problem solving. Therefore, in solving a person's previous learning problem, especially the rules or principles he or she has learned, New ways to combine. Thus, it can be said that how teachers deliver and convey concepts and their quality and teaching methods are effective factors in students' problem-solving ability that teachers use. In the concept-based model that emphasizes the learner being active in the process of learning, knowledge is constructed or learned by adding new information to what has previously been learned or combining understandings to create new conceptual relationships.

Hypothesis 2: There is a significant difference between the ability of creative thinking in the science lessons of students who are trained in the concept-based teaching model and the students who are trained in the traditional way.

The covariance analysis of one variable was used to test this hypothesis. The results showed that there was a significant difference between the creative thinking scores of the students who were trained in the concept-based method and the students who were trained in the traditional way. Therefore, concept-based teaching of science has been effective in students' creative thinking in comparison to the traditional one.

Creativity as a process can consistently be associated with finding, solving problems and trying new ways. It is also a repetitive process that engages with thinking and action, seeking feedback, testing and proposing new ways of doing things, rather than relying on automatic repetitive habits or behaviors as a result. Have described. People need to apply the right process first to create a creative result to help them become more creative. For example, they may look into the unknown to find a better or unique solution to the problem, or look for new ways to do it.

Creative Thinking Is One of the Three Elements of Creativity In fact, creativity encompasses the realm of skills, creative thinking skills and motivation.

Creative thinking is the process of sensing problems, issues or gaps in information, missing elements, incidents, conjectures and hypotheses about deficiencies and evaluating and testing these assumptions, rethinking and reassessing them, and ultimately transmitting the results.

Therefore, attention to this valuable ability and its reinforcement in students is obvious, and it is important to make this skill more active by utilizing an appropriate way of teaching. The concept-based model has its three-dimensional nature as a result of adding the concept dimension to curricula and training and by giving valuable attention to the facts, as tools to gain a deeper understanding of transferable concepts and principles, Uses. This model is designed to teach key ideas that form the basis of high-level thinking for students and enable them to interact and communicate. The concept-based paradigm provides students with the opportunity to analyze the flow of thought and to develop effective ways.

Hypothesis 3: There is a significant difference between self-regulated ability in the science lessons of students who are trained in the concept-based teaching model and the students who are trained in the traditional way.

One-covariance analysis was used to test this hypothesis. The results showed that there was a significant difference between the scores of students self-regulated in concept-based training and those trained in traditional way. Therefore, concept-based teaching of science has been effective in students' self-regulation ability in comparison with the traditional method. Reference to concurrent and inconsistent research results in line with this finding is limited to indirect findings in the light of the lack of significant research background in this area. In fact, active learning encourages students to engage in meaningful learning activities and to think about what they are doing.

What has been widely suggested in various texts is the use of active methods versus passive or traditional methods in which learners are involved in the learning process.

Traditional curriculum design patterns lack a strong conceptual database, which is why they provide superficial teaching and learning. More importantly, each discipline has an inherent conceptual structure; as the database grows in the discipline, the importance of the role of these conceptual structures in modeling, categorizing, and processing new information becomes increasingly apparent. The higher the level of factual information, the higher the level of abstraction needed to organize and process information (Ericsson, 2012: 28).

Therefore, achieving high levels of thinking, including metacognitive skills and problem-solving abilities, can be developed in the light of active teaching methods such as concept-based modeling. Conceptual understanding is a key aspect of learning and one of the important goals of teaching is to help students understand the basic concepts of a subject rather than keeping it parrot. When the teacher delves deep into a topic and provides interesting examples of a particular concept, it adds to the conceptual understanding of most students. Concepts are the building blocks of thinking.

The thinking-centered classroom is more in line with curriculum design and concept-based teaching patterns. These patterns deal with mind development while acquiring knowledge, certainly different from traditional patterns. Conceptual thinking requires the ability to critically appraise factual information; relate it to prior knowledge; understand patterns and relationships; make meaningful sense at conceptual level; make logical judgments based on available evidence; convey meaningful understanding of time or position; and use conceptual understanding to solve. Being creative is an issue or product creation, a process or a new idea.

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