

Using Writing Assessment to Evaluate the Children's Understanding of Moon Phase Changes

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Abstract: The purpose of this study is to explore the children's understanding of moon phase changes. Study methods include qualitative and quantitative methods. The subjects of the study are 683 students from grade three to six in an elementary school in New Taipei City. This study uses the method of writing assessment to explore the ideas of elementary school children on the causes of the moon phase changes and analyze the explanations of the causes of the moon phase changes. Students' writing assessment were collected as the major source for the study. In the analysis of the study data, first evaluate and classify the content and explanation of the causes of the moon phases by the schoolchildren, then conduct descriptive statistics to analyze the frequency distribution and percentage, and compare them according to the grade level. The writing assessment processes and the reliability and validity of the study were confirmed by three science educators and senior teachers. The results of the study found: (1) When students explain the causes of the moon phases of the full moon, waxing moon, last quarter moon, and first quarter moon during the day, the 3th graders mostly consider their own relationship, while the 4th, 5th, and 6th graders hold more views of the sun, moon, and the earth; (2) In terms of the proportion of students that the formation of moon phases is related to the sun, except that the proportion of last quarter moon in the 5th grade is slightly higher than that in the 6th grade, the rest are the highest in the 6th grade, indicating that the higher grade students feel the sun more related to the formation of the moon phases.

Keywords: earth science, Moon phases, Science learning, Writing assessment

Introduction

One of the learning points of the moon unit is to compare the moon phase changes with the lunar calendar date and understand the relationship between the moon phase changes and the lunar calendar date. This study tries to analyze the concept of the cause of the moon phases of the research object by discussing the relationship between the moon itself, the moon and the sun, the moon and the earth, the sun and the earth, the sun and the

moon and the earth, and others.

By analyzing the writing assessment results of the third to sixth grades of elementary school children on the causes of the moon phases of different moon phases, and longitudinally comparing the concept of the cause of the moon phases of the third to sixth grades of elementary school students, the purpose of this study is to explore the third to sixth grades children's perception of the moon is hoped to serve as a reference for the teaching of the moon phase unit in the future.

The questions to be answered are as follows:

1. What is the difference in explaining the causes of the full moon and the phases of the moon in the 3th to 6th grades of elementary school?
2. What is the difference between the explanation of the cause of the waxing moon phase by the students in grades 3 to 6 in elementary school?
3. What is the difference between the third to sixth grade students in elementary school explaining the causes of the last quarter moon phases?
4. What is the difference between the explanation of the causes of the first quarter moon phases by the children in grades 3 to 6 of elementary school?
5. What is the difference between the explanation of the relationship between the moon phases and the sun for the 3th to 6th grades of elementary school?

In the process of scientific inquiry, asking children to write down the sentences after thinking is one of the ways of inquiry. Champagne and Kouba (2005) believe that the content written by schoolchildren can be regarded as a kind of writing evaluation (Performance Measures, Performance Assessment). Writing assessment emphasizes that the context of the assessment should be real, showing the performance of children in a real situation, so writing assessment is a kind of authenticity assessment (Huang Shu-ling,1999). Shih-Jung, Huang et al. (2019) pointed out that in addition to emphasizing the connection with the content of the textbook and the evaluation in the real context, the writing evaluation also hopes to find an effective way to collect student data and reduce the time and funding constraints on research. In addition to using writing assessments to obtain students' conceptual situation of the causes of moon phases, this study also hopes to understand the perceptions of the moon in the 3th to 6th grades, so as to prepare for the follow-up study of longitudinal teaching design in the natural field.

Method

This research refers to the analysis models of Qiu Meihong, Chen Yingxian (1995) and Chen Cuiwen, Hou Yiling, and Liu Jiaru (2010), and try to discuss the relationship between the moon itself, the moon and the sun, the moon and the earth, the sun and the earth, the sun and the moon and the earth, and others. Analyze the concept of the cause of the moon phase of the research object.

Based on self-compiled writing assessments, 128 students in 3th grade in 5 classes, 398 students in 4th grade in 15 classes, 54 students in 5th grade in 2 classes, and 103 students in 6th grade in 4 classes. A total of 683 students explain the causes of specific moon phases. Analyze and classify. The writing assessment questions and analysis methods are set with the assistance of experts and senior teachers.

Results

In the writing assessment, students' personal thoughts on the causes of the moon phases are discussed. This study is divided into four lunar phases: full moon phase, waxing moon phase, last quarter moon phase, and first quarter moon phase. Statistics children are explaining the causes of moon phases. In the process, the moon itself, the moon and the sun, the moon and the earth, the sun and the earth, the sun and the moon and the earth, and others (own experience), explore the concepts and ideas of the 3th to 6th grade students in elementary school. The sub-items are as follows: Table 1 to 4.

Table 1. The discussion mode of the relationship between the 3th to 6th grades of elementary school students on the causes of the full moon phase

Grade/Mode	Moon	Sun and moon	Moon and earth	Sun and earth	Sun moon earth	other
3th	15 (11.72)	21 (16.41)	5 (3.91)	2 (1.56)	16 (12.50)	69 (53.91)
4th	18 (4.52)	79 (19.85)	17 (4.27)	2 (0.50)	136 (34.17)	146 (36.68)
5th	14 (25.93)	4 (7.41)	5 (9.26)	0 (0.00)	29 (53.70)	0 (0.00)
6th	31 (30.10)	13 (12.62)	7 (6.80)	1 (0.97)	47 (45.63)	3 (2.91)

It can be seen from Table 1 above that when students explain the causes of the full moon phases, the third-grade students have more opinions based on their own experience (53.91%) and the relative relationship between the moon and the sun (16.41%), and the fourth-grade students are The views on the relationship between the sun and the moon and the earth (36.68%), and the relative relationship between the moon and the sun (34.17%) accounted for the majority, while the fifth and sixth grade students are the sun, the moon and the earth (53.70%, 45.63%), The relative relationship of the moon itself (25.93%, 30.10%) is mostly.

Table 2. The discussion mode of the relationship between the 3th to 6th grades of elementary school students on the causes of the waxing moon phase

Grade/Mode	Moon	Sun and moon	Moon and earth	Sun and earth	Sun moon earth	other
3th	41 (32.03)	23 (17.97)	3 (2.34)	1 (0.78)	11 (8.59)	49 (38.28)
4th	25 (6.28)	83 (20.85)	15 (3.77)	0 (0.00)	113 (28.39)	162 (40.70)
5th	11 (20.37)	7 (12.96)	5 (9.26)	0 (0.00)	26 (48.15)	1 (1.85)
6th	41 (39.81)	14 (13.59)	6 (5.83)	1 (0.97)	38 (36.89)	1 (0.97)

It can be seen from Table 2 above that when students interpret the causes of the phases of the last quarter moon, the third-grade students are mostly based on their own experience (38.28%) and the moon itself (32.03%). The fourth-grade students are There are more opinions about their own experience (40.70%) and the relative relationship between the moon, the earth and the sun (28.39%). The fifth and sixth grade students are the relative relationship between the sun and the moon, the earth (48.15%, 36.89%), and the moon itself (20.37%, 39.81%) accounted for the majority.

Table 3. The discussion mode of the relationship between the 3th to 6th grades of elementary school students on the cause of the last quarter moon phase

Grade/Mode	Moon	Sun and moon	Moon and earth	Sun and earth	Sun moon earth	other
3th	31 (24.22)	29 (22.61)	2 (1.56)	0 (0.00)	5 (3.91)	61 (47.66)
4th	18 (4.52)	82 (20.60)	10 (2.51)	0 (0.00)	99 (24.87)	189 (47.49)
5th	7 (12.96)	7 (12.96)	5 (9.26)	1 (1.85)	31 (57.41)	0 (0.00)
6th	31 (30.10)	16 (15.53)	8 (7.77)	0 (0.00)	40 (38.80)	4 (3.89)

It can be seen from Table 3 above that when students explain the cause of the eyebrow-shaped crescent moon phase, the third grade students are based on their own experience (47.66%), the moon itself, and the factors of the sun and the moon (24.22%, 22.61%) Most of the views of the fourth grade students are about their own experience (47.49%), the relative relationship between the moon, the earth and the sun, and the relative relationship between the sun and the moon (24.87%, 20.60%). The fifth-grade children are the sun and the sun.

The relative relationship between the moon and the earth (57.41%) and the moon itself and the sun and the moon (12.96%, 12.96%) have more opinions. The order of the majority of sixth-grade students is the relative relationship between the sun and the moon and the earth (38.80%) and the moon itself. Relationship (30.10%) view.

Table 4. The discussion mode of the relationship between the 3th to 6th grades of elementary school students on the cause of the first quarter moon phase

Grade/Mode	Moon	Sun and moon	Moon and earth	Sun and earth	Sun moon earth	other
3th	3 (2.34)	36 (28.13)	1 (0.78)	0 (0.00)	3 (2.34)	85 (66.41)
4th	21 (5.28)	47 (11.81)	4 (1.01)	0 (0.00)	94 (23.62)	232 (58.29)
5th	6 (11.11)	9 (16.67)	2 (3.70)	2 (3.70)	29 (53.70)	1 (1.85)
6th	23 (22.33)	14 (13.59)	3 (2.91)	1 (0.97)	43 (41.75)	10 (9.71)

It can be seen from the above Table 4 that when students interpret the causes of the first quarter moon phases, the third-grade students are mostly based on their own experience (66.41%) and the relative relationship between the moon and the sun (28.13%). The fourth grade the order of most school children is based on their own experience (58.29%), the view of the sun and the moon and the earth (23.62%). The fifth grade school children are the relative relationship between the sun and the moon and the earth (53.70%), and the relative relationship between the moon and the sun (16.67%) There are more opinions on the relationship between the sun and the moon, the earth (41.75%), and the moon itself (22.33%) in the sixth grade.

The third-grade students are explaining the idea of the causes of the moon phases. This study found that most of the phenomena are based on their own experience, while the fourth to sixth grades shifted to more explanations based on the relationship between the sun, the moon and the earth. See four in astronomy studies after grades, students are better able to explain astronomical phenomena with the astronomical concepts and changes they have learned.

As for the relationship between the cause of the moon phase and the sun, the researcher gave the statistical answers and the results are shown in Table 5.

Table 5. Thoughts on the causes of the moon phases and the sun from the 3th to 6th grades of elementary school

Relationship Grade	Have				No				Unanswered			
	Full moon	Waxing moon	Last quarter moon	First quarter moon	Full moon	Waxing moon	Last quarter moon	First quarter moon	Full moon	Waxing moon	Last quarter moon	First quarter moon
3th	65 (58.78)	39 (30.47)	46 (35.94)	45 (35.16)	22 (17.19)	33 (25.78)	28 (21.88)	29 (22.66)	41 (32.03)	56 (43.75)	54 (42.19)	54 (42.19)
4th	244 (61.31)	186 (46.73)	181 (45.48)	162 (40.70)	56 (14.07)	70 (17.59)	50 (12.56)	60 (15.08)	98 (24.62)	142 (35.68)	167 (41.96)	176 (44.22)
5th	33 (61.11)	32 (59.26)	32 (59.26)	28 (51.85)	2 (3.70)	6 (11.11)	7 (12.96)	5 (9.26)	19 (35.19)	16 (29.63)	15 (27.78)	21 (38.89)
6th	72 (69.90)	62 (60.19)	61 (59.22)	56 (54.37)	9 (8.74)	17 (16.50)	11 (10.68)	6 (5.83)	22 (21.36)	24 (23.30)	31 (30.10)	41 (39.81)

From Table 5 above, it can be seen that the proportion of schoolchildren that the formation of moon phases is related to the sun, except that the proportion of fifth grade (59.26%) in the last quarter of the moon is slightly higher than that of grade six (59.22%), the rest are all six. The highest grade, the higher the grade, the more I feel that the sun is more related to the formation of the moon phases.

Conclusion

We found students explain the causes of the moon phases of the full moon, the 3th grade students are based on their own experience and the views of the relationship between the moon and the sun, the 4th grade students are based on their own experience and the views of the relationship between the sun and the moon and the earth, the 5th grade students are based on their views on the relationship between the sun and the moon and the earth, and the moon itself. The 6th grade students are the view of the relative relationship between the sun and the moon and the earth, and the moon itself.

When school children interpret the causes of the phases of the waxing moon, the 3th grade students are based on their own experience and the views of the relationship between the moon itself, the 4th grade students are based on their views on the relationship between their own experience and the sun and the moon and the earth, the 5th grade students are based on their views on the relationship between the sun and the moon and the earth, and the moon itself. The 6th grade students are the view of the relative relationship between the moon itself and the sun and the moon and the earth.

We also found students explain the cause of the last quarter moon phase, the 3th grade students are based on their own experience and the views of the relationship between the moon itself, the 4th grade students are based on their views on the relationship between their own experience and the sun and the moon and the earth, the 5th grade students are based on their views on the relationship between the sun and the moon and the earth, and their own experience. The 6th grade students are the view of the relative relationship between the sun and the moon and the earth, and the moon itself.

When students interpret the causes of the first quarter moon phases during the day, the 3th grade students are based on their own experience and the views of the relationship between the sun and the moon, the 4th grade students are based on their views on the relationship between their own experience and the sun and the moon and the earth, the 5th grade students are based on their views on the relationship between the sun and the moon and the earth, and the sun and the moon. The 6th grade students are the view of the relative relationship between the sun and the moon and the earth, and the moon itself.

In terms of the proportion of school children that the formation of moon phases is related to the sun, except that the proportion of last quarter in the 5th grade is slightly higher than that of the 6th grade, the rest are the highest in the 6th grade. The higher the grade, the more relevant the formation of the sun and the moon phase is.

Recommendations

The results of the writing assessment of the schoolchildren can be seen in the schoolchildren's concept of the cause of the moon phase. After the 4th grade study of the moon unit, there are still many incomplete or other concepts, so how to effectively change the teaching method to help the schoolchildren change Their concept needs further research.

This study initially explores the thinking mode of the causes of the moon phases in the 3th to 6th grades. In the future, it can analyze the concept of the content of the students' answers to obtain more information and provide research on how to effectively change the teaching method to assist School children change their other concepts.

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