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Alternative Conceptions of Senior High School Students to Astronomy Concepts

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Introduction

Filipino students are required to undertake the revised basic education curriculum (RBEC, or K–12 curriculum) from kindergarten up to senior high school set by the Department of Education (DepEd). Included in the revised curriculum are astronomy concepts that are taught at different grade levels in junior high school (from Grade 7 up to Grade 9). Topics in Grade 7 include the concepts of seasons and eclipses. Characteristics of asteroids, comets, and other members of the solar system are taught in Grade 8, while characteristics of stars and constellations are taught in Grade 9. (Department of Education, 2016)

The arrangement of topics in astronomy and other science concepts in elementary and junior high school is patterned using a spiral progression curriculum. This curriculum was promoted by Bruner. Bruner (1960) encourages different educational institutions to teach concepts first at a more simplified level, but as the learner progresses, those concepts will be relearned and they will add concepts that are more complex but related to the first one. Thus, concepts will have a gradual increase in difficulty. To assess the effectiveness of the curriculum, the Bureau of Educational Assessment conducts the National Achievement Test (NAT) for junior high and senior high school students. Based on the latest result of the NAT, the national result is 44.1% in the school year 2016–2017, which is lower compared to the 44.7% result in the school year 2015–2016. (Aguinaldo, 2019) However, scores in relation to astronomy concepts are not included. One of the perennial problems in curriculum assessment is the alternative conceptions of students.

Alternative conception is defined as the students' personal construct of knowledge that is different from the universally accepted scientific facts (Chhabra & Baveja, 2012). Also, Gilbert (1983) defined alternative conception as an idea or thought of a learner that is different from the socially agreed concept. If the student learned an alternative concept, it may be difficult to unlearn or change due to the high resistance of the learner to change it. (Novak, 1988) In recent years, there have been numerous studies that focus on identifying the difficulties students have in comprehending different astronomical concepts (Kharis, 2016). However, there is scarce literature on the alternative conceptions of astronomy concepts among students in the Philippines. Based on this, researchers would like to determine the different alternative conceptions of astronomy concepts taught to senior high school students during junior high school.

Methods

The researcher used a qualitative descriptive survey design. According to Calmorin & Calmorin (2007), this design is best suited to determining the degree of differences between the subjects. Also, the researcher will determine the variation of participants in different conditions and situations.

The participants of the study were the Grade 11 senior high school students. Grade 11 students were the participants because they already learned about astronomy topics in junior high school. Also, the researcher assumes that they have no astronomy concepts learned in their grade 11 subjects in science (Earth Science, Physical Sciences, Earth and Life Science, and DRRR) in relation to the chosen astronomy topics since those topics are not included in the curriculum guide of the said subjects. The researcher employed stratified random sampling. Stratified random sampling used layering techniques. In each layer or stratum, the participants were selected randomly. (Calmorin & Calmorin, 2007).

The previous junior high school of each participant will be considered in this study. This is to make sure that the participants came from different junior high schools and to increase the variability of the answers. After classifying the students in stratification, the researcher will use systematic random sampling to select the students randomly.

The researcher used a guided or structured interview to determine the alternative conceptions of astronomy concepts among senior high school students. The researcher and the participant used video conferencing applications for the interview. The guided or structured interview consists of pre-formulated questions that will help the researcher answer the formulated problems. To answer the first question, the researcher will include two sets of questions. The first set of questions will assess the known understanding of the subject of eclipses (solar and lunar eclipses). The second set of questions will determine their understanding of seasons. For the answers to the second question, the research will include questions that will determine how the participants acquired those alternative conceptions. For the third question, the interview guide will consist of questions

that will determine the factors influencing how they acquired those conceptions. These guided or structured interview questions were designed by the researcher. The researcher will also make a table of specifications for the questions. This will allow the researcher to align the questions with the required competency in astronomy in the science curriculum guide from the Department of Education. The questions from the interview guide were submitted to the research adviser to check and to give comments and suggestions. After that, the researcher seeks the guidance of astronomy professors at the Department of Earth and Space Science at Rizal Technological University to validate the content of the questions.

Results

The different results and analyses are presented in the order of sub-problems of this study, as follows: Senior high school students have alternative conceptions of different astronomy concepts covered by the curriculum guide for junior high school students.

In the concept of a solar eclipse, students have alternative conceptions if they explain the concept in verbal form rather than in diagram form. The alternative conceptions of students in drawing form are the Earth-Sun-Moon model and the Moving Sun and Moon model. For the verbal form, the alternative conceptions are: (1) solar eclipses happen at night; (2) the sun and moon are moving towards each other; (3) when the moon rotates, it covers the sun; and (4) the moon is blocking the path of the sun.

In the concept of a lunar eclipse, students also commit alternative conceptions if they explain the concept in verbal form rather than in diagram form. In the diagram form, the alternative conceptions of students are: (1) the moving moon and sun model; and (2) the earth-moon-sun model. Students also commit alternative conceptions if they explain them verbally. These are: (1) light emitted from the Moon was blocked by Earth; (2) the Moon disappeared during a lunar eclipse; (3) Earth came between the Sun and Moon; (4) the Moon blocked the sunrays reflected on the Earth; (5) the mechanism of a lunar eclipse was the same as that of a solar eclipse; (6) the Moon was blocking Earth's light; and (7) the Sun was blocking the Moon during the nighttime.

However, for Philippine seasons, there is no difference between the verbal and diagram forms. The alternative conceptions in drawing form are: (1) distance of the Earth from the Sun; and (2) local weather model. Also, students have alternative conceptions regarding the names of the seasons, like (1) rainy and summer, (2) winter and summer, (3) El Nino and La Nina, and (4) sunny, rainy, and typhoon. In verbal form, these are the alternative conceptions of students: (1) the northern hemisphere experiences a rainy and sunny season, while the southern hemisphere experiences winter and autumn; and (2) if the Philippines is not in the spotlight of the sun, then it is a rainy season. Otherwise, if the country is in the spotlight, then it is sunny or "tag-init" and (3) if the Earth is farther from the Sun, then it is rainy. If near, then it is summer; (4) the Philippines is located at the center of the equator; and (5) the Philippines is experiencing balanced day and night. Students acquired those alternative conceptions through the pedagogy of their teachers (length of instructional time, teaching methods), the surfing of the internet and social media, the personal experiences of the students, and the visual representation of the mechanisms of the astronomy concepts.

Conclusions

The results of the study led the researcher to conclude that senior high school students have alternative conceptions of different selected astronomy concepts that are included in their junior high school lesson. The researchers noticed that students gave more alternative conceptions if they explained the concepts in verbal form than in drawing form. This conclusion is true for the concepts of solar and lunar eclipses but not for Philippine seasons. Also, students gave a higher alternative conception of the mechanism by which lunar eclipses work than solar eclipses, both in verbal and in drawing form. Based on the responses of the respondents, the research also concludes that students acquired those alternative conceptions through the pedagogy of the teacher (which includes the length of instructional time and teaching methods), the use of the internet and social media as information sources, the personal experiences of the students, and the visual representation of those phenomena.

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