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A Study on Using Matrix Laser Teaching Aids to Improve the Learning Effectiveness of Elementary School Students on the Moon Observation Unit

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Abstract: The purpose of this study is to use the matrix laser teaching aids to teach in the moon observation unit to explore the effectiveness of science learning of elementary school students. The subjects of the study were 367 fourth-grade students in an elementary school in New Taipei City, including 154 students in the experimental group and 213 students in the control group. In this study, we first designed a matrix laser teaching aids to produce parallel light like the sun, so as to provide moon observation unit for teaching, which can show the true changes of moon phase changes in teaching. Students in the experimental group received the instruction with the matrix laser teaching aids on the moon observation unit, while students in the control group received the conventional instruction. The research instrument is the Moon Observation Unit Achievement Test, and the reliability of the test is Cronbach α=.72. The analysis of research data adopts covariate analysis. The results of the study found: (1) There is no significant difference between the experimental group and the control group in the learning effects on the concepts of the moon; (2) The experimental group did better than the control group on the understanding of observing the moon ($F=10.211$, $p<.01$); (3) The experimental group did better than the control group on the understanding of moon phase changes ($F=10.220$, $p<.01$).Therefore, it can be concluded that using matrix laser teaching aids is effectiveness for the moon observation unit in this study.

Keywords: Matrix laser light teaching aids, Moon phases, Science learning

Introduction

Autumn is the best time to observe the moon. This is exactly how elementary school teach this unit between September and October every year. From the first quarter to the last quarter of the moon, you can discover the surface of the moon. There are obvious differences in light and dark. We call this phenomenon the moon-phase

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observation of the moon. If you use the long-term observation method of scientific process skills and the continuous spirit of patience and perseverance, you can detect the moon's phase in the observation records. There are rules for profit and loss changes. School children often have many other concepts in the learning and cognition of the moon unit. It is worthwhile to further explore the improvement of teaching materials at the level of teaching materials.

The purpose of this research is to explore whether the matrix laser teaching can improve the cognitive learning of the moon phase changes in the learning of the moon observation unit for middle-grade students in elementary schools.

The questions to be answered are as follows:

1. What is the difference between the learning effectiveness of moon cognition for students receiving matrix laser teaching and the students receiving general traditional teaching?
2. What is the difference between the learning effectiveness of observing the moon cognition for students receiving matrix laser teaching and the students receiving general traditional teaching?
3. What is the difference between the learning effectiveness of the moon phase change cognition for the students receiving the matrix laser light teaching and the students receiving the general traditional teaching?
4. Does the matrix laser light teaching aid help to improve the learning effectiveness of the students' cognition of moon phase changes?

The study of moon phase changes has always been a problem for elementary school students. Because of the movement of celestial bodies, school children have not been able to experience it. The main reason for school children's inability to express the surplus or lack of moon phases is that they cannot observe the overall structure of the sun, moon, and earth environment from a single point of view of moon phase changes and their interactions (Helm and Novak, 1983). Therefore, in the element of elementary school's nature and life science and technology in the middle-grade moon observation unit, students often have various myths or other concepts about the moon phase, especially the parallel light effects and experiments related to the sun's rays hitting the earth from a long distance.

There is no specific inquiry discussion (Wang, Mei-Fun, 1992; Jiang, Fan, 1993; Driver., Asoko, Leach, Mortimer and Scott, 1994; Xu, Ming-Yan and Wang, Ching-Kun, 2001). This is probably because the simulation environment of many teaching experiments is in general. A light bulb or flashlight replaces the sun, but the light source diverging from the light bulb to the surroundings cannot correctly express the concept of parallel light (Su, Wei-Zhao, 2007); when the light from the bulb hits the sphere, the gradual brightness of the reflective surface is not easy to outline the clear appearance of the moon , There is a big gap between the phases of the moon and the actual observations. Therefore, how to instruct students to understand the correct concept of

sunlight and phases of the moon in teaching activities has always troubled the teaching of teachers in the field of nature.

The matrix laser light teaching aid gives a new opportunity for the moon unit to learn. Due to personal experience simulating the parallel laser light of the sun, students can find that the change of the moon phase is caused by an infinite number of parallel sun lights shining on the surface of the moon. Traditional light bulbs or the flashlight can only project a collective beam, and it is impossible for students to observe the parallel light of the sun on weekdays and the moon phase seen at night, and they cannot understand the parallel characteristics and influence of sunlight.

The laser parallel light matrix allows students to clearly know that the sun is shining on the moon in the form of parallel light, and they can learn about the mystery of the moon phase change in the follow-up study of the rotation and revolution of the moon and the earth. The matrix laser light teaching aid can correctly express the concept of solar parallel light, and the research results can also significantly improve the learning effectiveness of the students' ability to observe the moon phases and the recognition of moon phase changes, providing teachers with a better choice for teaching the moon phase unit.

Method

The object of this research is 367 students in the fourth grade of a elementary school in New Taipei City. A total of 14 moon phase units are taught. The experimental group includes 154 students in six classes, and the control group includes 213 students in eight classes. The experimental group accepts the integration of matrix lightning. In the light teaching, the control group was taught in general traditional style. Both groups received the moon phase unit cognitive achievement test before and after the teaching, and then conducted independent sample covariate analysis based on the pre- and post-test data between the two groups.

This study uses the Kang Hsuan version of the fourth-grade moon unit textbook, which is mainly divided into three learning activities: moon cognition, observation of the moon and moon phase changes. Among them, the matrix laser parallel light teaching aid is mainly used in the cognitive teaching of moon phase changes, and the sun is set to be parallel. The experimental field of light allows students to experience the changes of the moon phases (Kang Xuan Wen Jiao, 2018). In the learning activities of the moon phase changes, the content of the teaching materials are mainly about how the moon phases change from 3-1 to 3-1.

It is mainly hoped that through life experience, students can tell that the moon phases they see on different dates are different, and through learning, they will observe and record for a long time. Moon phase changes; 3-2 Moon Phase Observation Diary, allowing students to observe the moon’s long-term activities to detect the regularity of the moon phase changes and the relationship between the moon phase changes and the lunar calendar date, and learn to predict from the lunar calendar date Moon phases; the regularity of moon phase

changes from 3 to 3 allows school children to learn and understand the relationship between the traditional Chinese calendar (lunar date) and moon phase changes by summarizing the moon phase changes in a month.

The researcher used 110 red lasers arranged in an 11*10 matrix, fixed on a wooden frame, matched with a smoke generator, and projected the laser light (simulating the sun) on the simulation of the moon (white Styrofoam ball). The light appeared. In the regular teaching activities of 3-3 moon phase changes, after students have a preliminary understanding and understanding of the moon phases, the experimental group will be taught matrix laser light. During the process, the changes of the moon phases will be reviewed and the students will be guided to understand the sun. The relationship between the distance and the distance of the moon from the earth, let students observe the white Styrofoam ball (simulating the moon) illuminated by laser light (simulating the sun), understand the changes of the moon phases such as the first quarter moon, full moon, and last quarter moon, and perceive the moon phases The change is caused by the sun's rays in different positions of the moon.

In this research, a matrix laser parallel light teaching aid that simulates the sun is made, and with a smoke generator, this matrix laser parallel light can actually show the effect of simulating the sun’s parallel light in the teaching experiment, and the matrix laser parallel to the sun will be simulated. The light shines on the white Styrofoam balls that simulate the moon in different corresponding positions in the teaching site, and the teaching plan and unit activity design of the moon unit developed by the researcher are used for teaching. The content of the cognitive achievement test questions has passed the internal consistency letter. For degree analysis, the measured Cronbach α value is .724, and the estimated reliability coefficients of all items in the overall statistical analysis of the project are mostly consistent, which are used as pre- and post-tests. Then carry out experimental teaching and general standard teaching, and compare the learning effects of students.

Results

Students who receive matrix laser light teaching have no difference in the learning effect of moon cognition from students who receive general traditional teaching.($p=.900$, $p>.05$) Students who receive matrix laser light teaching have better learning results in observing moon cognition than students who receive general traditional teaching ($p=.002$, $p<.05$) Matrix laser light teaching can help improve students' learning effectiveness in observing moon cognition. Students who receive matrix laser light teaching have better learning results than students who receive general traditional teaching ($p=.002$, $p<.05$) Matrix laser light teaching can help improve students' learning results in the understanding of moon phase changes.

Table 1. Covariate analysis results of independent samples of cognitive achievement test between experimental group and control group

Source	The cause variable	Type III Sum of Squares	df	Average square	F	Sig.
Modifying the model	Activity 1 post-test	2.116	2	1.058	3.429	.033*
	Activity 2 post-test	23.329	2	11.665	9.704	.000**
	Activity 3 post-test	91.099	2	45.550	7.026	.001**
intercept	Activity 1 post-test	163.553	1	163.553	530.086	.000**
	Activity 2 post-test	637.290	1	637.290	530.154	.000**
	Activity 3 post-test	3851.124	1	3851.124	594.032	.000**
Activity 1 pre-test	Activity 1 post-test	2.114	1	2.114	6.851	.009*
	Activity 2 post-test	5.071	1	5.071	4.201	.041*
	Activity 3 post-test	21.710	1	21.710	3.354	.068
Activity 2 pre-test	Activity 1 post-test	.114	1	.114	.364	.547
	Activity 2 post-test	6.931	1	6.931	5.766	.017*
	Activity 3 post-test	5.580	1	5.580	.856	.355
Activity 3 pre-test	Activity 1 post-test	.000	1	.000	.001	.974
	Activity 2 post-test	12.769	1	12.769	10.766	.001**
	Activity 3 post-test	18.313	1	18.313	2.825	.094
Constituencies	Activity 1 post-test	.005	1	.005	.016	.900
	Activity 2 post-test	12.274	1	12.274	10.211	.002*
	Activity 3 post-test	66.257	1	66.257	10.220	.002*
Error	Activity 1 post-test	112.309	364	.309		
	Activity 2 post-test	437.559	364	1.202		
	Activity 3 post-test	2359.816	364	6.483		
grand total	Activity 1 post-test	2710.000	367			
	Activity 2 post-test	8701.000	367			
	Activity 3 post-test	6981.000	367			
Corrected Total	Activity 1 post-test	114.425	366			
	Activity 2 post-test	460.888	366			
	Activity 3 post-test	2450.916	366			

**=p<.01, *=p<.05

Conclusion

We can find that there is no difference in the learning effectiveness of moon cognition for students who receive matrix laser teaching and students who receive general traditional teaching. The students who receive the matrix laser teaching are more effective in observing the moon than the students who receive the general traditional teaching. The learning effect of the students who received the matrix laser light teaching is better than the students receiving the general traditional teaching. It can be seen that the matrix laser light teaching helps to improve the learning effect of the students in observing the moon and moon phase change cognition.

The matrix laser light teaching does help students understand how the sun's long-distance parallel rays affect the moon through actual observations. By clearly delineating the outer periphery of the moon phase, students can understand the cause of the moon phase change due to the earth. The relationship between the relative positions of the moon, the moon and the sun further assist students in obtaining the correct scientific concepts of the moon phases, making the teaching of the moon unit produce meaningful learning effects.

Recommendations

This study suggests that future studies can continuously improve the density of matrix laser light, so that the image of moon phase changes can be more clearly outlined, and if this study can have more empirical research, we believe that more understanding of the benefits of matrix laser light teaching.

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