THE DEVELOPMENT OF ACADAMIC ACHIEVEMENT BY USING STEAM TEACHING METHOD IN MATHEMATICS FOR GRADE 4

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Abstract

The purposes of this research are: 1) Compare the academic achievement in mathematics of grade 4 students before and after using the STEAM teaching method. 2) Examine student satisfaction towards Instructions by using with the mathematics STEAM teaching method. Research instrument include: 1) six learning plans by using STEAM teaching method in mathematics with a total of 12 hours. 2) Tow technology achievement tests: before and after learning (Mathematics). 3) a questionnaire on Student's satisfaction on academic achievement in mathematics through STEAM. The data were analyzed by mean, standard deviation, t-test Dependent.

The research finding revealed that:

1) Posttest learning by using STEAM teaching method in mathematics was higher than pretest learning at 0.05 level of significance. the average score before learning is 10.03, and the average score after learning is 21.73, with a full score of 30. The standard deviation (S.D.) of the pre-study scores was 4.60 and the standard deviation (S.D.) of the post-study scores was 4.32.

2) The students were satisfied with the leaning by using STEAM teaching method in mathematics at the highest level($\overline{X}$ =4.65, S.D.= 0.36).

Keyword: Academic Achievement in Mathematics, The STEAM Education Concept, Students' Satisfaction

Introduction

Since China's basic education curriculum reform began in 2001, although the development of China's basic education has achieved many remarkable achievements, so far the basic education curriculum reform has not been able to meet our expectations for education. As a rational subject with a strong foundation, mathematics not only has wide application in life and research but also promotes the development of other subjects. However, for our Chinese curriculum goals, at present, the teaching of a single subject knowledge is still

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the main focus, with too much emphasis on the mastery of subject knowledge, being out of touch with real life, and neglecting diversified training. It is not easy for students to develop comprehensively. And for the current teaching content, teachers pay attention to the transmission of book knowledge, so students' application of knowledge in life is disappointing, so most students lack the ability to solve practical problems. Therefore, many experts and scholars realize that because of the exam-oriented teaching system, although Chinese students have strong question-sea tactics and a strong ability to complete closed questions, and it is easier to get high scores in the exam compared with foreign students, most Chinese are not innovative enough. As a result, although China has a large population base, it is facing the problem of insufficient innovative talent.

However, in order to solve these problems, the Chinese Ministry of Education promulgated the "Outline of China's Basic Education Curriculum Reform" in 2011. It is proposed to carry out mathematical activities around the development of students' mathematical core literacy, with particular emphasis on mathematical modeling activities and mathematical inquiry activities. Guiding Opinions (Draft for Solicitation of Comments) states that cultivating a large number of innovative talents is the development goal, adheres to the principle of integration and innovation, uses information technology to innovate teaching and management models, promotes integration by application, promotes innovation by integration, and promotes development by innovation, effectively Promote the transformation of educational service methods, teaching, and management models, and form a development path for educational information with Chinese characteristics. The "Outline of National Science Literacy Action Plan (2021-2035)" proposes to improve the level of science education in the basic education stage and to carry out personalized training for young people with scientific potential. These views are consistent with the STEAM education philosophy.

The STEAM education concept advocates the symbiosis of science, technology, and the humanities and conducts scientific integration based on real problems. In recent years, however, there has been an increased focus on developing science, technology, engineering, arts, and mathematics courses that are widely seen as a means of driving change and propping up the national economy. Therefore, the cross-disciplinary integration of disciplines advocated by STEAM education is the development trend of global education and an important means of cultivating national innovative talents. However, in teaching, the STEAM education concept creates a relaxed and harmonious learning environment for students, thereby developing students' diversified thinking. Therefore, the application of the STEAM education concept in elementary school mathematics curriculum and teaching can enable students to carry out cross-disciplinary integration in the process of exploring problems and learning knowledge, realize the basic and extensive application of mathematics in other subjects and social life, and improve students' mathematical literacy.It is a systematic and standardized educational concept to cultivate students' scientific literacy, technical literacy, engineering literacy, artistic literacy, and mathematical literacy. This concept advocates cross-disciplinary integration. There are six steps: focus, detail, discovery, application, presentation, and link.

Research Objectives

1. To compare the academic achievement in mathematics of grade 4 students before and after using the STEAM teaching method.
2. To study students' satisfaction with the mathematics STEAM teaching method.

Research Plan

The Development of Academic Achievement STEAM Teaching Method in Mathematics by Using for Grade 4, The researchers' research plan is as follows：

1. Descriptions of Population and Sample Group

The population of this study consisted of primary grade 4 mathematics program students from Weiganao Primary School in Sichuan province,China ,in the first semester of the academic year 2024.

2. Research Instruments

Three instruments will use in this research：

2.1 The 4 STEAM lesson plans consist of assessment tasks. Each lesson plan uses STEAM, for a total of 12 teaching hours. 3 hours per lesson. There are 12 hours in total. During each phase of the experiment, students were assessed on formative and interactive skills tasks. The lesson planning activity consists of six steps: focus, detail, discovery, application, presentation, and link.

2.2 Formative assessment on interaction achievement pre-test and post-test. The math test consists of multiple-choice questions, each with 4 options and 1 correct answer, for a total of 30 questions.

2.3 A questionnaire on Student's satisfaction on academic achievement in mathematics through STEAM for a total of 20 questions.

3. Data Analysis

The researchers conducted data analysis by using computer calculations to calculate the Frequency, percentage, $\overline{X}$, and S.D of the data obtained in order to interpret various aspects of the study. All data were presented in the form of tables.

Research Results

The Development of Academic Achievement STEAM Teaching Method in Mathematics by Using for Grade 4, The researchers' research results are as follows：

1.Data analysis and results of students' academic performance in mathematics before and after students receive STEAM teaching method for mathematics teaching:

exam subject	full score	scores before study		scores after study		t
		$\overline{X}$	S.D	$\overline{X}$	S.D	
Mathematics	30	11.13	4.60	23.50	4.36	20.68*

STEAM teaching method is used for teaching in the 4th grade mathematics class of Weiganao Primary School. According to the data of the student sample group, the average score before learning is 10.03, and the average score after learning is 21.73, with a full score of 30. The standard deviation (S.D.) of the pre-study scores was 4.60 and the standard deviation (S.D.) of the post-study scores was 4.32. Therefore, it can be analyzed that the students' mathematics test scores after learning are higher than those before learning, and the statistical significance has reached the 0.05 level.

2. Teaching is conducted through STEAM teaching methods, and data obtained from student satisfaction questionnaires are analyzed.

Data analysis of the 4th grade students (30 students) from Weiganao Primary School in Sichuan Province, China, after receiving STEAM mathematics course teaching, to determine whether the STEAM mathematics course teaching method has improved students' learning achievements.

Question	$\overline{X}$	S.D	Result
Learning attitude and engagement			
1. I like learning STEAM.	4.63	0.61	very satisfactory
2. I look forward to conducting STEAM activities in class.	4.50	0.68	satisfactory
3. My active participation in classroom activities in the STEAM math course.	4.60	0.62	very satisfactory
4. I wander distracted in STEAM class.	4.50	0.68	satisfactory
The part	4.56	0.65	very satisfactory
Course content and practicality			
1. In class, we will conduct many interesting STEAM activities.	4.67	0.61	very satisfactory
2. The STEAM class will help me prepare for my life.	4.67	0.48	very satisfactory
3. The STEAM knowledge helps to protect the environment.	4.57	0.63	very satisfactory
4. I learned more when I saw the connection between several concepts.	4.67	0.55	very satisfactory
5. I can have a good grasp of what I have learned in class.	4.60	0.62	very satisfactory
6. The introduction of scientific knowledge interspersed in the class made me understand the world of science.	4.67	0.61	very satisfactory
7. I learned a lot of practical things in my STEAM class.	4.73	0.52	very satisfactory
The part	4.65	0.57	very satisfactory
Teacher role and teaching methods			
1. The teacher is very passionate in class.	4.77	0.50	very satisfactory
2. My teacher often helps me during my study process.	4.63	0.67	very satisfactory
3. The teacher designed the classroom activities according to our needs.	4.77	0.43	very satisfactory
4. Teachers often guide us in our hands-on operations.	4.83	0.38	very satisfactory
The part	4.75	0.50	very satisfactory
Teacher and student interaction			
1. Work related to STEAM is only useful for scientists.	4.57	0.57	very satisfactory
2. Through the study of STEAM class, I realized the advantages and disadvantages in my study.	4.50	0.78	satisfactory
3.The attitude of the teachers towards their students.	4.80	0.48	very satisfactory
The part	**4.62**	**0.61**	**very satisfactory**
Totally	**4.65**	**0.36**	**very satisfactory**

The results of the student satisfaction study using STEAM teaching methods to teach mathematics courses to 4th grade students in Weiganao Primary School can be obtained.The mean score in terms of learning attitude and engagement is equal to 4.56, and the standard deviation (S.D.) is equal to 0.65. The average score in terms of course content and usefulness was equal to 4.65, and the standard deviation (S.D.) was equal to 0.57. It resulted in a mean score equal to 4.75 and a standard deviation (S.D.) equal to 0.50 in the area of teacher role and teaching methods. The mean score in the area of teacher role and teaching methods was found to be equal to 4.62 and the standard deviation (S.D.) was equal to 0.61. Overall, the overall mean score of the satisfaction questionnaire is equal to 4.65 and the overall standard deviation (S.D.) is 0.36, so it can be concluded that student satisfaction is very high.

Conclusion

The Development of Academic Achievement STEAM Teaching Method in Mathematics by Using for Grade 4, The researchers' research conclusions are as follows :

1. Use STEAM math course teaching methods to deepen students' understanding of math knowledge points and improve students' learning achievements. STEAM teaching method is used for teaching in the 4th grade mathematics class of Weiganao Primary School. According to the data of the student sample group, the average score before learning is 10.03, and the average score after learning is 21.73, with a full score of 30. The standard deviation (S.D.) of the pre-study scores was 4.60 and the standard deviation (S.D.) of the post-study scores was 4.32. Therefore, it can be analyzed that the students' mathematics test scores after learning are higher than those before learning, and the statistical significance has reached the 0.05 level.

STEAM has developed a new technology that allows you to create powerful and efficient STEAM systems.1.SREAM teaching method is used for teaching in the 4th grade mathematics class of Weiganao Primary School, mathematics learning achievement, the average score ($\overline{X}$) before learning is 10.03 points, and the average score ($\overline{X}$) after learning is 21.73 points. The standard deviation. The standard deviation (S.D.) before learning is 4.45, and the standard deviation after learning is 4.13. Therefore, it can be analyzed that the students' mathematics test scores after learning are higher than those before learning, and the statistical significance has reached the 0.05 level.This shows that the STEAM education concept can improve students' learning outcomes to a higher level. Therefore, teachers can adopt the STEAM teaching method in mathematics teaching. This is consistent with นัสรินทร์ บือซา. (2558, page7) said STEAM mathematics curriculum teaching is a teaching method. Emphasize the importance of learners, so that students gradually learn to analyze, explain and draw conclusions. And help students to better understand the knowledge they have learned without knowing it.

2. The results of the student satisfaction study using STEAM teaching methods to teach mathematics courses to 4th grade students in Weiganao Primary School can be obtained.The mean score in terms of learning attitude and engagement is equal to 4.56, and the standard deviation (S.D.) is equal to 0.65. The average score in terms of course content and usefulness was equal to 4.65, and the standard deviation (S.D.) was equal to 0.57. It resulted in a mean score equal to 4.75 and a standard deviation (S.D.) equal to 0.50 in the area of teacher role and teaching methods. The mean score in the area of teacher role and teaching methods was found to be equal to 4.62 and the standard deviation (S.D.) was equal to 0.61. Overall, the overall mean score of the satisfaction questionnaire is equal to 4.65 and the overall standard deviation (S.D.) is 0.36, so it can be concluded that student satisfaction is very high.

Some knowledge is relatively abstract and requires students' spatial imagination, but students' abstract thinking ability is not yet developed, which causes some students to be unable to keep up with the teacher's thinking. STEAM teaching allows students to focus on a project or problem, acquire knowledge through practical operations, and ask their peers for help if they cannot learn. Therefore, when the group reports or the teacher summarizes, the students can understand and the learning efficiency is improved. This is consistent with 余胜泉（2015）said“STEAM education is a multi-disciplinary integrated teaching method focusing on process and practice, guided by real problems, emphasizing both knowledge and ability, advocating "learning" in "doing," disciplinary migration, and its relevance to learners.”

The STEAM education concept is conducive to promoting the cultivation of students' innovative spirit and practical ability, and promoting students' sense of cooperation and hands-on ability.This is consistent with the conclusion of 刘璐 (2019) that STEAM teaching in the STEAM teaching concept is exploratory. The STEAM teaching concept mainly advocates that teachers integrate knowledge from various subjects in the teaching process rather than conducting it in isolation, emphasizing the connectivity of knowledge and students' ability to solve and understand problems. This concept coincides with the deep learning theory, which is conducive to improving students' ability to recognize and solve problems, improving students' innovative spirit and practical ability, promoting students' deep understanding of learning, and promoting the cultivation of students' lifelong learning awareness. This is consistent with 余胜泉 and 胡翔（2015）said“The organic fusion and scientific integration of knowledge from different disciplines can not only strengthen students' understanding of the knowledge they have learned, but also greatly improve their learning efficiency and future work efficiency.”

In order to examine the effect of the research project, the researchers conducted a questionnaire survey on the students. A total of 30 questionnaires were distributed and 30 valid questionnaires were collected. Through the feedback from the questionnaire data, it can

be seen that the students are very satisfied with the teaching activities carried out in this study. 1) “"Teacher often guides us in our hands-on operations" is one of the feedbacks with high student satisfaction ($\overline{X}$ = 4.83). The students’ practical operation ability is improved in the teaching process, which is consistent with the STEAM teaching concept proposed by 朱予橦 (2021). 2) “The STEAM class will help me prepare for my life” is one of the most satisfactory feedbacks from students. ($\overline{X}$ = 4.67), Students said that they learned new mathematical knowledge and how to apply this knowledge in relevant life situations, and realized the practical significance of mathematics in life. This fully reflects what the National Governors Association (2007) pointed out: "In the economic era, only those with STEM literacy can gain an advantage and win in the fierce competition." 3) “"The introduction of scientific knowledge interspersed in the class made me understand the world of science." is one of the feedbacks with high student satisfaction. ($\overline{X}$ = 4.67), Students can gain other knowledge while learning mathematics, feel the connection between mathematics and other subjects and the fun of learning mathematics in an interdisciplinary context, and develop an interest in continuing to explore related content. This is consistent with 余胜泉 and 胡翔 (2015) said “Interdisciplinary emphasizes the use of interrelated knowledge in science, technology, engineering, and mathematics to solve problems, realize cross-disciplinary boundaries, and improve student’s ability to solve problems from the perspective of comprehensive application of multidisciplinary knowledge.” the overall mean score of the satisfaction questionnaire is equal to 4.65 and the overall standard deviation (S.D.) is 0.36, so it can be concluded that student satisfaction is very high.

Research Recommendations

1. Before learning activities, it is necessary to plan and prepare in advance, plan the time period for organizing activities and the materials and equipment needed for learning activities, so as to prevent any interference and prevent the work from proceeding as planned.

2. For STEM education methods, teachers can use it to provide tutoring for students with slow learning speed, or provide supplementary teaching for students with high ability during extracurricular time, and can also be used to supplement teaching activities so that students can achieve higher academic results.

3. When preparing STEM education topics, it is recommended to select interesting topics with local resource characteristics for STEM course education. Being good at using local resources can prepare students for life.

Suggestions for further research

1. Problem-solving skills and creative thinking should be studied and developed. Teachers can add more problem situations to further develop students' problem-solving skills and creative thinking.

2. This research model should be studied with other levels of learner groups, such as junior high school and high school, to cultivate students' other abilities and thinking, such as problem-solving ability, creativity, dialectical thinking, etc. It can also be studied in other subjects, such as science, art, etc.

3. The STEAM education concept emphasizes that students learn through hands-on practice, which requires the support of some professional facilities. For example:

1) When learning about a cuboid, students can use a 3D printing pen to make a cuboid, and students can easily master the characteristics of the cuboid in the process.

2) Using VR virtual reality technology when learning geography knowledge allows students to be immersed in the scene.

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