

TEACHING BEYOND BORDERS: EFFECTIVENESS OF HEURISTIC APPROACH IN TEACHING SCIENCE IN PUBLIC SECONDARY SCHOOLS IN AREA IV, DIVISION OF BATANGAS, PHILIPPINES

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ABSTRACT

The primary purpose of this study was to determine the usefulness of the Heuristic approach in the teaching and learning process among Grade 8 public secondary schools, Area IV, Division of Batangas with the end in view of preparing supplementary materials for maximum utilization of the Heuristic approach. The descriptive type of research was used in this study with the use of questionnaires as an instrument to gather data from 30 science teachers and 356 Grade 8 students from public high schools in Area IV, Division of Batangas. Statistical tools used were independent t-test, ranking, and weighted mean. The findings revealed that the Heuristic approach was found to be useful in teaching science. There are real-life heuristics that people use to solve a problem or to learn something. These are consistency Heuristic, educated guess, absurdity Heuristic, common sense, contagion Heuristic, availability heuristic, working backward, familiarity Heuristic, scarcity Heuristic, rule of thumb, affect heuristic, and authority heuristic. The supplementary material was designed to enhance the performance of Grade 8 students in science classes. There is no significant difference between the assessment of teachers and students in the usefulness of the Heuristic approach in the teaching and learning process. It was defined in areas of concern that Heuristic approach should establish a lively classroom in teaching learning process.

Keywords: *heuristic approach, science teaching, supplementary materials*

INTRODUCTION

The success on teaching science depends largely on the educational background, training, and experiences of the teacher. Effective science teachers cannot afford to be contented with what they know at any time otherwise they will soon be left behind by the rapid advancement being made in the educational field. Teaching approaches give relevance to the improvement of instruction. Both teachers and students must gain understanding of the lesson by applying the effective strategy in teaching concepts. The teacher should be aware of the subject matter and the ability of the students to interpret and understand the topic.

In teaching science, one of the most important approaches is the heuristic approach. This refers to the experience-based technique for problem solving, learning, and discovery that gives solution which is not guaranteed to be optimal. Heuristic is used to speed up the process of finding a satisfactory solution via mental shortcuts to ease the cognitive load of making decision. These include using the rule of the thumb, an educated guess or hypothesis, an intuitive judgement, stereotyping, or common sense, and trial and error method. (<http://www.wisegeek.com>)

Heuristics are using readily accessible, though loosely applicable information to control problem solving in human beings and in machines. Philosophers of science have emphasized the importance of heuristics in creative thought and constructing scientific theories. The successful identification, classification, and explanation on the heuristic methods used by the students and teachers will serve as the baseline data for the development of effective teaching approaches to be employed by teachers in handling science subjects. An

inventory of these approaches is believed to give way in upgrading science instruction and developing better approaches for better understanding.

The high school curriculum's goal must be preparing all students to do well in life, contributing to their well-being and the good of society, and preparing students to succeed in college. Making literate science students was focused on mental training and withheld performance in science studies from consideration for college entrance. The elementary science should focus on simple natural phenomena by means of experiments carried out in-the-field, secondary science should focus on laboratory work and the committee's prepared lists of specific experiments, teaching of facts and principles for college preparation. This standard call for more than science as process in which students learn such skills as observing, inferring, and experimenting. Inquiry is central to science learning. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others. They identify their assumptions, use critical and logical thinking, and consider alternative explanations. In this way, students actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills

According to Marxze (2014), the National Achievement Test results 2012-2014 (measured in terms of the "mean percentage score"), Grade 8 students from CALABARZON were still below the DepEd's target of 75 percent. Specifically, in Division of Batangas Province, students got correct answers to less than 50% of the questions in Science as calculated by Department of Education, National Education Testing and Research Center, year 2012. Philippines was ranked 69th in educational system, 112th in science and math and 76th on Internet access out of 125 countries. The Philippines was falling behind Singapore, Brunei, Malaysia, Indonesia, Thailand and Vietnam (Umil, 2014).

The researchers observed that most of the high schools were not performing well in Science subjects due to ineffective teaching and learning process, insufficient instructional materials and lack of training among teachers. Also, Science was a difficult subject for the students that is why additional contact time may be needed and innovative teaching techniques should be devised.

One of the policy recommendations of Department of Education (DepEd) to school level / division level for teachers is exposing the students to authentic learning activities using different approaches like learning by doing to strengthen educational supervision at the school level. Thus, this requires study regarding the heuristic approach used in teaching science.

RESEARCH QUESTIONS

The study aimed to determine the use of Heuristic approach in teaching and learning Science among Grade 8 students of public secondary schools in Area IV Division of Batangas.

Specifically, this study sought answers to the following questions:

1. What are the distinct features of Heuristic approach as used in Science teaching?
2. How do the teachers and students assess the usefulness of Heuristic approach in teaching and learning process?
3. Is there significant difference in the responses of the teachers and students in the usefulness of Heuristic approach?
4. What are the constraints met by teachers in utilizing heuristic approach?
5. From the analysis of the study what supplementary materials may be

proposed for maximum utilization of Heuristic approach?

RESEARCH DESIGN

The study made use of descriptive method of research to determine the use of Heuristic approach in teaching science among Grade 8 students of public secondary schools in Area IV, Division of Batangas.

The descriptive research is essentially a method of quantitative description of the general characteristics of a group under investigation (Reyes, 2004). This method includes the gathering of data regarding current conditions and ascertaining what is typical or normal under specific conditions. The researchers used the questionnaire as the instrument in gathering data.

Subjects of the Study

The respondents of the study were 30 Science teachers and 356 Grade 8 students from public high schools in Area IV, Division of Batangas. No sampling method was used to determine the number of teacher respondents. The student respondents were selected through random sampling. Table 1 shows the distribution of respondents by school.

Data Gathering Instrument

The researchers made use of a constructed questionnaire as major instrument in gathering the data. This served as the main tool to generate data, to determine the use of Heuristic approach in teaching science.

Construction of the Questionnaire. The researchers constructed a questionnaire which was the primary gathering instrument. They reviewed books, journals, magazines and related studies to gain insights on concepts which could be used as bases of items for the instrument.

The questionnaire has two parts. Part I covered the usefulness of Heuristic approach in teaching-learning process. Part II consisted of constraints met by teachers in utilizing Heuristic approach. The adviser examined and analyzed each item carefully and offered suggestions to improve the questionnaire. After going through the items with no corrections done, the researchers were advised to reproduce it for validation.

Validation of the questionnaire. The questionnaire was distributed to some experts for further content validation. There were some modifications on the questionnaire item to clearly define the specific problems of the study. Additional comments and suggestions were given by the experts to improve the items. Final draft of questionnaire was prepared with all the suggestions given by the experts in field. After complying with the suggestions, the questionnaire was presented again to the adviser who approved the reproduction and distribution of the questionnaire.

Administration of the questionnaire. Upon the approval of the principal, the copies of the questionnaire were distributed personally by the researchers to the teachers and Grade 8 students of public high schools in Area IV, Division of Batangas. The assistance of science teachers was sought to facilitate the administration of the instrument and in the retrieval of the filled-up questionnaire.

Interview. As the questionnaire was given, the researchers asked questions to the participating teachers to tell the reasons why the students have a difficulty in learning science subject and also the other constraints that they encounter.

Scoring of the responses. The responses of science teachers and grade 8 students were tallied, scored and tabulated for statistical treatment. The items in the questionnaire were scored as 4 being the highest score to 1 as the lowest score. These were provided with equivalent verbal interpretation.

Questionnaire Part I

Option	Scale/Range	Verbal Interpretation
4	3.5-4.00	Very Useful
3	2.5-3.49	Useful
2	1.5- 2.49	Moderately Useful
1	1.00-1.49	Not Useful

Questionnaire Part II

Option	Scale/Range	Verbal Interpretation
4	3.5-4.00	Always Met
3	2.5-3.49	Often Met
2	1.5- 2.49	Sometimes Met
1	1.00-1.49	Never Met

DATA GATHERING PROCEDURE

In order to gather the needed data, a letter of request was sent to the Schools Division Superintendent of Batangas Province to ask permission to conduct study in the said division. Upon the approval, the researchers sent a letter of request to the principal of each school. Having been granted the necessary permit, the researchers went to every school for the administration of the questionnaire. The researchers explained the purpose of the study and discussed some important details. Through the help of the science teachers, the questionnaires were distributed to the student-respondents. An interview for teachers was conducted regarding the reasons why students have difficulty on learning science subject as well as the constraints they met upon implementing Heuristic approach. The filled- up questionnaire were retrieved after three days. Responses were tallied, scored and tabulated for statistical treatment of data. The assistance of statistician was secured to ensure precision of statistical decision, computation and tabulation.

Statistical Treatment of Data

The following statistical tools were used to treat data in this study.

Independent T-Test. This was used to determine the differences in the responses of teachers and students in the usefulness of Heuristic approach.

Ranking. This was used to determine the positional importance of the responses in the questionnaire.

Weighted Mean. This was used to determine the assessment of teachers and students regarding the usefulness of Heuristic approach in teaching and learning process as well as the constraints met by teachers in utilizing Heuristic approach.

RESULTS AND DISCUSSION

Distinct Features of Heuristic Approach

Heuristic approach was different from other teaching approaches. This approach promotes self-discovery among students with less teacher manipulation and requires hands on and minds on activity. It is used not only in teaching scientific subjects like Mathematics, Physics, Chemistry and Nature Study, but in all subjects of the curriculum. Heuristic approach opposed to dogmatic techniques of teaching, where student are passive learners. This may be applied to inductive as well as deductive lessons and thus heuristic approach is problem- solving.

Heuristic approach uses readily accessible, though loosely applicable information to be used in problem solving in Science and Mathematics. Philosophers of science have emphasized the importance of heuristics in creative thought and constructing scientific theories. There are some examples of real-life heuristics that teachers use as a way to solve a problem or to teach something:

First, Consistency heuristic is a heuristic where a person responds to a situation in a way that allows them to remain consistent. Though an educated guess a person considers what they have observed in the past and applies that history to a situation where a more definite answer has not yet been decided. Second, Absurdity heuristic which is an approach to a situation that is very atypical and unlikely – In other words, a situation that is absurd. This particular heuristic is applied when a claim or a belief seems silly or seems to defy common sense. Third, Contagion heuristic is a heuristic which applies a broad approach to solve a certain problem. It is a simple heuristic that allows an individual to make an approximation without having to do exhaustive research. Fourth, Availability heuristic that allows a person to judge a situation on the basis of the examples of similar situations that come to mind, allowing a person to extrapolate to the situation in which they find themselves. It allows a person to solve a problem by assuming that they have already solved it and working backward in their minds to see how such a solution might have been reached. Fifth, Familiarity heuristic that allows someone to approach an issue or problem based on the fact that the situation is one with which the individual is familiar, and so one should act the same way they acted in the same situation before. And lastly, Affect heuristic is when someone makes a snap judgment based on a quick impression. This heuristic view a situation quickly and decides without further research whether a thing is good or bad. Naturally, this heuristic can be both helpful and hurtful when applied in the wrong situation. (<http://c2.Heuristic.com>)

The aim of this approach is to develop the scientific attitude and spirit in students. The spirit of inquiry prompts the pupils to learn. This approach insists on truth, whose foundation is based on reason and personal experiences. As a matter of fact, there is no spoon-feeding or more acceptances of facts which are given by the teacher. An eminent educationist has pointed out that the object of the heuristic approach is to make pupils more exact, more truthful, observant and thoughtful to lay this solid foundation for future self-education and to encourage this growth of spirit of enquiry and research.

Assessment of Teachers and Students on the Usefulness of Heuristic

Approach in Teaching and Learning Process

Teachers and students play a great role in assessment of teaching approaches since they are the main actors of the curriculum and they serve as one of the stakeholders in curriculum development. Teacher and students assessed Heuristic Approach to check if it is useful in teaching and learning process. Table 2 presents the assessment of the teachers and students on the usefulness of heuristic approach in teaching and learning process.

As seen in the table, teachers assessed that Heuristic approach is moderately useful in establishing a lively classroom, ranked first with a weighted mean of 1.87. According to the respondents, Heuristic approach promotes interactive activities which develop communication skills of the students. This idea affirms with Holbrooke in which science learning includes the development of thinking skills, social and emotional well-being as well as communication skills. This made students developed their interest to actively participate into the class. Therefore, students' interests are aroused by individualized and intensive experimental activities.

Also assessed as moderate useful by the teacher-respondents, was that the Heuristic approach enhances students' abilities and skill needed in the hands on activity, weighted mean of 1.83, ranked second. Likewise, this approach promotes hands on and minds on learning process. This conforms to the study of Medina and Balse which discussed hands on experiences which makes the students think and express their own ideas. Therefore, Heuristic approach was important in teaching science which requires actual experiments and demonstrations. It allows the students to engaged in a real-life and actual situations for them to easily understand the lesson and acquire knowledge efficiently.

The teacher-respondents likewise noted that Heuristic approach promotes real life environment to capture students' interest, weighted mean of 1.80 ranked third. It means that students learned in realistic scenarios which develop their psychomotor domain. This supports the study of Aquino who stated that students learned from exploring real-life problems/situations and challenges and they are the owners of their own learning. Likewise, this could made students build up their self-confidence and self-reliance. This is a manifestation that Heuristic approach provides the avenue for the students to develop and acquire new things through exploring and discovering by their own.

Ranked fourth by the teacher-respondents was their assessment that Heuristic approach was moderately useful in allowing the students to determine their own strengths and weaknesses, weighted mean of 1.77. This allowed the students to assess their personality, abilities and interest. According to the respondents, determining students' strength and weaknesses was an essential part in teaching and learning process. This seems to be the most crucial part in the use of Heuristic approach due to the various intelligences and learning styles of the students.

As disclosed by the teacher agreed to a moderate extent, Heuristic approach encourages self-learning among students and allows the students to experience and discover solutions to the problems on their own, each with 1.70 weighted mean and both on the seventh rank. This indicated that the teachers facilitate, supervise and guide the students in the learning process. This affirms Pollion and Dankar who cited that students must try to find out the relevant solutions based on some logic and learn by self-experience. This indicated that Heuristic approach requires critical thinking and good analytical skills.

Also assessed by the teacher-respondents, Heuristic approach was moderately useful in utilizing students' creative and critical thinking and emphasizes learning by doing throughout the teaching and learning process, each with 1.63 weighted mean and 10.5th ranks. The results revealed that students must enhance their creative thinking skills for them to easily come up for a solution on a problem encountered. This supports the idea of Salazar who cited that students must use their creative and critical thinking skills to solve logical problems. Therefore, critical and creative thinking skills are very important and a necessity for the students to learn and to gain new knowledge under this approach.

Ranked 12th by the teachers who assessed that Heuristic approach was moderately useful in developing the value of appreciation and patience among students, weighted mean of 1.60. According to teachers, students'

affective domain was also touched by Heuristic approach which indicated that this is a holistic teaching approach that develops the whole child. Therefore, this approach touches and develops the state of well-being of every learner and also exemplifies that this approach was really useful and effective in Science teaching

Also assessed by the teacher-respondents that Heuristic approach was moderately useful in enabling the students to comprehend, react, relate and compare their learnings, weighted mean of 1.57 and rank 13th. This indicated that students undergo cooperative learning. They learned individually and shared what they have learned to others. It means that cooperative and collaborative learning are significant in Science teaching and learning.

The last in rank order distribution as assessed by the teacher-respondents, Heuristic approach was moderately useful in developing the students' value of responsibility on their own learning, weighted mean of 1.50. According to teachers, group members depend only on their leader in every group activities. This is a manifestation of negative impact on students which made them dependent and irresponsible. Hence, it is more suitable for the teachers to employ individualized and intensive self-discovery activities among the students. It will help them to assess the progress and weaknesses of their students.

To sum up, the teacher-respondents assessed that Heuristic approach was found to be moderately useful in teaching science with 1.66 composite mean. This is a manifestation that the teachers found this approach useful and effective since it promotes self-discovery, investigation, problem-solving and the use of real-life scenarios which were all needed in an effective and efficient science teaching process.

On the other hand, the student-respondents assessed that Heuristic approach was moderately useful in emphasizing learning by doing throughout the teaching and learning process, ranked first with a weighted mean of 1.88. According to the respondents, Heuristic approach was really helpful in implementing individualized activities which develops students' skill in investigation and discovery. This idea supports the study of Villamin that Heuristic approach sets on the track of learning by doing and self-discovery. This made the students develop their sense of responsibility and confidence towards the learning activities.

Also assessed by the student-respondents, Heuristic approach was moderately useful in encouraging self-learning among students, weighted mean of 1.79, ranked second. Likewise, teachers serve as facilitators of learning which they allow their students to discover for themselves. This conforms with Duena, teaching should be consistent with the nature of scientific inquiry and should engage students actively. This is a sign that Heuristic approach was applicable in teaching science which requires self-discovery and sole learning.

The student-respondents likewise noted that Heuristic approach allows the students to determine their own strengths and weaknesses, weighted mean of 1.76 ranked third. This is a manifestation that students appreciate the value of self-evaluation which was an essential part of learning. Likewise, this could made students build up their self-confidence and self-reliance as well as their positive views towards the essence of individualized learning.

Ranked fourth by the student-respondents was their assessment that Heuristic approach was moderately useful in allowing the students to experience and discover solutions to the problems on their own, weighted mean of 1.67. This indicated that students developed their curiosity towards different problems and real-life situations. This affirms Scott who emphasized that discovery method was really a need in learning. Through the inductive procedure, one may arrive at a fact, principle, truth, or generalization. Likewise, students eventually develop their analytical and critical thinking skills.

Also assessed by the student-respondents, Heuristic approach was moderately useful in promoting real life environment to capture students' interest, weighted mean of 1.63 and rank 7th. This is a manifestation that heuristic approach was somewhat effective in capturing the attention of the students because real-life examples were really captive and students can relate on it.

Ranked eighth, the students considered Heuristic approach as moderately useful in developing students' value of responsibility on their own learning, weighted mean of 1.68. This indicated that both teachers and students noted that Heuristic approach did not develop student's sense of responsibility. Students are dependent on their group leader and they were not interested to participate. Thus, teachers are held responsible in selecting and implementing the best individualized activities for the learners.

Assessed by the students-respondents, Heuristic approach was moderately useful in establishing a lively classroom, weighted mean of 1.57 and ranked 11th. This is a manifestation that teachers must provide good motivational activities as well as interactive games for the students to enhance their interest towards the subject. This affirms to Svinicki who cited that instructors who understand student motivation can greatly enhance the classroom experience and student performance. Teachers can affect student motivation in ways that either facilitate or impede learning.

Teacher-respondents assessed that Heuristic approach was moderately useful building up students' point of view towards the topic, with 1.56 weighted mean and 12th ranked. The results revealed that teachers must exert extra effort in developing their student's point of view. This idea supports Lardizabal who emphasized that it is the sole responsibility of the teachers to develop the point of view of the students on the subjects through attainable objectives and well-planned activity. Therefore, Heuristic approach possessed the innate characteristics of being motivational in such a way that it stimulates the interests of the students towards the topic.

Also assessed by the student-respondents, Heuristic approach was moderately useful in utilizing students' creative and critical thinking, weighted mean of 1.52 and rank 13th. This indicated that students noticed that their cognitive skills were not developed by this approach. According to teachers, a student does not engage on class activities because they do not like to work alone. Thus, the flexibility of this approach was seems to be very important because teachers can manipulate or even formulate new learning activities to motivate the students aligned with this approach.

The last in rank order distribution as assessed by the students-respondents, Heuristic approach was moderately useful in encouraging cooperation and collaboration among students, weighted mean of 1.48. According to teachers, group members depend only on their leader in every group activity. This is also manifestation of negative impact on students which made them dependent and irresponsible.

To sum up, the student-respondents assessed that Heuristic approach was found to be moderately useful in learning science subject with 1.64 composite mean. This indicated that students found out that Heuristic approach was essential in learning process since it emphasized discovery learning, investigating, problem-solving, creative thinking, critical thinking and self-evaluation. These findings affirm to the study of Manicdao who reiterated the problem solving and experimentation skills of students. They use different strategies to show the unknown and learn something by doing.

Comparison of the Assessment of Teachers and Students in the Usefulness of Heuristic approach.

Heuristic approach was said to be useful in teaching Science because it intends to set the learner themselves on the track of invention and to direct them into the paths in which the author has made his own discoveries. The assessment of the teachers and students regarding the usefulness of Heuristic approach are compared in this study.

Table 3 presents the comparison of the responses of teachers and students regarding the usefulness of heuristic approach in teaching and learning process. In the comparison of the assessment of the teachers and students in the usefulness of Heuristic Approach, there is significant difference in the responses of teachers and students regarding establishing a lively classroom. This means that Heuristic approach is not that useful in establishing a lively classroom based on the result having a t_c of 2.003 and a p -value of 0.046 it was rejected and said to be significant.

Students revealed that during the activity proper, the students will just do their own work. Thus, there is no longer interaction among the student except from group activities. On the other hand, the teachers thought that they had already given their part. From this finding, it could be inferred that there is a need for Heuristic activities that would establish a lively classroom.

This finding supports Magsaysay as she determined the issues and the problems in science teaching that served as her basis in developing intervention program which aimed to strengthen the communication and computational skills of students.

Constraints Met by Teachers in Utilizing Heuristic Approach

The constraints met assessed by teachers in utilizing Heuristic approach will be useful for the researchers in determining the shortcomings of this approach. Table 4 shows on to what extent does the teacher met these constraints. It can be gleaned from the table that teacher-respondents sometimes met that Heuristic approach requires a lot of time doing the activities and for the expensive learning materials and specimens which was often met, each with weighted mean of 3.63 and ranked 1.5th. This indicated that the individualized activities in Heuristic approach was the main problem encountered by the teachers maybe because students will work alone so they tend to finished the work within a long period of time. This affirms Polya who cited that teachers must find good solutions of difficult problems in reasonable time. Therefore, the skills of the teachers as well as the students are very important in the success of the teaching and learning process.

Teachers agreed that they always experienced limited accomplishment activities due to time constraints and conflicts, weighted mean of 3.60 and ranked third. Individualized activities for self-discovery requires a lot of time to be accomplished since the student should investigate, analyze, interpret and solve the problem on their own. One of the crucial parts of utilizing Heuristic approach is the selection and application of the learning activities, hence it is the sole responsibility of the teachers to properly select the best activity that is suitable and attainable for the learner.

The last in rank order distribution as assessed by the teacher-respondents agreed that they sometimes observed the student's lack of motivation, weighted mean of 3.03. Majority of the constraints met by teachers were all affected by the objectives, methods and techniques used in teaching and instructional materials used. This conforms to the study of Donquines which revealed the difficulties in teaching science and the study of Magsaysay revealed the issues in teaching science. Therefore, motivation for the students must be the focus, the teachers provide good and interesting activities for the students as well as attainable learning objectives.

Supplementary Materials for Maximum Utilization of Heuristic Approach.

The findings of the study revealed that the item establishing a lively classroom as the usefulness of heuristic approach was rejected and said to be significant. The supplementary materials to be made were activities that will establish a lively classroom using Heuristic approach.

The problem behind this study was the low percentage scores in science category from National Achievement Test (NAT) of Grade 8 students from national high schools in Area IV Batangas. The result of the survey shows that heuristic approach was said to be useful in teaching and learning process but not that highly used and implemented due to many constraints met by teachers. Based from the findings, one of the shortcomings was that Heuristic approach does not establish a lively classroom. Thus, the researcher's output of the study is making supplementary material that was composed of activities that promotes a lively classroom with the use of heuristic approach.

The supplementary material was designed to offer the students with motivating, exiting as well as experimental activities to understand concepts, facts and ideas in Science which establish a lively classroom. The supplementary materials made are: PowerPoint presentation, study guide, experimental activities and interactive games. The study guide and experiments include the objectives, materials needed, process and learning outcome.

Conclusion

Based from the findings the following conclusions are drawn: Heuristic approach promotes learning by doing which a student engage on problem solving that takes one's personal experience and reason as a foundation. Both teachers and students agreed to a moderate extent on the usefulness of Heuristic approach in teaching and learning process. There is no significant difference between the assessment of teachers and students in the usefulness of Heuristic approach. Science teachers met constraints such as the expensiveness of materials to be used and insufficient time to accomplish an activity to a great extent. The supplementary materials are essential for maximum utilization of Heuristic approach.

Recommendations

In the light of the findings and conclusions of the study, the following recommendations are hereby endorsed. The researchers made supplementary materials may be used to enhance the utilization of Heuristic approach as well as to solve the shortcomings of this approach. The science teachers should develop more their strategic skills to further get students' attention. Similar study may be conducted to reinforce the science teaching and learning process.

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