The Relationship between Problem Solving Skills with Creative Thinking of Mathematics Teachers in Diyala City, Iraq

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Abstract

This research aimed to determine the relationship between problem-solving skills and creative thinking among mathematics teachers in the city of Diyala, Iraq. The descriptive research method is the correlation type. The statistical population was 180 mathematics teachers in Diyala city, and 123 people were selected by simple random sampling method using the Cochrane formula. Measurement Instruments Cassidy and Long (1996) 6-component Problem Solving Skills Questionnaire, helplessness, control in problem solving, creative style, self-confidence in problem solving, avoidant style, problem-solving orientation, and creative thinking Welch and McDowell (2002).). To analyze the results, Pearson correlation coefficient and step-by-step regression were used using SPSS. The results showed that there is a relationship between problem-solving skills and creative thinking among mathematics teachers in the city of Diyala. The variance of inability, control in solving problems, creative style, self-confidence in solving problems, avoidance style, and tendency towards solving problems are 3.3, respectively, 1.7, 0.48. 11.7, 10.1 and 27.4 percent participated in creative thinking. The best predictors of creative thinking in gradual decline are creative style, problem-solving orientation, and avoidant style.

Keywords: problem solving skills, creative thinking

1. Introduction

One of the basic thinking skills is problem solving skills. A problem is a conflict or difference between the current situation and another situation that the person wants to achieve. In fact, when a person faces a situation to which he cannot respond quickly with the information and skills he has, he faces a problem (Saif, 2019).

The ability to solve problems is a basic necessity for everyone, especially people who are most exposed to situations that require quick and rational decision-making (Proctpor, 2010). Problem-solving skill is a

cognitive-behavioral process that guides the person himself and with its help finds effective and adaptive solutions to life's problems. In fact, problem solving involves a conscious, logical, effortful and purposeful process. By mastering this skill, people can find the possible causes of a problem and prepare a practical plan to solve that problem (Cassidy and Long[1], 1996, p. 53).

Creativity is one of the prominent features of human thinking to solve problems, and there is no doubt that enhancing creativity is one of the most important goals of education. (Ghafouri et al., 2016). In order to access power resources, investing in human power is important, and students, through their creativity and initiative, are one of the sources of access to this power. Therefore, the environment and curricula in schools, universities, and higher education must be such that they do not hinder the growth and flourishing of individuals' talent and creativity (Rahimi mand and Abbas pour, 2015).

Today, especially in the Third World, the emphasis is only on reading, writing and arithmetic, while these skills no longer have intrinsic value in today's world. The value of schools lies in educating educated people, and education at any level should develop the ability to think, especially creative thinking (Rangedoost et al., 2013). The survival and efficiency of educational systems depends on the diversity of knowledge, experiences, capabilities and skills of human resources, especially their teachers. The more prepared, competent and capable teachers are, the more they will contribute to improving the efficiency of systems (Diabe et al., 2016). Teachers have an irreplaceable role in the learning and thinking process of students. If the educational system seeks creativity and transformation of ideas, it is inevitable to renew teachers' thinking, roles and duties. Teachers are pedagogical leaders in schools who, through planning, forecasting, setting goals and organizing classroom activities, create a collaborative atmosphere in which everyone participates in decision-making and accepts responsibility for the results of their work along with a shared concept of goals. Considering the school as an educational community that encourages the participation and empowerment of teachers and creates a culture of mutual cooperation among students, their creativity and ideas. Today it has been proven that this talent is as common as memory in humanity, and it can be developed by applying certain principles and techniques, creating new ways of thinking, and creating a suitable environment. Schools are responsible for this great task, and in schools, teachers can accomplish this task through appropriate teaching methods, appropriate treatment, as well as the application of other factors at the right time (Sergiovanni & Starrat [2], 2007).

Cassidy and Long (1996) consider six styles for problem solving, which are: helplessness, inhibition in problem solving, confidence in the ability to solve problems, avoidance style, orientation style and creativity

1 Cassidy & Long

2 Sergiovanni & Starratt

style. Creative problem solving style shows planning and considering various solutions according to the problem situation. The confidence style in problem solving expresses the belief in a person's ability to solve problems. Orientation style shows a positive attitude towards problems and willingness to face them head on. The helplessness style expresses a person's helplessness in problematic situations. The inhibitory style in problem solving refers to the influence of external and internal controllers in the problem-causing situation, and finally, the avoidance style indicates the tendency to ignore problems instead of confronting them. The first three styles of problem solving methods (creativity, trust and orientation), constructive problem solving methods and the next three styles (lethargy, aggression and avoidance) are called non-constructive problem solving methods.

Problem solving is one of the necessary and important soft skills for all teachers in any organization. Many organizations are looking to hire people who have the ability to solve the problems of that organization. In fact, these organizations are always busy with their unsolved problems and are looking for people who can show them the main problems of their company and have the ability to solve those problems. The person with such skills creates the most value for his organization. A teacher who has developed problem-solving skills knows what the main need of the people receiving services is, by simplifying the process of serving these people and using creativity, he realizes the interests of the organization. Teachers who have problem-solving skill are definitely creative people. Because solving many problems requires creative methods and cannot be solved by traditional methods. While these people are creative in their field of work, on the other hand they are also resistant to problems and issues related to the organization, and people with this ability usually manage time better because they focus on solving problems in the shortest possible time and more often, rather than Using traditional methods, they solve problems using modern methods (Norouzian, 2018).

Salimi et al. (2023), in a research entitled "comparison and relationship between creative thinking and critical thinking with problem solving ability in intelligent male and female high school students" concluded that there is a difference between creative thinking and problem solving ability in intelligent students. There is a significant positive relationship. In other words, with the increase in students' creative thinking, their problem-solving ability also increases. Also, a significant positive relationship was observed between creative thinking in the fields of fluidity, expansion, initiative and flexibility with the problem-solving ability of high-intelligence students. The findings of Naderi et al. (2021), under the title of the effect of problem solving skills training on creative and critical thinking of second grade elementary school students, also showed that problem solving training has a positive effect on students' creative thinking and critical thinking. In the research of Mahzounzadeh (2016), under the title of the relationship between problem-solving skills, student creativity, and creative thinking with the mediating role of academic self-efficacy, it was found that problem-solving skills have a direct impact on the use of creative thinking by students, and

with the use of problem-solving skills, the problem in the same way Correct information directly affects people's creative thinking. The results of Yamamoto[3] (2016) research titled titled the relationship between creative thinking and teachers' abilities and students' progress and adjustment showed that more creative teachers have correct, better and more appropriate reactions to various situations and tend to understand and react to various aspects of various events. The results of Khoiriyah & Husamah[4] (2018) research titled problem-based learning: creative thinking skills, problem-solving skills and student learning outcomes also showed that problem-solving skills can predict creative thinking in students by 27%.

The main problem and necessity of this research is to examine the relationship between problem solving skills with creative thinking and resilience in teachers to help improve their performance and increase knowledge circulation in different organizational conditions. The results of the current research can be considered valid for use in various organizations, especially the educational institution and various educational centers. On the other hand, very little research has been conducted on this topic in Iraq, and this doubles the need for research in this field in Iraq.

The current research aims to answer the question of whether there is a statistically significant relationship between problem-solving skills, creative thinking, and flexibility among teachers.

Research hypotheses

1. There is a relationship between problem solving skills and creative thinking.

2. Problem solving skills can predict creative thinking.

3. There is no difference between the scores of problem solving skills and creative thinking in terms of demographic variables.

2. Material and Methods

This research is descriptive and has an applied purpose. The research method is descriptive and correlational. The statistical population for the current study includes all mathematics teachers in Diyala Governorate, Iraq, who number 180 people. The statistical sample size was determined at 123 people through the Cochrane formula, which was chosen through simple random sampling. The measurement tools in this research were two questionnaires, problem solving skills by Cassidy and Long (1996) and creative thinking by Welch and McDowell (2002). The Problem Solving Skills Questionnaire is a 24-item instrument

3 Yamamoto

4 Husamah & Khoiriyah

developed by Cassidy and Long in 1996. This questionnaire has 6 subscales, which are: helplessness, control in problem solving, creative style, self-confidence in problem solving, avoidant style and attitude to problem solving, with a range of yes and no and with a score between 0 and 1. The Creative Thinking Questionnaire is a 20-item instrument developed by Welch and McDowell in 2002, which includes two dimensions of understanding the concept of creativity with 8 items and expressing one's understanding of creative ability with 20 items with a 5-point Likert scale (from completely disagree to I completely agree) scoring is 1 to 5. Due to the frequent use of questionnaires in various internal and external researches and their validity verification, its face validity has been trusted. Total reliability coefficients for each of the questionnaires of problem solving skills and creative thinking were obtained by calculating Cronbach's alpha coefficient of 0.87 and 0.79. The analysis obtained from the present research was done using SPSS statistical software, at two levels of descriptive and inferential statistics. In the descriptive statistics section, statistical characteristics such as frequency, percentage, mean, and standard deviation are used, and in the inferential statistics section, multiple regression tests, Pearson's correlation coefficient, and analysis of variance tests are used.

3. Results

Descriptive demographic findings showed that 59.4% of the participants in the research are women and 40.6% of them are men. The age of 46.4 percent of the participants in the research is between 31 and 40 years old. The education level of 2.47% of the participants in the research is bachelor, and the experience of 49.6% of the participants in the research is under 10 years.

First hypothesis: There is a relationship between problem solving skills and creative thinking of mathematics teachers in Diyala city.

Table (1): Correlation coefficient between problem solving skills and teachers' creative thinking

Criterion variable **Creative Thinking teachers**			
Statistical index **predictor variable**	**Correlation coefficient** **The square of the correlation coefficient of the significance level**		
Helplessness	*0.184-	0.033	0.026
Control in problem solving	*0.131-	0.017	0.014
Creative style	*0.693	0.480	0.023
Confidence in problem solving	*0.342	0.117	0.037
Avoidant style	*0.318-	0.101	0.039
Problem solving attitude	*0.524	0.274	0.034

< 0/ 05p

The findings of table (1) show that the correlation coefficient between problem solving skills and creative thinking of teachers is significant. That is, there is a significant and inverse relationship between helplessness, control in problem solving, avoidant style with creative thinking, and there is a significant and direct relationship between creative style, self-confidence in problem solving, and problem solving attitude with creative thinking. Based on the coefficient of determination 3.3, 1.7, 0.48, 11.7, 10.1 and 27.4 percent of the variance of helplessness, control in problem solving, creative style, confidence in problem solving, avoidant style and The attitude to problem solving has been shared with the creative thinking of teachers. Therefore, the first hypothesis was confirmed, which states that there is a relationship between problem-solving skills and creative thinking among mathematics teachers in the Diyala city.

Second hypothesis: problem solving skills can predict the creative thinking of mathematics teachers in Diyala city.

Table (2): Multiple correlation coefficient of problem solving skills with creative thinking

Statistical index / Criterion variable		predictor variable	Multiple correlation coefficient	Squared multiple correlation coefficient	The squared adjusted multiple correlation coefficient	Factor F	Significance level
Creative Thinking	The first step	Creative style	0.701	0.491	0.485	42.917	0.012
	The second step	Creative style, approach to problem solving	0.831	0.690	0.676	36.533	0.012
	The third step	Creative style Avoidant style problem solving attitude	0.874	0.763	0.749	23.501	0.013

<0/05p

The findings of table (2) show that among the variables studied in the regression, the best predictor of teachers' creative thinking in the first step was the creative style, in the second step, the problem-solving attitude, and in the third step, the avoidant style. Accordingly, in the first step, the coefficient of creative style is .49.1% of the variance of teachers' creative thinking, in the second step, the coefficients of creative style and attitude to problem solving are 0.69% of the variance of teachers' creative thinking, and in the third step, the coefficients of creative style, attitude to problem solving and The avoidant style explains 73.6% of the variance of teachers' creative thinking. The observed F was significant at the $p<0.05$ level, so the regression can be generalized to the statistical population

Table (3): Beta coefficient in predicting creative thinking with problem solving skills.

Statistical index / Criterion variable		predictor variable	Unstandardized beta coefficients	Standard beta coefficients	The squared adjusted multiple correlation coefficient	Coefficient t	Significance level
			The standard error				
Creative Thinking	The first step	Creative style	0.462	0.029	0.693	17.223	0.021
	The second step	Creative style	0.297	0.029	0.446	5.793	0.024
		Attitude style to problem solving	0.261	0.031	0.392	4.380	0.023
	The third step	Creative style	0.221	0.043	0.336	3.495	0.026
		Problem solving attitude	0.186	0.042	0.301	2.688	0.022
		Avoidant style	- 0.143	0.035	- 0.245	2.760 -	0.027

<0/05p

The findings in table (3) indicate that the beta coefficient per one unit increase in creative style increases teachers' creative thinking by 0.336 units, the beta coefficient per one unit increase in problem solving attitude increases teachers' creative thinking. 0.301 unit increase and beta coefficient for one unit increase in avoidant style, teachers' creative thinking decreases by 0.245 units.

The prediction equation of the third research hypothesis can be presented as follows:

Teachers' creative thinking = constant coefficient (8.943) + creative style (0.336) + problem solving attitude (0.301) + avoidant style (-0.245).

Third hypothesis: There is a difference between the average scores of problem solving skills, creative thinking and resilience according to demographic variables.

Table (4): Multiway analysis of variance of scores of problem solving skills, creative thinking and resilience according to demographic variables (gender, age, education degree, experience)

Demographic variables	Variable	sum of squares	Degrees of freedom	mean square	F	The significance level
Gender	Problem solving skills	0.901	1	0.901	0.932	0.332
	Creative thinking	1.863	1	1.863	1.910	0.207
	Resilience	0.936	1	0.936	0.968	0.375
Age	Problem solving skills	3.352	3	1.117	1.125	0.710
	Creative thinking	1.688	3	0.562	0.589	0.571
	Resilience	2.216	3	0.738	0.786	0.623
Education degree	Problem solving skills	2.627	2	1.315	1.453	0.361
	Creative thinking	1.288	2	0.644	0.664	0.398
	Resilience	0.839	2	0.419	0.429	0.423
Experience	Problem solving skills	1.425	2	0.712	0.753	0.822
	Creative thinking	1.628	2	0.814	0.865	0.712
	Resilience	1.123	2	0.561	0.587	0.362

The results listed in table (4) show that there is no significant difference between the average scores of problem solving skills, creative thinking and resilience according to gender, age, education and experience.

4. Discussion

The purpose of this research was to determine the relationship between problem solving skills and creative thinking of mathematics teachers in Diyala city, Iraq. The findings showed that the relationship between problem solving skills and teachers' creative thinking is significant. That is, there is a significant and inverse

relationship between helplessness, control in problem solving, avoidant style with creative thinking, and there is a significant and direct relationship between creative style, self-confidence in problem solving, and problem solving attitude with creative thinking.

Problem solving is one of the necessary and important skills for teachers. Teachers with problem solving skills try to solve problems that require creative ways and cannot be solved by conventional methods. What is important in creating a new method or plan and in general in the process of solving problems with a creative style is thinking, because creativity is a kind of intellectual activity. One of the distinctive features of man and the main axis of his life is the power of thought. Among the other effective factors in the creative thinking of teachers is the attitude of teachers towards problem solving, people who try to take a positive step in solving problems and see the positive aspects in every situation and consider problems as a part of their work process, which naturally It is possible to happen, they don't run away from problems and without feeling helpless they turn to creativity and creative thinking to solve problems and problems.

The findings of the first hypothesis of the research are consistent with the findings of Salimi et al. (2023), Naderi et al.(2021), Mahzounzadeh (2016), Khoiriyah & Husamah (2018)

The findings of the second hypothesis showed that among the variables studied in the regression, the best predictor of teachers' creative thinking was creative style in the first step, problem solving attitude in the second step, and avoidant style in the third step.

People who perform problem-solving activities and methods effectively and those who are trained in problem-solving and are skilled in solving problems effectively are looking for problem-solving methods in a diverse and creative way, which requires creative thinking. They first create ideas and identify solutions using creative thinking and then evaluate them. Problem solving skill is finding a solution to overcome the obstacle and reach the desired goal. The basic element of problem solving is the application of creativity principles for problem solving. Some people get upset and distressed in front of the smallest issue and problem and are not able to solve it, but there are other people who face very difficult crises and have the ability to overcome them successfully. One of the reasons that empowers such people is that they use correct and creative methods to solve problems. Creative thinking is the hidden part of the brain. A section that some people use. They are always oozing creative ideas and thoughts, and for this reason, they are more successful and cheerful in their daily lives. People who use a creative style to solve problems and problems in front of them need to turn to creative thinking and implement creative ideas. People with a positive attitude to solving problems always seek to find new and diverse ways to solve problems, therefore, the attitude to solving problems causes creative thinking in people to solve problems. People who do not feel the need to solve the problems in front of them and try to forget or ignore their problems and simply consider the passage of time to be enough to solve problems by themselves, often do not benefit from creative thinking and they do not think about solving problems. Therefore, there is no need to think creatively to

solve problems and issues. As a result, the style of avoiding problem solving has the opposite effect on creative thinking. The findings of the second hypothesis of the research are consistent with the findings of Salimi et al. (2023) and Yamamoto (2016). Similarly, the results of Nair third hypothesis showed that there is no significant difference between the average scores of problem solving skills and creative thinking according to gender, age, education and experience.

5. Conclusions and Recommendations

According to the findings and confirmation of the first and second hypothesis that there is a relationship between problem solving skills and creative thinking of mathematics teachers in Diyala city, the following suggestions are presented.

Education officials and directors should pay attention to teaching problem-solving skills and hold workshops in this field for their directors and teachers. Also, if there is a problem in schools, they should focus on solving the problem rather than the problem itself by consulting with teachers. Teachers should think of all possible solutions to solve the problem, even if some solutions seem silly at first. For this purpose, they must use the power of their creative thinking and this type of creative thinking is promoted in teachers. In educational workshops, he taught teachers to think about other aspects of problems and issues in order to enhance their problem-solving skills. In other words, change the direction and position of their thoughts through lateral thinking and looking at issues and problems from different angles

This research was conducted among mathematics teachers in Diyala city, Iraq. Therefore, for a better comparison and to obtain more results, it is suggested that this research be conducted in other cities and countries and among teachers of other disciplines.

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