Using matrix laser parallel light teaching aids and group cooperative learning to conduct teaching research on the moon unit in the fourth grade of elementary school

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Abstract

In the moon unit of the fourth grade of elementary school in Taiwan, students often do not understand the causes of the phases of the moon, and they cannot understand the concept of sunlight. This research focuses on the development of matrix laser parallel light teaching aids, which can specifically display the parallel light of the sun and show the changes of the moon phase. Not only that, cooperative learning can also improve students' learning effectiveness. The object of this research is 150 students in the fourth grade. A two-factor quasi-experimental research design is adopted, that is, matrix laser parallel light teaching aids and group cooperative learning. The results showed that: (1) the moon cognition of the students in the laser-cooperation group, the laser group and the cooperation group was better than that of the students in the control group; (2) in terms of writing, the students would think about the causes of the moon phases in terms of the relationship between the sun, the moon and the earth; (3) In the case of group cooperative learning, the students in the laser-cooperative group performed better.

Key words: Matrix laser parallel light teaching aids, Moon phases, Cooperative learning, Writing evaluation

1. Introduction

The cognition of moon phase changes has always been a trouble for elementary school students. The movement of the moon, the students were not able to experience the situation, which led to the students unable to correctly express the situation of the moon phase, that is to say, the students could not observe the overall interaction between the sun, the moon and the earth from the perspective of the moon phase changes (Helm & Novak, 1983). Therefore, in the unit about the moon in the fourth grade of elementary school, students often have alternative concepts about the moon phases, especially the parallel light and experiments related to the sunlight irradiating the earth from a long distance, but there is no specific exploration and discussion, this is probably because many teaching simulation environments use light bulbs instead of the sun, but light bulbs are divergent light sources, which cannot be expressed correctly parallel light of the sun (Su, 2007). When the light from the bulb hits the sphere, the gradient of the reflective surface will not easily outline the clear appearance of the moon phase, and there will be a big gap with the actual observed moon phase. Therefore, how to guide students in teaching activities recognizing the correct concept of sunlight and moon phase change has always troubled the teaching of science teachers.

Therefore, in the teaching activities about moon phases, Corin and Boyette (2014) used the earth model and a light bulb to form a teaching module of the earth, moon, and sun in a dark classroom. Each student could imagine himself in the space of this module and be able to generate abstraction situation, carry out an interpretation that can explore the phases of the moon. Not only that, Jackson and Castro (2011) used eight white and eight black paper plates to construct the moon phase figure by cutting, and then used two yellow and two blue paper plates, imitating NASA’s "The blue marble" pattern to construct the earth and produce the moon phase diagram as shown in Figure 1.

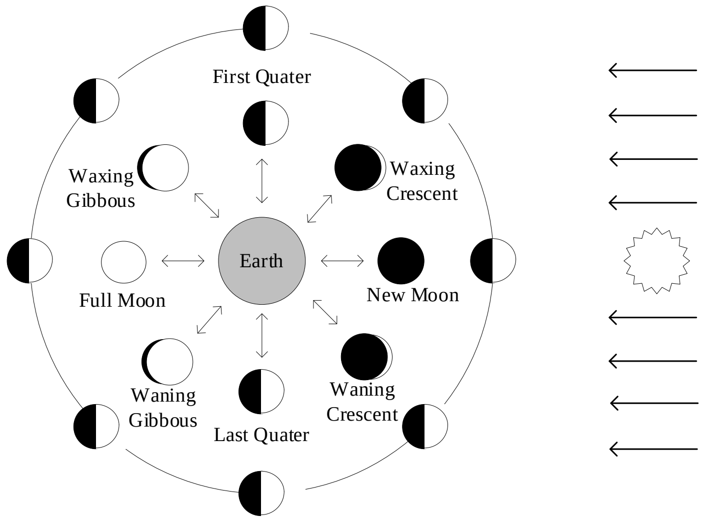

Figure1. Phases of the Moon

Figure 3-2. Students observe the situation where the white Styrofoam ball is irradiated by laser light.

In addition to using models to teach, many teachers use computer simulation software to teach moon phases. Gazit, Yair, and Chen (2005) used a Virtual Solar System (VSS) software as a teaching tool, which not only used to explore students' understanding of day and night phenomena, but also found that students' understanding of the Earth, the moon and the sun produced different alternative concepts. Not only that, some researchers believe that students can learn science from computer simulation, so the Ohio State University (2010) uses the concept of computer simulation of the moon phase to teach, the reason for which is that this teaching method is effective, inexpensive, and time-saving for teaching related scientific concepts; while such computer simulations are an opportunity to learn moon phase concepts, it is not a concrete real world.

Although the moon phase-related teaching field, more and more teachers use digital software to conduct simulation teaching research on computer screens (Keating, Barnett, Barab& Hay, 2002; Gazit, Yair& Chen, 2005; Hobson & Trundle, 2010 ; Su, 2007; Chen & Mao, 2013), but the parallel light effect of sunlight hitting the moon from a long distance is seldom discussed, and it has not been specifically presented in teaching experiments, so that students can easily understand Moon phases have other ideas (Wang, 1992; Jiang, 1993; Xu, 2001). Although there are many teaching graphics instructions that can easily draw parallel rays of sunlight (Jackson & Castro, 2011; Su, 2007), how to show it in teaching experiments cannot be done, especially in general teaching experiments. With bulbs instead of sunlight, it cannot correctly represent the parallel light concept of the sun.

In addition to the above difficulties in teaching the moon phases, in fact, the teaching of science courses requires other teaching methods to help guide students to learn more effectively. Group cooperative learning adopts students' ability to group heterogeneous groups, and uses students' differences to make students with different characteristics do their best and get their own way, which can not only reduce the adverse effects caused by differences, but also enable students to develop appropriately (Ministry of Education, 2013). This study helps to improve the effectiveness of moon phase teaching. Chang (2019) pointed out that group cooperative learning is learner-centered and has a teaching strategy that takes into account the three aspects of cognition, affection and skills.

The process emphasizes that group students should take the initiative to learn, and pay attention to the active interaction and mutual assistance among classmates in the group, which in turn encourages the group to learn more actively. Each student is able to self-learn and progress in order to achieve mutual benefit and common good. In addition, many studies have found that the implementation of group cooperative learning can effectively improve academic achievement, improve learning motivation, enhance interactive performance with peers, reduce learning anxiety, and promote class teamwork. (Chang & Lin, 2013; Lea & Wang, 2012; Chang & Hsu, 2004; Johnson & Johnson, 1994, 1999; Slavin, 1980, 2014a, 2014b).

Not only that, group cooperative learning has been proven to have a positive impact on students' academic performance, behavior and peer interaction performance, and as long as it is used properly, all students can learn. To learn to be responsible and complete the assigned role and tasks, one must also work hard and contribute to the group, considering the effectiveness of individual and group learning (Chuang, 2021). Therefore, through the implementation of group cooperative learning, it can further enhance students' meaningful learning of moon observation. To sum up, group cooperative learning emphasizes mutual cooperation and provides opportunities for students to interact with others. Through repeated discussions and arguments, students can change their cognition due to assimilation and adjustment, and promote meaningful learning. Through systematic curriculum design and mutual assistance among peers, teachers also promote students' learning in the zone of proximal development, learn new concepts and problem-solving skills, and interactive learning between students also allows teachers to have the opportunity to reorganize and refine teaching content. All these are worth exploring in this study.

2. Research motivation and purpose

Because the moon phase changes are regular, in practice, students usually cannot observe for a long time due to factors such as schoolwork or weather. Therefore, students often have many other concepts in the learning and cognition of the moon unit, which is worth further discussion on the improvement of teaching aids. . This research develops matrix laser parallel light teaching aids to explore students' learning effectiveness of moon phases. At the same time, group cooperative learning can promote students' learning effectiveness, which is also the focus of this research. Therefore, the purpose of this research is to explore whether the use of matrix laser parallel light teaching aids and group cooperative learning can enhance students' meaningful learning of moon phases in the fourth-grade students of elementary schools.

3. Research design

This study focuses on the use of matrix laser parallel light teaching aids and group cooperative learning on the learning effect of students in the moon unit, and proposes effective teaching improvements. The research design is as follows:

3.1 Teaching aids design

The design of the matrix laser parallel light teaching aid is to use 110 red laser light sources, arranged in an 11×10 matrix, and fixed on a wooden frame (as shown in Figure 3-1), and with a smoke generator, the laser light can be projected on the white Styrofoam ball (simulating the moon), the parallel rays of the sun can be displayed during the projection process, so that students can understand the projection of parallel rays of the sun.

Figure 3-1. Matrix laser parallel light teaching aids.

During the regular teaching activities of moon phase changes, let students observe the situation of the white styrofoam ball being irradiated by laser light (as shown in Figure 3-2), understand the changes of the moon phases, and realize that the cause of the moon phase changes is due to the moon in different locations and formed by sunlight. Due to the design of this teaching aid, Huang, Hsieh, & Lin. (2019) found that students could see changes in specific moon phases, which were caused by parallel light shining on the moon surface.

3.2 Design of teaching content and assessment tools

The teaching content of this research is the fourth-grade moon unit, which is mainly divided into three learning activities: understanding the moon, observing the moon and moon phase changes. The matrix laser parallel light teaching aid is mainly used in the cognitive teaching of the moon phase change activities. Set up an experimental field of parallel light of the sun, and let students experience the changing situation of the moon phase. In the learning activities of moon phase changes, the main contents are (1) Understanding the moon: let students realize that the phases of the moon on different dates are different through life experience; (2) Observing the moon: let students observe the moon through long-term activities , record the changes of the phases of the moon; (3) Moon phase changes: let students understand the relationship between the traditional Chinese calendar and the changes of the moon phases by summarizing the changes of the phases of the moon by recording.

According to the teaching content, this study refers to the teaching manual and the content of the assignments, and develops the cognitive achievement test of this unit, which covers the teaching objectives and the content of the teaching material, and formulates the questions according to the two-way specification table, a total of 25 questions; including understanding the moon, observing the moon, and the moon phase change. This test was tested for internal consistency, Cronbach $\alpha = .724$, and the estimated reliability of each item was consistent.

As for group cooperative learning, this study adopts the learning together method, because the common learning method emphasizes that students in each group share responsibilities and share learning outcomes, and teachers assist in distributing teaching materials for each group and arranging role tasks. Finally, the content of the course is unified, and the teaching progress can be better grasped, and it is also closer to the original science class grouping situation. In the teaching process of group cooperative learning, it is divided into four stages. First, the learning tasks are explained before each experimental activity; secondly, after the students understand the learning tasks and their responsibilities, they start the learning activities; thirdly, the teacher walks between the groups to assist the groups or students who need assistance; finally, carry out teaching activities of assessment and reflection (Ministry of Education, 2013). The main teaching area of group cooperative learning is in the classroom, with the experimental table as the grouping unit, allowing students to have the opportunity to interact. The group cooperative learning experience questionnaire in this study was taken from the Ministry of Education program, and its internal consistency Cronbach $\alpha > .80$.

3.3 Experimental Design

To sum up, this research should be concerned with two factors: the use of matrix laser parallel light teaching aids for teaching and group cooperative learning. The group experiment design of this study includes teaching with matrix laser parallel light teaching aids and group cooperative learning (laser-cooperative group), only using matrix laser parallel light teaching aids for teaching (laser group), and only in group cooperative learning mode teaching (cooperative group), and finally teaching in the current way (control group). It is hoped to know whether there are differences in the learning of the four groups of students in the learning process. The experimental design of this research group is shown in Table 3-1.

Table 3-1. Group experiment design of matrix laser parallel light teaching aids and group cooperative learning

group	Pre-test	Experimental treatment	Post-test
laser-cooperative group	O_1 O_3	X_1 X_2	O_1 O_2 O_3
laser group	O_1 O_3	X_1	O_1 O_2 O_3
cooperative group	O_1 O_3	X_2	O_1 O_2 O_3
control group	O_1 O_3		O_1 O_2 O_3

X_1: Matrix laser parallel light teaching aids teaching; X_2: group cooperative learning
O_1: Moon Phase Unit Achievement Test; O_2: Moon Phase Unit Writing Assessment; O_3: Group Cooperative Learning Experience Questionnaire

The teaching process and activity design of all four groups were discussed in detail by the research team, and then formal experimental teaching was conducted. The object of this research is 201 students in the fourth grade of primary school. There are 14 teaching sessions, and the experimental teaching includes six classes with a total of 150 students. Among them, there are two classes in the laser-cooperative group (N=50); two classes in the laser group (N=51); two classes in the cooperative group (N=49); in addition, there are two classes in the control group (N=51).

In addition, the writing assessment of this study is based on Champagne and Kouba (1999) using written products to demonstrate the performance of students' scientific writing ability assessment, and teacher development rubrics to assess students' expectations performance expectation.

Furthermore, according to the backward design of teaching activities by Wiggins & Mc Tighe (2005), the teacher's role in evaluating students should be an assessor and setting rubrics to judge the overall performance of students' work. Therefore, in the design of scientific writing assessment, teachers can design relevant simulated situations, so that students can actually participate in the operation or observation in the situation, and solve problems in the form of group thinking. At the same time, according to students' writing performance, use objective rubrics to measure performance. Therefore, the writing assessment of this study emphasizes the connection with the content of the textbook and evaluates it in a real situation, hoping to find an effective way to collect data on students' writing performance. Not only does the writing proficiency measure a student's true ability, it also promotes meaningful learning. For the moon unit, this research develops two groups of questions: (1) draw the full moon and write the reasons for the formation of the full moon, and write the relationship with the sun; (2) draw the quarter moon and write the reasons for the formation of the quarter moon, and write the relationship with the sun.

4. Analysis Results

4.1 Moon Phase Unit Achievement Test

This study carried out two-factor teaching, that is, using matrix laser parallel light teaching aids to teach and group cooperative learning. Each group took the moon unit cognitive achievement test before and after the moon unit teaching. The statistics are shown in Table 4-1:

Table 4-1. Descriptive statistics of the cognitive achievement test before and after the three experimental teaching groups and the control group

Group		Laser-Cooperative group N=50		Laser group N=51		Cooperative group N=49		Control group N=51	
		Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Moon unit	M SD	14.81 4.66	21.56 4.18	16.04 3.30	19.29 3.55	16.15 3.650	18.92 4.71	16.10 2.81	17.10 3.57
Understanding the moon	M SD	2.21 .67	2.71 .50	2.25 .72	2.59 .68	2.08 .85	2.33 .78	2.32 .71	2.27 .78
Observing the moon	M SD	3.33 1.35	5.25 1.03	3.27 1.25	4.14 1.10	3.52 1.19	4.31 1.19	3.30 1.20	3.61 1.1
Moon phase changes	M SD	9.27 3.54	13.60 3.23	10.51 2.29	12.55 2.53	0.54 2.62	12.27 3.62	10.48 2.29	11.22 2.67

In this study, the pretest of the cognitive achievement test of the three experimental teaching groups is used as a common variable, and the post-test of cognitive achievement test is used as a dependent variable, and the homogeneity test of the regression coefficient within the group is carried out, as shown in Table 4-2:

Table 4-2. The homogeneity test of the regression coefficient within the three experimental teaching groups and the control group

Source	SS	df	MS	F
Groups	47.60	3	15.87	1.12
Error	2707.27	191	14.17	
Total	2754.80	194		

Laser-cooperative group, laser group, cooperation group and control group in the Cognitive Achievement Test Homogeneity Test, $F = 1.12$ ($p = .342$, $p > .05$), which did not reach the significance level of .05, indicating no violation of variation A test of numerical homogeneity can be followed by independent sample analysis of covariates (ANCOVA).

Next, the independent sample covariate analysis of the pre- and post-test of cognitive achievement between the laser-cooperative group and the control group, the results are shown in Table 4-3:

Table 4-3. Covariate analysis summary table of independent samples of the moon unit cognitive achievement test of the laser-cooperative group and the control group

Source	SS	df	MS	F
Groups	605.95	1	605.95	44.47**
Error	1349.07	99	13.63	
Total	1955.02	100		

It can be seen from Table 4-3 that the students who received the matrix laser parallel light teaching aids and cooperated in group learning and teaching had better moon unit cognition than the students in the control group ($F=44.47$**, $p<.01$). Further analyze its teaching content, as shown in Table 4-4:

Table 4-4. Covariate analysis summary table of cognitive covariates in the laser-cooperation group and the control group in terms of understanding the moon, observing the moon and changing moon phases

activity	Source	SS	df	MS	F
Understanding the moon	Groups	5.70	1	5.70	14.04**
	Error	40.19	99	.41	
	Total	45.89	100		
Observing the moon	Groups	67.23	1	67.23	57.45**
	Error	115.86	99	1.17	
	Total	183.09	100		
Moon phases change	Groups	195.02	1	195.02	24.67**
	Error	782.64	99	7.91	
	Total		100		

From Table 4-4, it can be seen that the laser-cooperation group is better than the control group students in understanding the moon, observing the moon, and cognition of moon phase changes ($F=14.04$, $p<.01$; $F=57.45$, $p<.01$; $F=24.67$, $p<.01$), that is, matrix laser parallel light teaching aids and group cooperative learning teaching can help improve students' cognitive learning effectiveness.

Next, the independent sample covariate analysis between the laser group and the control group before and after the cognitive achievement test, the results are shown in Table 4-5:

Table 4-5. Summary table of independent sample covariate analysis of the moon unit cognitive achievement test in the laser group and the control group

Source	SS	df	MS	F
Groups	128.45	1	128.45	11.136**
Error	1107.33	96	11.54	
Total		97		

It can be seen from the above Table 4-5 that the students who received the teaching aids of matrix laser parallel light have better cognition of the moon unit than the students in the control group ($F=11.14$, $p<.01$). Further analysis of the content is shown in Table 4-6 :

Table 4-6. Covariate analysis summary table of Cognitive Achievement Test of Cognitive Achievement Test of Cognitive Achievement Test of Laser Group and Control Group

activity	Source	SS	df	MS	F
Understanding the moon	Groups	2.80	1	2.80	5.25*
	Error	51.12	96	.53	
	Total	53.92	97		
Observing the moon	Groups	7.16	1	7.16	5.91*
	Error	116.40	96	1.21	
	Total	123.56	97		
Moon phases change	Groups	47.28	1	47.28	7.64**
	Error	593.87	96	6.19	
	Total	641.15	97		

From Table 4-6, it can be seen that the students in the laser group have better learning outcomes than those in the control group in understanding the moon, observing the moon, and cognition of moon phase changes ($F=5.25$, $p<.05$; $F=5.91$, $p< .05$; $F=7.64$, $p<.01$), that is, the use of matrix laser parallel light teaching aids can help improve students' cognitive learning effectiveness.

Finally, the independent sample covariate analysis between the cooperative group and the control group before and after the cognitive achievement test, the analysis results are shown in Table 4-7:

Table4-7. Summary table of independent sample covariate analysis of the moon unit cognitive achievement test in the cooperation group and the control group

Source	SS	df	MS	F
Groups	82.09	1	82.09	5.74^{**}
Error	1358.40	95	14.30	
Total	1440.49	96		

It can be seen from Table 4-7 that the students who received group cooperative learning teaching had better moon unit cognition than the students in the control group ($F=5.74$, $p<.05$). Further analysis of its content is shown in Table 4-8

Table 4-8. Summary table of covariate analysis of cognitive achievement test for understanding the moon, observing the moon and changes in moon phases between the cooperation group and the control group

activity	Source	SS	df	MS	F
Understanding the moon	Groups	.55	1	.55	1.02
	Error	51.79	95	.55	
	Total		96		
Observing the moon	Groups	9.04	1	9.04	7.33^{**}
	Error	117.12	95	1.23	
	Total		96		
Moon phases change	Groups	27.72	1	27.72	3.07
	Error	858.51	95	9.04	
	Total		96		

It can be seen from Table 4-8 that there is no difference except that the learning effect of observing the moon cognition is better than that of the students in the control group ($F=7.33$, $p<.01$).

4.2 Moon Phase Unit Writing Assessment

The three groups of students in the experimental teaching and the control group all received the writing assessment of the moon phase unit. According to the post-test data of the writing assessment, the causes of the full moon and moon phases were discussed. The results of the students in each group are shown in Table 4-9:

Table 4-9. Summary of the discussion mode of the relationship between the three groups of experimental teaching and the control group on the causes of the full moon phases

Group	The phases of the moon are caused by the moon itself	The phases of the moon are caused by two factors: the sun, the moon, and the earth	The phases of the moon are caused by three factors: the sun, the moon, and the earth	Other
laser-cooperative group	14 (28%)	2 (4%)	26 (52%)	8 (16%)
laser group	17 (33.33%)	3 (5.88%)	27 (52.94%)	4 (7.85%)
cooperative group	13 (26.53%)	2 (4.08%)	25 (51.02%)	9 (18.37%)
control group	15 (29.41%)	4 (7.84%)	30 (58.82%)	2 (3.93%)

As can be seen from Table 4-9, when students explain the causes of the phases of the full moon, the students in the laser-cooperation group think more about the relationship between the sun, the moon and the earth (52%) or the moon itself (28%). The majority of students in the group are thinking about the relationship between the sun, the moon and the earth (52.94%) or the moon itself (33.33%), while the students in the cooperation group are about the relationship between the sun, the moon and the earth (51.02%) or the relative relationship of the moon itself (26.53 %), and the students in the control group thought more about the relationship between the sun, the moon and the earth (58.82%) or the relative relationship between the moon itself (29.41%).

Similarly, regarding the discussion mode of the relationship between the phases of the crescent moon and the moon, the analysis results are shown in Table 4-10:

Table 4-10. Discussion on the relationship between the three experimental teaching groups and the control group on the causes of the crescent moon

Group	The phases of the moon are caused by the moon itself	The phases of the moon are caused by two factors: the sun, the moon, and the earth	The phases of the moon are caused by three factors: the sun, the moon, and the earth	Other
laser-cooperative group	12 (24%)	6 (12%)	24 (48%)	8 (16%)
laser group	15 (29.41%)	6 (11.76%)	28 (54.91%)	2 (3.92%)
cooperative group	16 (32.65%)	3 (6.12%)	22 (44.90%)	8 (16.33%)
control group	12 (23.53%)	6 (11.76%)	28 (54.90%)	5 (9.81%)

It can be seen from Table 4-10 that when students explain the causes of the phases of the crescent moon and the moon, the students in the laser-cooperation group think more about the relationship between the sun, the moon and the earth (48%) or the moon itself (24%), most of the students in the ejaculation group are about the relationship between the sun, the moon and the earth (54.91%) or the moon itself (29.41%), while the students in the cooperation group are about the relationship between the sun, the moon and the earth (44.90%) or the relative relationship of the moon itself (32.65%), and the students in the control group mostly thought about the relationship between the sun, the moon and the earth (54.90%) or the relative relationship between the moon itself (23.53%).

4.3 Questionnaire for students' group cooperative learning experience

The three experimental teaching groups and the control group were given a group cooperative learning experience questionnaire. The contents of the questionnaire included four parts: science classroom situation, learning motivation and attitude, cooperative skills and peer interaction, and teacher-student relationship. The results of the pre- and post-test t-test are shown in Table 4-11:

Table 4-11. Analysis results of the four groups of students in the group cooperative learning experience questionnaire

Question		laser-cooperative group			Laser group			Cooperative group			Control		
		pre-test	post-test	t	pre-test	post-test	t	pre-test	post-test	t	pre-test	post-test	t
Science classroom situation	M	3.52	4.08	-2.10*	3.59	4.08	-1.83	4.43	4.33	.57	3.65	3.88	-1.10
	SD	1.50	1.28		1.70	1.35		1.08	.97		1.37	1.28	
Learning motivation and attitude	M	2.94	2.90	.35	2.95	2.85	1.16	3.10	3.13	-.35	2.92	3.07	-1.78
	SD	.72	.62		.68	.72		.68	.71		.74	.47	
Cooperative skills and peer interaction	M	3.03	3.28	-2.55*	3.33	3.23	1.12	3.42	3.41	.09	3.39	3.32	.84
	SD	.11	.56		.69	.77		.58	.59		.56	.64	
Teacher-student relationship	M	2.83	2.91	-.69	3.07	3.03	.40	3.05	3.06	-.16	3.07	3.04	.34
	SD	.82	.67		.84	.68		.73	.75		.83	.66	

From Table 4-11, it can be seen that the laser-cooperative group has significantly grown in the science classroom situation and cooperative learning experience of cooperative skills and peer interaction.

5. Discussion and Suggestions

Judging from the analysis results of students' achievement test, whether it is the learning content of recognizing the moon, observing the moon, or changing the phases of the moon, the teaching of matrix laser parallel light teaching aids and group cooperative learning can indeed help improve students' learning function in moon cognition. Not only that, students in the moon unit writing assessment, whether it is explaining the causes of the full moon or the quarter moon, the laser-cooperative group students can think and explore the relationship between the sun, the moon and the earth, that is, use the matrix laser parallel light teaching aids for teaching and group cooperative learning can help students explore the relative positions of the sun, the moon and the earth. Even in the case of group cooperative learning, in the analysis of the content of the group cooperative learning experience questionnaire, it was found that the post-test results of the laser-cooperative group were better than the pre-test results, such as accepting the different opinions of classmates, or being able to get close to the feelings of classmates, etc. This all shows the effectiveness of matrix laser parallel light teaching aids and group cooperative learning in moon phase teaching.

Matrix laser parallel light teaching aids can indeed help students to understand how the parallel light of the sun at a distance affects the moon phase changes in actual observation. By clearly delineating the periphery of the moon phase, students can understand the moon phase changes. The reason is that due to the relationship between the relative positions of the earth, the moon and the sun, it further assists the students to obtain the correct concept of the moon phase, so that the teaching of the moon unit has a meaningful learning effect for the students.

Not only that, in terms of science classrooms, cooperative skills, peer interaction, and teacher-student relationships, students in the laser-cooperative group experienced significant growth in using group cooperative learning experiences.

This study suggests that future research can continue to improve the density of the parallel light of the matrix laser, so that the image of the phase change of the moon can be more clearly outlined. In addition, if there are more empirical studies in this study, I believe that we can better understand the teaching benefits of matrix laser parallel light teaching aids and group cooperative learning.

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