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The Effects of Problem-based Learning Program on Chinese Higher Vocational Students' Creative Self-efficacy

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Abstract

Background and Aim: In the context of the innovation-driven development strategy and the deepening of education reforms, the study aimed to develop a problem-based learning program to improve students' creative self-efficacy in Chinese higher vocational education and explore the effects of the problem-based learning program on improving students' creative self-efficacy in Chinese higher vocational education.

Methodology: The methodology of this study is a quasi-experimental pre-test and post-test design. The sample was divided into two groups: experimental and control groups. The students' creative self-efficacy is examined by comparing the total average scores of the pre-test and post-test. The sample for this study was 108 freshman e-commerce students with the lowest creative self-efficacy out of 326 students who were equally and randomly assigned to the experimental and control groups, 54 students in the experimental group, and 54 students in the control group. The experimental group was taught using a problem-based learning program, while the control group was not. The instruments used in this study are as follows: The problem-based learning program to improve creative self-efficacy of Chinese higher vocational students in terms of three components: Ideageneration, Uncertainty, and Focus, and The Test of Creative Self-Efficacy, which was based on Alan Hill's (2008) test of creative self-efficacy. Before the experiment, the researchers recorded the students' pre-test scores and had the students participate in a two-week problem-oriented learning course. The students took a post-test at the end of the problem-based learning program. Finally, data were collected and analyzed to evaluate the effectiveness of the problem-based learning program in improving students' creative self-efficacy in Chinese higher vocational education.

Result: The results showed that the experiment group applying the problem-based learning program had a higher level of creative self-efficacy than the control group, and before the experiment in all components at the .01 level.

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Conclusions: (1) The difference in the scores of creative self-efficacy level of the students in the experimental group before and after the test indicates that the level of creative self-efficacy increased after completing the problem-based learning program. The study's results support the first research hypothesis. (2) Students who participated in the problem-based learning program scored higher on the creative self-efficacy test than those who did not. This indicates that the problem-based learning program effectively enhances students' creative self-efficacy. The findings support the second research hypothesis.

Keywords: Creative Self-efficacy; Problem-based Learning Program; Chinese Higher Vocational Students

Introduction

Creative self-efficacy describes an individual's confidence and belief in their ability to succeed in creative tasks. Its concept is based on Bandura's (1977) self-efficacy theory and contemporary understanding of creativity as a behavior that generates novel and valuable ideas and products. Creativity and self-efficacy are the fundamental psychological processes that affect an individual's level of self-confidence(Hill et al., 2008). With confidence, people are likely to have the motivation to act towards their goals and persevere, especially when facing difficulties (Bandura, 1977). The stronger the students' sense of self-efficacy in innovation is, the more confident they will be and the more inclined they are to choose relatively challenging tasks. Creative Self-efficacy is not innate; it is socially constructed through the experience of interaction between people and their environment(Karwowski et al., 2018). In China's higher vocational education system, creative self-efficacy, an important psychological trait in students' learning and practice, has received increasing attention. The particularity of vocational education determines that vocational school students need a greater sense of innovative effectiveness in learning various skills and knowledge. However, at present, the innovative self-efficacy of vocational school students in China is generally low. Tang et al. once pointed out that more than 60% Chinese vocational school students had low levels of creative self-efficacy(Tang et al., 2017). and multiple factors are hidden behind this phenomenon. First of all, students often encounter more setbacks, and these experiences tend to make them question their learning abilities(Puente Díaz, 2016). Furthermore, society's excessive emphasis on academic qualifications and a certain degree of discrimination against vocational school students put even those with excellent grades and outstanding abilities at a disadvantage in competition(Chankseliani et al., 2016). Moreover, Similar students with poor grades and low self-confidence gather to study and live together, influencing each other and further exacerbating the spread of negative trends that make it difficult for students to focus on improving their creative skills. In recent years, China's innovation capacity has been rapidly improving, and it has become an important force in global scientific and

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technological innovation, with broad prospects for future development(Hu & Mathews, 2008). However, at the same time, there are many problems, and it is particularly urgent to strengthen the innovation capacity of young people. Therefore, as an important form of education for cultivating high-quality vocational talents, China's higher vocational education faces the double challenges of reform and development. Against this background, enhancing the Creative Self-efficacy of higher vocational students has become a core issue of concern for educators. Higher vocational students face unprecedented challenges and opportunities as an important group of Chinese youth in developing creativity. Therefore, higher vocational colleges and universities must adjust their teaching concepts and emphasize cultivating students' creativity. If a person wants to improve their creativity, Creative Self-efficacy is an important factor that cannot be ignored, and it has a close relationship with creativity.

Objectives

1) Design the Problem-based Learning Program to enhance Chinese higher vocational students' Creative Self-efficacy

2) Study the effects of the Problem-based learning program on Chinese higher vocational students' Creative Self-efficacy.

Literature Review

Creative Self-efficacy refers to an individual's confidence and self-assessment of their ability in creative activities. It is an individual's confidence in their ability to generate novel and valuable ideas and solutions when faced with a creative task. Creative self-efficacy in this study comprises three components as follows(Hill et al., 2008):

Idea generation refers to the ability to create, develop, and communicate new ideas where fresh concepts and solutions are needed to address challenges, improve products, or enhance services.

Uncertainty refers to the ability to make choices that lead to challenges in planning and decision-making from having limited knowledge or a lack of definite information about an outcome, event, or situation. Uncertainty can arise from doubt and ambiguity and present opportunities for growth and innovation, encouraging adaptability and creative problem-solving.

Focus refers to concentrating attention or effort on a particular task, subject, or objective. It involves filtering out distractions and honing in on what is most important, enabling individuals to achieve their desired outcomes more efficiently.

As a special area of self-efficacy, creative Self-efficacy has been emphasized by scholars in creativity research. Beghetto (2006) conducted a study on the relationship between Creative Self-

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efficacy and related variables with 324 secondary school students as subjects and found that students with high levels of Creative Self-efficacy were more willing to enter college, complete after-school assignments, and participate in extracurricular activities than those with low levels of Creative Self-efficacy (Beghetto, 2006).

The Problem-based Learning Program (PBLP) refers to a learning program that uses a student-centered teaching strategy that emphasizes teaching methods that promote learning and knowledge acquisition through solving specific problems. The teaching and learning process of the Problem-based Learning Program is divided into five main areas: Group organization, Questioning, Discussion, Debriefing, and Reflection (Barrows, 1996). A problem-based learning program emphasizes problem-solving. Its theoretical foundation is rooted in Cognitive-Discovery Learning Theory, Constructivist Learning Theory, Humanistic Learning Philosophy, and other related theories. The theory of Cognitive-Discovery Learning advocates discovery learning by providing students with learning materials to explore and think independently (Cheng, 2019). In this process, students need to plan their learning paths independently, collect information, analyze problems, propose solutions, and continuously adjust and optimize their solutions during the implementation process, a process that significantly improves students' concentration and learning initiative. Through teamwork, students can not only brainstorm and improve the efficiency and quality of problem-solving but also cultivate team spirit and self-confidence through mutual learning and support (Almulla, 2020). PBLP pedagogy encourages students to think about the problem from multiple perspectives and come up with innovative solutions. During the implementation of the project, students need to try, explore, reflect, and improve continuously, and this process helps to develop their idea generation and problem-solving abilities(Affandy et al., 2024).

According to Hill's (2008) research, creative self-efficacy is mainly composed of three components, namely, idea production, uncertainty, and focus, and it is from these components that PBLP works on students, thus indirectly enhancing their creative self-efficacy.

Conceptual Framework

In this study, the independent variable is the Problem-based Learning Program, and the dependent variable is the Creative Self-efficacy of Chinese higher vocational students.
The variable relationship is shown in Figure 1 below:

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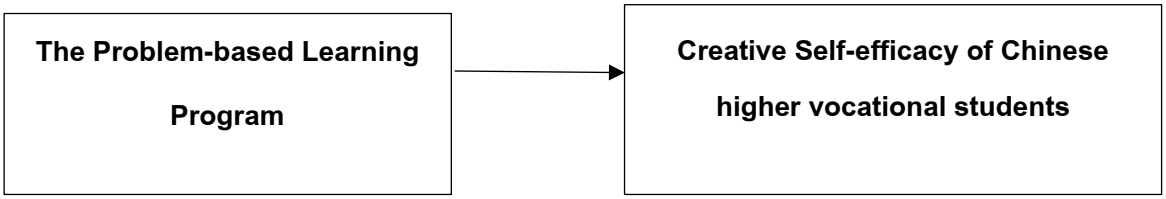

Figure 1 Conceptual Framework

Methodology

The methodology of this study is a quasi-experimental pre-test and post-test design. The sample was divided into two groups: experimental and control groups. The experimental group adopted the problem-based learning program, while the control group did not. The students' creative self-efficacy is examined by comparing the total average scores of the pre-test and post-test. The population of this study was 326 first-year e-commerce students from Guangdong NanFang Institute of Technology in Guangdong Province. The sample was selected through random sampling, and 108 students with the lowest creative self-efficacy scores were chosen. Then, the 108 students were randomized to the experimental and control groups equally, with 54 students in the experimental group and 54 students in the control group. The experimental group was taught using a problem-based learning program, while the control group was not. The instruments used in this study are as follows: (1) The problem-based learning program to improve creative self-efficacy consists of 12 activities (2) The creative self-efficacy Test was based on Alan Hill's test of creative self-efficacy in terms of three components: Ideageneration, Uncertainty, and Focus, had a total reliability of 0.902 with the CITC is range from 0.374-0.606. Three experts in the field were invited to validate all instruments to test their validity and appropriateness. To understand the effects of the problem-based learning program, the researchers recorded the students' pre-test scores before the experiment. Then, had them participated in a two-week problem-based learning course. Implementation of 6 teaching activities per week, for a total of 12. The students took a post-test at the end of the problem-based learning program. Finally, descriptive statistics were analyzed for pretest and posttest scores, including means and standard deviations. The mean scores and standard deviations were then calculated, and t-tests were used to determine if there was a significant difference between the mean scores of the pretest and post-test in order to compare the creative self-efficacy of the experimental and control group students before and after their course of study through the Problem-based Learning program.

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Results

From Research objectives 1, Design the problem-based learning program (PBLP); the result was as follows: problem-based learning program comprised of 12 activities, each program includes a theme thematic activities, in each activity, the teacher will carefully design the problem, the students need to group, each group of six people, a total of nine groups, each group should be around the teacher's questions for discussion, using different methods to explore the answer to the problem, in the process of student discussion, the teacher should also give students some guidance, has corrected the students wrong direction. In the process of students' discussion, the teacher should also give students some guidance to correct their wrong direction. Finally, the students present their results, and the teacher evaluates the results of each group.

The teaching program included teacher's guides and student guides. The teacher's guide provides the necessary information about the problem-based learning program, including the content, objectives, required instructional materials and tools, and a detailed description of the steps in the problem-based learning program. This helps teachers to effectively prepare and organize classroom instruction to ensure that the teaching and learning process runs smoothly and maximizes student learning outcomes and development.

The Student Guide focuses on providing students participating in the program with the necessary information about the problem-based learning program, including subject matter content, requirements, and the number of participants per session.

The teaching process consists of 5 steps, including Group organization, Questioning, Discussion, Debriefing, and Reflection (Barrows, 1996), and the detailed information for each step is as follows:

Step 1: Group Organization. Before the first problem-based learning program class begins, the teacher will divide the students into groups of 6 people based on their situations and the characteristics of the course.

Step 2 Questioning: Teachers design questions in advance based on the teaching objectives, teaching content, and the actual situation of students. Problems should focus on students' interests, effectively stimulate their interest in learning, and guide them to think.

Step 3 Discussion: After receiving the questions raised by the teacher, the group members will, under the direction of the group leader and the teacher's supervision, divide the work reasonably among the questions. Each group member fully utilizes their strengths, expresses their opinions, and actively participates in discussions and cooperation.

Step 4 Debriefing: At the end of the group discussion, the teacher will randomly assign all groups to report back, and the group leader will present the group's final and best solution to the audience through oral reports and presentations.

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Step 5 Reflection: After completing the group report, the instructor guided the group in conducting an in-depth reflection and discussion, exploring solutions to the problems. They explored and summarized the understanding and application of new knowledge.

From Research objectives 2, Study the effect of using the effects of inquiry-based learning program on Creativity self-efficacy of E-commerce students in higher vocational students; the result was as follows:

Table 1 The t-test score of creative self-efficacy between the experimental group and the control group before using the problem-based learning program

creative self-efficacy	Experimental group pretest (N=54)		Control group pretest(N=54)		t	p
	$\overline{X}$	S.D	$\overline{X}$	S.D		
Ideagenration	20.59	4.47	20.95	4.86	1.139	0.260
Uncertainty	20.02	3.70	20.24	3.64	0.650	0.519
Focus	20.33	2.42	20.56	2.74	0.812	0.420
Total	60.94	9.67	61.75	9.03	1.225	0.226

The data showed that the total creative self-efficacy scores of the experimental and control groups on all dimensions indicated that there was no difference between the two groups of students in creative self-efficacy before the implementation of the problem-based learning program. Therefore, learners in the experimental group could be organized to participate in the problem-based learning program.

Table 2 The t-test score of pre-test and post-test of creative self-efficacy in the experimental group

creative self-efficacy	Experimental group pretest (N=54)		Experimental group Posttest(N=54)		t	p
	$\overline{X}$	S. D	$\overline{X}$	S. D		
Ideagenration	20.59	4.47	25.43	4.58	-9.249 **	<0.001
Uncertainty	20.02	3.70	25.13	4.98	-11.603**	<0.001

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creative self-efficacy	Experimental group pretest (N=54)		Experimental group Posttest(N=54)		t	p
	$\bar{X}$	S. D	$\bar{X}$	S. D		
Focus	20.33	2.42	24.78	3.90	-10.354**	<0.001
Total	60.94	9.67	75.33	11.47	-12.603**	<0.001

**p < .01

The paired samples t-test of the experimental data showed that the mean score of the pre-test of the experimental group was 60.94 with a standard deviation of 9.67, while the mean score of the post-test was 75.33 with a standard deviation of 11.47. There was a significant difference between the two groups of data (p<.001), both in terms of mean ($\bar{X}$) and standard deviation (S. D). From the data, it can be seen that after participating in the problem-based learning program, the students in the experimental group performed very significantly on the creative self-efficacy dimensions in terms of Ideagenration ($\bar{X}$=25.43, S.D=4.58), Uncertainty ($\bar{X}$=25.13 ,S.D=4.98) ,and Focus ($\bar{X}$=24.78, S.D=3.90). In terms of creative self-efficacy dimensions. The experimental results demonstrate that the problem-based learning program effectively enhances students' creative self-efficacy.

Table 3 The t-test score of pretest and posttest of creative self-efficacy in the control group

creative self-efficacy	Control group pretest (N=54)		Control group posttest(N=54)		t	p
	$\bar{X}$	S. D	$\bar{X}$	S. D		
Ideagenration	21.31	5.24	21.22	4.58	-1.000	0.332
Uncertainty	20.46	3.59	20.67	4.98	-1.228	0.225
Focus	20.78	3.03	20.80	3.90	-0.500	0.960
Total	62.56	9.53	62.96	12.15	-0.262	0.794

The pre- and post-test data for the control group of students were tested using a paired-samples t-test. The total pre-test score was 62.56, and the total post-test score was 62.96. The data showed that the control group's overall creative self-efficacy scores on all dimensions did not significant difference.

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Table 4 The t-test score of the posttest of creative self-efficacy between the experimental group and the control group

creative self-efficacy	Experimental group posttest (N=54)		Control group posttest(N=54)		t	p
	$\bar{X}$	S. D	$\bar{X}$	S. D		
Ideagenration	25.43	5.31	21.22	4.58	5.056**	<0.001
Uncertainty	25.13	4.33	20.67	4.98	6.446**	<0.001
Focus	24.78	4.38	20.80	3.90	7.088**	<0.001
Total	75.33	11.41	62.69	12.15	7.762**	<0.001

**p < .01

The results obtained from the independent sample t-test comparing the post-test scores of the experimental group with those of the control group are presented in Table 4 above. Students in the experimental group who participated in the problem-based learning program had significantly higher creative self-efficacy scores on all components than students in the control group who did not participate in the problem-based learning program, with a statistically significant p-value of <0.001. The statistical significance of the dimensions of the experimental group of students who participated in the problem-based learning program reached the P<.01. (Ideagenration $\bar{X}$=25.43, S.D.= 5.31 Uncertainty $\bar{X}$=25.13, S.D=4.33, Focus $\bar{X}$=24,78, S.D=4.38). The experimental results showed that the creative self-efficacy level of the experimental group was higher than that of the control group. The results show that the problem-based learning program can enhance creative self-efficacy.

Discussion

From Research Objective 1, design the problem-based learning program

The problem-based learning program is a student-centered instructional strategy. In this study, the program activities focused on creating an environment that encourages students to actively participate in solving real-world problems and facilitates learning and knowledge acquisition through the solution of specific problems. Throughout the learning process, students need to learn to work in teams, understand problems, think deeply, and solve them.

Problem-based learning programs are divided into five steps: Group organization, Questioning, Discussion, Debriefing, and Reflection (Barrows, 1996). In the program, 12 problem activities were set up. Problems are the starting point for learning, so the questions designed by

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the teacher should be inspiring, guiding, and relevant. Questions should be of moderate difficulty to stimulate students' interest and prompt them to think deeply. When implementing a problem-based learning program, the focus should be on grading the difficulty of the activities. Maintaining an appropriate level of challenge is crucial for developing students' creative and generative skills, as well as their attention. If the activity is too easy, students will easily complete the task and may lose interest in it. Conversely, if the activity is too difficult, students will lose confidence, making it challenging to develop their creative self-efficacy. In the process of problem-based teaching method, the teacher uses various teaching techniques such as “role-playing”, “brainstorming” method, the “Six Thinking Hats” method, the ’SCAMPER' method”, and “observation” method, the “SCAMPER method”, and “observation and imitation” method et al. these can promote students' innovation and foster the development of creative thinking. It can make students more engaged in learning and increase their interest and participation in the learning process. Various teaching techniques can cater to the diverse learning needs of students, allowing each individual to grasp knowledge in a manner that suits them and boost their confidence in navigating uncertainty. It can also develop students' teamwork skills and enable them to learn to express themselves in a team and respect the opinions of others. This indirectly develops students' creative self-efficacy.

From Research objectives 2, study the effect of using the problem-based learning program on the creative self-efficacy of higher vocational students.

Hypothesis 1: After participating in the problem-based learning program, the experimental group has a higher level of creative self-efficacy than before.

The study's data showed that students’ creative self-efficacy in the experimental group increased after completing the problem-based learning program. The study's results supported the first research hypothesis. Changes in the creative self-efficacy of the students in the experiment depended on a pedagogical design based on a problem-based learning program.

Problem-based learning programs are student-centered learning programs that create a problem-solving environment for students, place them in complex and near-realistic problem situations, and boost their self-confidence by engaging them in problem solving and experiencing a sense of successful accomplishment, which will further motivate them to try new things and not be afraid of failure in learning and life(Ali, 2019). In a problem-based learning program, students need to take the initiative to seek information, analyze problems, formulate hypotheses, and test solutions. This process developed their creative production and concentration skills. Students may experience frustration and failure in the process. However, by reflecting on and correcting their mistakes, they can learn how to face difficulties and persevere (Hmelo Silver, 2004).

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Therefore, the Problem-based teaching method indirectly positively affects creative self-efficacy by stimulating students' idea generation, cultivating their ability to adapt to uncertainty, and emphasizing problem-solving. This teaching method helps cultivate students' concentration, stimulates idea generation, and enhances their ability to cope with uncertainty in life and learning, thereby improving their creative self-efficacy. This ability will be critical in their future careers, as the workforce will encounter challenges and complex problems that require them to be creative in finding solutions. Adaptability and resilience to adapt to change, learn from failure, and persevere in the workplace, which is crucial for success in a fast-changing professional environment, will help boost their creativity and innovative thinking. Moreover, this ability is especially valuable in creative industries or fields that require innovative thinking(Yu, 2013). In addition, positive self-belief is crucial for future careers as it helps them to remain determined and optimistic in the face of challenges and difficulties(Halilsoy, 2019). Good teamwork and communication skills are indispensable in their future careers, which help students to build a strong network of relationships and play their roles in a team, which in their careers means that they are more willing and adept at embracing new skills, technologies, and ways of working.

In a problem-based learning program, students continue to ask questions, analyze problems, and solve problems in the process of problem solving, and the cultivation of this problem awareness helps students to form critical thinking and creative thinking, so that they can look at the problem from a different perspective and come up with novel solutions. The program also encourages cooperation and communication among students. AS affandy's (2024) study states, the problem-based learning program stimulates students' desire for inquiry and curiosity by posing challenging and attractive problems, and this desire for inquiry prompts students to think actively and actively seek ways to solve problems, thus stimulating their ideageneration (Affandy et al., 2024).

As seen in Hmelo's study, problems in problem-based learning programs are often open-ended, with no fixed answers or solution paths. Students need to think and explore on their own, and this process is full of uncertainty. Each student is a unique individual with different knowledge backgrounds, ways of thinking, learning interests, etc. Therefore, in the process of problem solving, students may come up with different ideas, methods, and solutions, which increases the uncertainty of the teaching and learning process (Hmelo-Silver, 2004).

Furthermore, Almulla (2020) suggests that the problem-based learning program helps to improve student focus. The problem-based learning program stimulates students' curiosity and inquisitiveness by posing a series of questions related to the content. Students will actively concentrate and focus on exploring and thinking about the questions to find the answers to the questions (Almulla, 2020). Under the guidance of the problem-based learning program, students

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clarify the problems they need to solve and the goals they need to achieve. This clear goal orientation helps students focus their attention and avoid distraction in the learning process.

This experience helps students to be resilient in the face of uncertainty and helps to increase their creative self-efficacy in all areas. At the same time, the teacher incorporates a variety of instructional techniques into the problem-based approach, such as “role-playing”, “the brainstorming” method, the“Six Thinking Hats“method, “the ‘SCAMPER’ method “, the “observation and imitation” method, etc. When these techniques are effectively combined and applied in teaching and learning, they can work together to build a powerful learning framework that helps students develop critical skills such as critical thinking, creative problem solving, teamwork, and communication(Seechaliao, 2017). At the same time, these techniques encourage students to think outside the traditional learning paradigm and engage in the learning process in a more active and innovative way. In this way, teachers not only impart knowledge but also develop students' abilities to become lifelong learners who can succeed in an ever-changing world.

The program created 12 problem activities based on students' interests and specializations, which defined the purpose and methodology. The themes are relevant to life, primarily allow students to solve real-world problems, and align with their existing experiences, so students have a strong sense of identity and desire to explore the themes created. Teachers play a crucial role in implementing this program by carefully designing each thematic activity to ensure that it is challenging and stimulates students' creativity, while taking into account individual differences and providing appropriate support and challenges for students at different levels of ability(Davies et al., 2014). For example, in the theme of “Environmental Protection Guard”, students are encouraged to explore sustainable solutions, ranging from waste separation at home to community greening programs, which not only deepen their understanding of environmental protection but also motivate them to apply creative thinking to solve practical problems.

In all theme activities, teachers help students get started by showing the basic form of the theme and explaining key points. Teachers encourage students to create independently through imitation, building their self-confidence and developing their creativity and problem-solving skills. This instructional strategy is designed to allow students to continue their self-development through progressively increasing challenges and to gain experience in learning and collaboration. This approach not only promotes deeper learning of knowledge but also fosters concentration, creativity, and problem-solving skills. Through these steps, the Problem-Based Learning program teaches students not only how to solve problems but, more importantly, how to learn, think, and innovate so that they can become capable and creative individuals in a complex and changing world. In this process, students need to actively explore, research, discuss, and practice

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in order to find solutions to their problems(Schmidt et al., 2011). Each activity in the program inspires unlimited creativity as students work in teams and explore through the use of the web. The core of this approach is to promote active learning and knowledge application by solving real or simulated complex problems(Azer, 2011). Students are placed in a situation that requires them to solve a problem, thus stimulating their ability to explore knowledge, apply theory, think critically, and work in teams.

The results are consistent with the research of Jianli, who explored the impact of the problem-based learning approach on teaching and learning in high school classrooms through an empirical study. The problem-based teaching method can significantly improve students' creativity and idea-generating ability by posing problems and guiding students to explore and solve problems on their own. The application of problem-based teaching method can effectively change students' learning behavior, drive the individual thinking of continuous exploration and thinking, and in the form of changing the state of passive learning, creating a good learning atmosphere, which can help to improve the learning efficiency, improve the confidence of students to deal with uncertainty, and change the learning behavior of the students so that the students are more focused on learning. So the problem-based teaching method can indirectly improve students' creative self-efficacy in all components.

Hypothesis 2: After participating in the problem-based learning program, the experimental group had a higher level of creative self-efficacy than the control group.

The results showed that there was a significant difference between the experimental group and the control group, and the experimental group had higher scores than the control group. The results also support the second hypothesis.

The main reason for this is that the students in the experimental group gained experience in a teaching method based on problem-based learning, unlike the control group. The teaching and learning process was divided into five stages. Among them, Group organization, Discussion, and Debriefing were three tasks assigned to students before class so that they would have more time to explore, discover, and create. Explanation, Questioning, and Reflection were done in class(Wijnia et al., 2019). Through these five steps, the problem-based approach can effectively enhance students' creative production, uncertainty, and concentration.

Firstly, a problem-based learning program facilitates students' Ideagenration, which is consistent with the findings of Ulger (2018). The reason is that, first of all, in the problem-based program, teachers usually put forward challenging and open questions, which can stimulate students' curiosity and prompt them to take the initiative to explore unknown areas and find new ways to solve problems. Problem-based learning program encourages students to examine problems from multiple perspectives, challenge traditional ideas, and put forward new insights.

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This way of thinking helps break the stereotypes of thinking and promote creativity(Ulger, 2018). In problem solving, students must combine theoretical knowledge with practical operations and gradually form innovative solutions through continuous attempts and corrections. This practical process can cultivate students' sense of innovation and practical ability(Kim & Hannafin, 2011). In Group organization, students need to communicate and share ideas to solve problems, which can inspire creative inspiration, broaden their thinking horizons, and cultivate teamwork and communication skills. In addition, teachers give timely feedback and encourage students' creativity and solutions, enhancing students' sense of innovation and self-confidence. This positive feedback mechanism can stimulate students' creative potential and promote the generation of ideas.

Secondly, Problem-based learning program pedagogy facilitates students' Uncertainty aspect, which is consistent with the findings of LaForce et al. (2017). In the problem-based learning program, students face various unknown and uncertain situations. This teaching style encourages students to accept and tolerate uncertainty as part of the learning and innovation process(Hung et al., 2008). By accepting uncertainty, students can think more openly and flexibly, making it easier to generate new ideas and solutions. When faced with uncertainty, the problem-based approach requires students to take the initiative to seek out information and resources and to develop and implement solutions. This process enhances students' problem-solving skills and makes them more adept at dealing with uncertainty and challenges(LaForce et al., 2017). This adaptive training enhances students' adaptability and resilience, making them more adept at surviving and thriving in uncertain environments. Uncertainty is an important driver of innovation, and the problem-based approach positively influences students' attitudes toward and ways of dealing with uncertainty by fostering an attitude of tolerance for uncertainty, enhancing problem-solving skills, increasing adaptability, and promoting innovative thinking.

Finally, the problem-based learning program approach promotes a shift in student focus, consistent with Hammel et al.'s (1999) findings. The problem-based learning program approach promotes a shift in students' Focus, consistent with the findings. The problem-based learning program encourages active exploration, discovery, and problem solving, stimulating intrinsic motivation. When students see that the learning material is relevant to their interests and goals, they are more likely to fully engage in the learning process, leading to improved concentration(Hammel et al., 1999). In PBLP, teachers set clear learning goals and questions, which help students stay oriented in the learning process. Clear goals help students focus on key information and avoid distractions, thus increasing concentration. Moreover, the problem-based learning program encourages students to engage in deep processing, i.e., understanding, integrating, and applying what they have learned. This deep processing process helps students

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better remember and understand information while improving their problem-solving skills(Saleh et al., 2017). Through deep processing, students can stay focused longer and respond to challenges more effectively. In the problem-based learning program, teachers provide timely feedback and guidance, which helps students understand their progress and problems. This feedback helps students adjust their learning strategies to avoid detours and thus stay focused more effectively. By engaging in PBLP activities, students can gradually improve their self-confidence and self-efficacy. When students feel empowered to solve problems and make progress, they are more likely to stay focused and sustain their efforts. In conclusion, the problem-based learning program influences students' concentration by stimulating intrinsic motivation, setting clear goals, facilitating in-depth processing, providing timely feedback, and fostering self-efficacy.

Recommendation

1. When implementing a problem-based learning program, students need to access a lot of information, so teachers need to provide students with the necessary resources, such as libraries, the Internet, and textbooks, to help them better understand and solve problems.

2. Problem-based learning emphasizes students' active learning, so teachers need to encourage students to think independently and explore actively. When students encounter problems, the teacher can give appropriate guidance, but should not give the answers directly, and let the students find their own ways to solve the problems.

3. In the discussion and sharing sessions, the teacher needs to guide students to speak actively and share their insights and experiences. At the same time, the teacher should also listen carefully to students' speeches and give timely feedback and suggestions. Through discussion and sharing, students can inspire each other and make progress together.

4. Each student has different interests, learning habits, and cognitive levels, so teachers need to pay attention to students' individual needs. When implementing problem-based learning plans, teachers can develop individualized plans to meet the needs of different students.

5. Problem-based learning often requires more time and effort, so learn to rationalize time to ensure that students can fully engage in learning.

6. Problem-based learning is a step-by-step process that requires patience and perseverance. Help students encounter difficulties or setbacks, don't give up easily, persevere, and seek help. When implementing a problem-based learning program, the combined efforts of teachers and students are key to success.

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