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Filipino Students' Preferred Motivational Strategies in Science: A Cross-Sectional Survey

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Abstract

A multitude of strategies are being utilized by the teachers to engage students in the classroom activities and foster critical thinking which can ignite their interest in the lesson. However, very few researches have been conducted on students' preferences in these different motivational strategies. This cross-sectional survey research explores the preferred motivational strategies in science instruction among 106 high school students in a public secondary school in Zambales, Philippines. The motivational strategies were classified based on Howard Gardner's theory on multiple intelligences. The study found out that the students moderately preferred visual-auditory (M=2.88), logical-mathematical (M=2.70) and kinesthetic (M=2.60) motivational strategies. Science trivia, picture presentation, and mini labwork are the most common motivational strategies used by Science teachers. The study recommends that teachers may utilize engaging, relevant, and learner-centered motivational strategies to make Science instruction more alive and more effective. The use of varied strategies to arouse students' interest may also be observed to cater the students' multiple intelligences.

Keywords

Cross-sectional survey, motivational strategy, pedagogical enhancement plan, Philippines, science teaching

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Introduction

A functioning method for learning through persuasive methodologies incorporates a wide cluster of exercises. The students are profoundly energetic and increasingly engaged with the learning procedure if they enjoy what they do. A large number of techniques are being used by the instructors to stir students' interest and motivation in the classroom activities. These techniques can be visual-auditory in nature, logical-mathematical or kinesthetic. Moreover, the use of technology is being utilized by science teachers to arouse Generation Z students' interest in the pedagogical cycle. Through motivational strategies utilized by the teachers, the students see better ideas and see learning as a pleasant endeavor (Hampden-Thompson & Bennett, 2013; McNeal, Petcovic, & Reeves, 2017;). Previous literature has focused on identifying teachers' motivation to teach in science (McNeal, Petcovic, & Reeves, 2017), motivating factors of different instructional strategies in science (Abrahams, 2009; Abrahams, & Millar, 2008), and student motivation in science (Barmby, Kind, & Jones, 2008; DeWitt & Osborne, 2008; Maltese & Tai, 2010; Osborne, Simon, & Collins, 2003; Porter & Parvin, 2008; Shirazi, 2017). However, very few studies have been conducted to explore the preferences of students on the different motivational strategies employed in science instruction.

In the Philippines, the K12 science curriculum stresses that science and innovation should be put in ordinary human issues. It coordinates science and innovation in the social, financial, individual and moral parts of life. The science educational programs advance a solid connection among science and innovation, including indigenous innovation, subsequently protecting the nation's social legacy. Science content and science processes are entwined in the K to 12 Curriculum. Without the substance, students are experiencing issues using science process abilities since these procedures are best learned in setting. Organizing the curriculum around situations and problems that challenge and arouse learners' curiosity motivates them to learn and appreciate science as relevant and useful. As opposed to depending entirely on course readings, fluctuated hands-on, minds-on, and hearts-on exercises were utilized to build up students' advantage and let them become dynamic students (K to 12 Science Curriculum Guide, 2016). Rogayan (2019) reiterated that the science education in the Philippines confront a myriad of changes in terms of curricular approach brought about by globalization, new industrial era or the Industry 4.0, Association of Southeast Asian Nations (ASEAN) integration, and K to 12 full implementation.

With these multitudes of challenges, Science educators are expected to make science learning more relevant and more engaging. Documenting the different motivational strategies in science teaching will facilitate better designing of learning plans for implementation. Understanding the students' preferences on this pedagogical aspect may further enhance the delivery of content in science. Thus, selection of innovative and appropriate strategies for arousing the students' interest is deemed indispensable. Dornyei (2001) expressed that motivation concerns about the bearing and extent of human conduct, that is first the decision of a specific activity, second the determination with it, and the third the effort exhausted on it. Motivation is a standout amongst the most significant instrument to help an individual towards personal growth. It is something students need once a day.

Without motivation, students will not be able to fully grasp the content they are learning. Exceptionally motivated students are completely occupied with the classroom assignments, participative in class dialogue and dynamic in the learning exercises. Consequently, educators must engineer fitting motivational techniques that would suit both the learning style and interest of the students. Further, motivational strategies help the learning process of the students to maintain balance while studying at the same time with fun in some sorts of activities. This method is used to make the students more attentive and not to get bored. Also, it helps to motivate students to perform their utmost interest in Science and other subjects and to deepen their thinking.

Due to the gaps presented, the present study explores the different motivational strategies preferred by the Science students as well as their observations on the common motivational strategies employed by their teachers. The study will serve as baseline information for Science teachers for them to design engaging and fun learning activities through employing effective motivational strategies. The research questions of this study are the following: (1) What are the preferred motivational strategies (visual-auditory, logical-mathematical, and kinesthetic) of students? (2) What are the common motivational strategies of the Science teacher as observed by the respondents?; and (3) What are the pedagogical implications of the study?

Literature Review

Conceptual framework

This study is based on the Maslow's Theory of Motivation (Maslow, 1943) which posits humans are motivated by a hierarchy of needs in which a person must meet one need to move to the next need. Maslow's (1943) theory argues humans are motivated in achieving certain needs, thus as one of these is fulfilled the person was seek to fulfil the next need. Likewise, the study is anchored on multiple intelligences theory introduced by Gardner (1991 as cited in Gardner & Hatch, 1989). Gardner (1991) pointed out; the multiple intelligences theory is a psychological theory of the mind. It is a critique of the notion that there is a single intelligence which we are born with, which cannot be changed, and which psychologists can measure. It is based on a lot of scientific research in fields ranging from psychology to anthropology to biology (Gardner & Hatch, 1989). This means that this theory is based on findings of the study of the mind. It gives importance to the abilities-intelligences in each individual. The theory of multiple intelligences has an important role in the field of teaching and learning. This is because there is a relationship between each part of multiple intelligences and the learning process. This relationship can help teachers to illustrate their opinions in curriculum, instruction, and assessment. The following intelligences were identified by Gardner (1991): verbal-linguistic, logical-mathematical, visual-spatial, bodily-kinaesthetic, musical, interpersonal and intrapersonal. In the context of the study, the motivational strategies were divided into three multiple intelligence groups such kinaesthetic, visual-auditory and logical-mathematical (Figure 1)

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Figure 1. *The research paradigm*

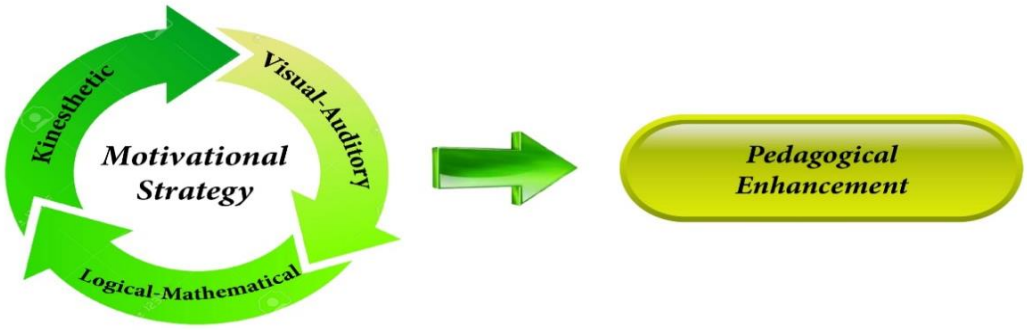

Figure 1 shows the preferred motivational strategies in science in terms of three aspects, the visual-auditory, logical-mathematical, and kinesthetic, which serve as a basis for the pedagogical enhancement plan towards a high-quality science education.

Motivational strategy

Motivational strategy is an approach by which a teacher employs at the start or even during the instruction. It is an essential part of any lesson specifically in Science. As indicated by Ryan and Deci (2000), to be motivated intends to be moved to accomplish something. An individual who feels no driving force or motivation to act is along these lines portrayed as unmotivated, while somebody who is stimulated or actuated toward an end is viewed as propelled. In the classroom setup, student motivation alludes to how much a student places efforts into and centre on learning so as to accomplish effective results. Motivation and engagement are very important for sound student learning.

In an investigation of Sabroso and Mina (2013), they referenced that interests and motivation are the ideal student qualities which are the significant determinants of learning. This examination concentrated on the favoured learning motivation system of Grade Six pupils as a reason for educational modules upgrade. A distinct technique was utilized to decide the reasons for poor execution of students in the National Achievement Test (NAT) for the 6th graders led by the Department of Education-National Educational Testing and Research Centre or NETRC and the learning motivation of the pupils. The investigation uncovered that a portion of the reasons for the poor achievement of pupils were because of absence of inspiration on account of the flimsy harmony and request circumstance, destitution, lacking instructor student proportion and the restricted learning assets in some government funded schools. An investigation in the local community that plans to discover an answer on the most proficient method to raise the consideration of the pupils as a learning motivation methodology through dynamic support, variability, humour, incongruity and conflict, a particular model and inquiry is much prescribed. The findings of this study could give teachers better ideas to come up with a more appropriate, more learner-centred and more relevant motivational strategies that could arouse students' interest in science.

Pedagogical enhancement

The success of any curriculum lies in its implementation or in the actual pedagogical process. The pedagogical enhancement is always at the core goal of each teacher. Pedagogy was for quite a while generally connected with the process of educating students. Learning should be transmitted to the students, and academic inquiries hovered around reasonable ways for educators to train the students. During the 1970s, academic research interest emerged concerning how students learn (Entwistle, 2009). Lueddeke (2003) demonstrated that educators who instruct in the hard disciplines, for example, the physical sciences, building and medication, were bound to apply an instructor-focused way of teaching, while educators from delicate disciplines (for example, sociologies and humanities) adopted a more learner-focused strategy to instruction. Hence, teachers must be able to employ learner-centred approach to teaching and one way to do that is to apply innovative, engaging and fun motivational activities in science instruction.

Methodology

Research design

This study used a cross-sectional survey design to describe the preferences of the students on different motivational strategies employed in Science instruction. A cross-sectional study describes a group of subjects at one particular point in time (Campbell, Machin, & Walters, 2007). The cross-sectional survey design was used to easily determine the students' most and least preferred motivational strategies on science learning. This design is usually comparatively quick and easy to conduct. The results of the survey were triangulated through random informal interview to select respondents on why they prefer a certain motivational strategies.

Respondents and locale of the study

The study involved a total of 106 students from a government-run secondary school in the Schools Division of Zambales, Department of Education Philippines. The study employed the multi-stage sampling technique wherein the researcher selected 5 sections in Grade 7 classes and chose 10 students per section using random sampling. The respondents of the study must meet the following selection criteria: (1) current enrolled in the school for AY 2016-2017; (2) bona fide Grade 7 student; (3) enrolled in a Science course; and (4) willing to take part in the study. The respondents are composed of 50 males and 56 females, aged 11-14, residing in southern Zambales, Philippines. An informed consent was secured among the respondents before the actual data gathering.

Research instrument

The researchers utilized a researcher-developed survey questionnaire as a primary tool for gathering data. The tool has three parts. The first part contains the simple

demographic profile of the respondents in terms age, sex, and residence. The second part contains the different motivational strategies employed in science classes. This part is composed of 20 items which were determined during the pre-survey conducted in one public secondary school. The motivational strategies were divided by the researchers into three categories based from Gardner's (1991) principles which include visual-auditory (6 items), logical-mathematical (7items) and kinesthetic motivational strategies (7 items). The third part of the tool asks the respondents to enumerate the most common motivational strategies employed by teachers in their science classes. The researchers formulated the questionnaire and requested the assistance of experts for its content and construct validation, and tried it to the group of non-respondents for the purpose of testing the reliability of the items. Modifications and further improvement of the items were done with the assistance of the experts before the reproduction of the final copies of the questionnaire. The Cronbach alpha value of the tool was 0.890 which indicates high reliability.

Data gathering procedure and analysis

Pre-survey. The researchers gave a formal letter to the school principal requesting permission to conduct the study. Prior to the administration of the survey questionnaire to the students, an informed consent was secured for ethical purposes. *Survey Proper. The* survey questionnaire was personally administered by the researchers to the student-respondents. The researchers explained the different motivational strategies before they indicate their degree of preference. *Post-survey.* The retrieval of the questionnaires was done immediately after 20 minutes. The statistical tools used in the study include frequency counts, percent, weighted mean, and standard deviation. The rating scale interpretation is as follows:

Table 1. *The rating scale interpretation*

Scale	Interval	Qualitative Interpretation (QI)
4	3.50 – 4.00	Highly Preferred
3	2.50 – 3.49	Moderately Preferred
2	1.50 – 2.49	Slightly Preferred
1	1.00 – 1.49	Not Preferred

All the data were run through MS Excel Tool Pack Kit 2013 and Statistical Package for Social Sciences (SPSS) v. 22.

Findings and Discussion

The study determined the preferred motivational strategies of Grade 7 Science students in terms of visual-auditory, logical-mathematical, and kinaesthetic. These motivational strategies are employed by Science teachers prior to or during the actual teaching-learning process (Table 2).

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Table 2. *Motivational strategies employed by science teachers*

Classification	Motivational Strategy	Description of the Strategy
Visual-Auditory	4 pics 1 word	Students will identify the science word represented by the four pictures displayed using the set of letters given below the pictures.
	Video clips/short film	Allows students to watch a short motion picture or short film about any science topic then share their reflections and personal insights afterwards.
	Science Jingle /science song	Students are given the opportunity to listen to or compose a short science jingle or science song and perform it in front of the class.
	Narration	It allows the teacher or the students to tell a short science story, science article or science information to the class.
	Picture Presentation	Students show, describe, or explain their understanding of the given photo to the class.
	Puzzle	Allows students to put pieces together in a logical way, in order to arrive at the correct solution of the puzzle which tests their ingenuity or knowledge in scientific facts, concepts or information.
Logical-Mathematical	Brainstorming	Allows students to engage in a production of a scientific idea or way of solving a problem by holding a spontaneous group discussion.
	Crossword puzzle	Students are tasked to solve a puzzle by forming a word or phrases being described in the question.
	Quiz bee type	It provides an engaging platform for students to a form of game in which a group of students (usually two to five) attempt to answer science questions correctly.
	Riddles/brain teasers/logic	A form of puzzle which allows students to think critically and logically to come up with the answer.
	Science Trivia	Students are given a piece of information or facts about science which are of interest to them.
	Text twist	Students are tasked to construct words from the jumbled letters which are usually twist and turn.
	Thought-Provoking question	Refers to a challenging question which allows students to think deeper, especially about things they have not thought about before.
Kinesthetic	Bingo	Students engage in a card game which they need to complete based from a certain form or pattern.
	Charades/Pinoy henyo	Allows students to engage in a word-guessing game by acting out each syllable of a word or phrase in order, followed by the whole phrase together, while the partner or rest of the group guess the word.
	Manipulation	Refers to the skillful handling, controlling or using of laboratory equipment, tool or material in class.
	Matching object	Allows students to match the given objects, items or examples, correctly.
	Mini labwork	Students engage in a form of a mini-experiment performed in the laboratory.
	Relay (pass the message)	Refers to an act of passing something, like object or message, along from one person, group, or station to another.
	Role playing/skit	Students are given the opportunity to apply science principle as they are put in a short acting or role performance.

Table 2 shows the different motivational strategies used in Science instruction in the Philippine setting. These strategies were identified by the researchers in a pre-survey conducted in in select schools in the schools division. The classifications of the strategies were made by the researchers based on Gardner's multiple intelligence principle. These motivational strategies are limited only to the pre-survey conducted. Other motivational strategies may be further document in the next studies. Tuan, Chin, and Shieh (2005) averred that research in science teaching and learning should address not only student cognition, but also the affective component to cognition such as motivation. Teachers in Science must have the proficiency to select appropriate strategies to motivate students to engage in the daily science lessons.

Students' preferred motivational strategies in science

The students were asked to rate their degree of preference in the three-category motivational strategies employed in their Science classes through a four-point survey tool.

Visual-auditory motivational strategies, as shown in Table 3, the visual-auditory motivational strategies are "Moderately Preferred" by the students with the overall mean of 2.88 and standard deviation of 0.05. Under this category, puzzle (M=3.32) ranked first among the different motivational strategies followed by 4 pic 1 word (M=3.24) and video clips/ short film (M=3.04). This suggest that students are fond of completing visual puzzles, working on picture-word activity and watching motion picture such as short videos. These strategies stir their interest to engage in their science classes. Meanwhile, students slightly preferred science jingle/science song (M=2.29) and narration (M=2.40) as motivational strategies.

Table 3. *Students' preferred motivational strategies*

Motivational Strategies	Mean	*SD*	QI
Visual-Auditory			
4 pics 1 word	3.24	1.01	MP
Video clips/short film	3.04	1.03	MP
Science jingle /science song	2.29	1.09	SP

Table 3. *continued…*

Narration	2.40	1.02	SP
Picture Presentation	2.97	1.05	MP
Puzzle	3.32	0.91	MP
Mean	2.88	0.05	MP
Logical-Mathematical			
Brainstorming	2.56	1.09	MP
Crossword puzzle	3.06	0.97	MP
Quiz bee type	2.75	1.01	MP
Riddles/brain teasers/logic	2.94	1.01	MP
Science Trivia	2.53	1.07	MP
Text twist	2.77	1.03	MP
Thought-Provoking question	2.32	0.98	SP
Mean	2.70	0.04	MP

Table 3. *Continued…*

Kinesthetic			
Bingo	1.86	1.02	SP
Charades/Pinoy henyo	2.92	1.04	MP
Manipulation	2.00	0.99	SP
Matching object	3.01	1.06	MP
Mini lab work	2.58	1.04	MP
Relay (pass the message)	3.13	1.00	MP
Role playing/skit	2.71	1.05	MP
Mean	2.60	0.02	MP
Overall	2.72	0.04	MP

Legend: Highly Preferred (HP) 3.50-4.00; Moderately Preferred (MP) 2.50-3.49; Slightly Preferred (SP) 1.50-2.49; and Not Preferred (NP) 1.00-1.49.

Teaching and learning process should be accentuated by students' engagement specifically in science learning. The student has the probability of taking all procedures to be a scientist (Gamanik, Sanjaya, & Rusyati, 2019). With appropriate motivational strategies, students will be able to master the content and eventually apply it to their daily lives.

Logical-mathematical motivational strategies. The table 3 shows that the respondents "Moderately Preferred" logical-mathematical motivational strategies with the overall mean of 2.70 (SD=0.04). The crossword puzzle (3.06), riddles, brain teasers and logic (M=2.94), and text twist (M=2.77) are the most preferred motivational strategies by the students under the logical-mathematical category. However, students least preferred the thought-provoking question (M=2.32). This connotes that the students love to work on crossword puzzle and text twist which involves science terms and concepts. They also enjoy solving riddles, brain teasers, and logic activities which are very relevant and congruent to science lessons. The logical-mathematical strategies are seen by the students to be good for their brain, thus they perceive them as exercise for their brain and help enhance their intelligence quotient (IQ).

The least preferred strategy under this category was the thought-provoking question which implies that students need to understand better that critical questions and high-order thinking questions are essential in the deeper understanding of science concepts and principles. Science teachers are encouraged to promote critical thinking in science classes through the use of divergent questions.

This corroborates Gardner's (1991) findings that that numerical knowledge comprises of the capacity to recognize designs, reason deductively and think sensibly. This intelligence is frequently connected with logical and scientific reasoning. Further, viable utilization of consistent scientific knowledge would empower kids to conceptualize augmentation's relationship to different tasks, to be specific, as repeated addition and as the reverse of division. This knowledge additionally underlies the advancement and verbalization of reasoning methodologies (Kaput, 1989).

Kinesthetic visual motivational strategies. The table shows that the kinesthetic visual motivational strategies are "Moderately Preferred" by the students with the overall

mean of 2.60 (SD=0.02). Most preferred strategies are relay (M=3.13), matching object (M=3.01), and charades/ Pinoy henyo (M=2.92). This suggests that students love to use their body to learn science concepts. They easily retain the lessons if they use their body in the process. One respondent shared, "these strategies are easy to play and very helpful for my learning." Some said that they learn new things from the different motivational strategies employed by their teacher. Meanwhile, bingo was the least preferred by the students. They slightly preferred bingo because it is time-consuming and they perceive it as not age-appropriate. The vast majority of the educational games that are out there today are really flash-cards. They are celebrated drill-and-practice. They don't have the profundity and rich account that really captivating computer games have (Carr-Chellman, 2010).

The findings of the study support the study of Sarmiento (2010) that hands-on in kinesthetic learning experiences was appeal to the visual-auditory senses as a natural subject in teaching science. Youngsters with solid substantial sensation utilize their bodies in exceptionally separated approaches to create and express ideas. Kinesthetic or tactile learners like movement and work with touchable objects. They appreciate customary breaks and move around the room (Oxford & Celce-Murcia, 2001). In the same vein, drama-typed activities such a role play can support the learning of cognitive, affective and technical objective especially higher-order thinking skills related to analysis, synthesis and evaluation (Anderson, 2001). The findings of the support is also parallel with the claim of the National Research Council (1996) that the use of the physical, pictorial and symbolic examples can be integrated into a multi-sensory approach to teaching students, in addition, hands-on scientific experiments reinforce appropriate scientific concepts which attracts students' attention and interest.

Common motivational strategies used by science teacher as observed by the respondents

The common motivational strategies used by Science teacher as observed by the respondents are presented in the Table 4. Science trivia (26.77%), picture presentation (11.02%), mini labwork (8.66%), video clips (8.66%), and quiz bee type (8.66%) are the most common motivational strategies used by Science teachers. This suggest that the teachers are employing multisensory motivational strategies from cognitive like science trivia and science quiz bee, to psychomotor such as mini lab work, and affective type like the video clips where students can process the lessons they learned from the material. Osborne and Collins (2000) found that without exception, learners expressed a greater interest in work that included opportunities for experimentation and investigation like the mini labwork. The same findings were obtained by Cerini, Murray, and Reiss (2003) which stated that when it came to doing a science experiment, 71% reported that they found this teaching and learning method enjoyable.

Table 4. *Common motivational strategies used by science teachers*

Motivational Strategies	Frequency	Percent	Rank
4 pics 1 word	3	2.36	12
Bingo	0	0.00	17
Brainstorming	5	3.94	9
Crossword puzzle	7	5.51	7
Jingle song/science song	2	1.57	13
Manipulation	1	0.79	16
Matching object	1	0.79	16
Mini lab work	11	8.66	3
Narration	4	3.15	10
Picture presentation	14	11.02	2
Puzzle	9	7.09	6
Quiz bee type	11	8.66	3
Riddles/brain teasers/logic	4	3.15	10
Role playing/skit	2	1.57	13
Science trivia	34	26.77	1
Text twist	6	4.72	8
Thought-provoking question	2	1.57	13
Video clips/short films	11	8.66	3

The least employed motivational strategies by the teachers as observed by the students are bingo, manipulation and matching object. This suggests that these strategies are not commonly used because they may not be appropriate to the lessons or they are time-consuming. The most preferred motivational strategy by the students is not similar to the common motivational strategy used by Science Teachers. However, the least motivational strategy of the students is similar to the least employed motivational strategy by the teachers. In the same vein, the European Commission (2007) emphasized that concentrating on high-quality teaching is a key pre-requisite for high-quality education and training. This also accentuates the school's obligation to provide young citizens with the skills they have to adjust to globalized, complex conditions, where imagination, advancement, activity, business enterprise and responsibility to continuous learning are as important as knowledge. Since not all the learning of educators advances professional development in practice and school improvement, existing literature gives a few signs about key proficient learning exercises that empower instructors to handle quick changes: keeping updated; experimentation; reflective practice; information sharing and development (Geijsel, Sleegers, Stoel, & Kruger, 2009).

The present study determined the students' preferences in terms of motivational strategies employed in Science courses in the high school level. Identification of the most preferred strategies by the students may inform Science teachers in their selection and utilization of such strategies. Since the study is exploratory in nature, the study may serve as a baseline study in exploring further the preferences of students in the different motivational strategies employed by teachers prior to instruction. Motivation to learn science is often

defined as an internal state that arouses, directs, and sustains science-learning behavior (Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011). Motivation plays a gargantuan role in science learning, promoting academic achievement, and provoking more help-seeking behaviors and commitment (Schunk, Pintrich, & Meece, 2008). Further, this study also contributes to the local literature in the Philippines in terms of the preferred strategies by the students in fostering motivation in science classes. Future research may also explore other motivational strategies that can enhance learning in Science not only in the Philippine context but in other countries as well.

Conclusions and Recommendations

The study ascertained the preferred motivational strategies of students in their science subject. Based from the results, the study concludes that the students moderately preferred visual-auditory motivational strategies, logical-mathematical motivational strategies, and kinesthetic motivational strategies. The most preferred motivational strategies are 4 pics 1 word, puzzle and relay while the least preferred motivational strategies are bingo and manipulation activities. The students chose their most preferred motivational strategies because they are fun and enjoyable however they do not prefer some motivational strategies because they are unfamiliar. Science trivia, picture presentation, and mini labwork are the most common motivational strategies used by Science teachers.

The study has important implications in science education specifically on pedagogy and assessment. The study may inform the Science teachers on what appropriate and most preferred motivational strategies in Science they can employ in the pedagogical process. The students' preferences may be used as a guide in the selection of the strategies without compromising its relevance, appropriateness and congruence to the specific lessons. Students' feedback is also an important indicator to ensure learner-centered science education.

In view of the results and conclusions, the researchers recommend that the teachers may differentiate their motivational strategies to cater the multiple intelligence of the students. The most preferred motivational strategies found in this study may be considered by teachers to be used in select and appropriate topics in Science. The least preferred motivational strategies may be modified or customized to make it more appealing and fun for the students. Also, teachers may explore other motivational strategies and must be reminded on the basic tenet of these strategies which is to engage learners in the teaching-learning process. Teachers should be careful in choosing motivational strategies so that the students will really be motivated to participate in class. They may also use the classic motivational strategies like pictures, science trivia, and mini labwork. The proposed pedagogical enhancement plan may be used. Further research may be conducted to validate the results of the study. Since the present is limited only to Grade 7 students, other grade levels may be involved in the next study. Likewise, larger population may be involved to get more valid results. The foregoing study may serve as baseline information in the crafting of the pedagogical enhancement plan for Science Grade 7.

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References

Abrahams, I. (2009). Does practical work really motivate? A study of the affective value of practical work in secondary school science. *International Journal of Science Education, 31*(17), 2335–2353. doi:10.1080/09500690802342836

Abrahams, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education, 30*(14), 1945–1969.

Anderson, L. W. (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

Barmby, P., Kind, P., & Jones, K. (2008). Examining changing attitudes in secondary school science. *International Journal of Science Education, 30*(8), 1075–1093.

Campbell, M. J., Machin, D., & Walters, S. J. (2007). *Medical statistics: A textbook for the health sciences* (4th ed.). Chichester, UK: Wiley.

Carr-Chellman, A. (2010). Gaming to re-engage boys in learning. Retrieved from http://www.ted.com/talks/ali_carr_chellman_gaming_to_re_engage_boys_in_learning.html?hpt=Sbin.

Cerini, B., Murray, I., & Reiss, M. (2003*). Student review of the science curriculum: Major findings*. London: Planet Science.

DeWitt, J., & Osborne, J. (2008). Engaging students with science: In their own words. *School Science Review, 30*(331), 109–116.

Dornyei, Z. (2001). *Motivational strategies in the language alassroom*. Cambridge: Cambridge University Press.

Entwistle, N. (2009). *Teaching for understanding at university: Deep approaches and distinctive ways of thinking*. London: Red Globe Press.

European Commission. (2007). New modes of learning and teaching in higher education. Luxernbourg: Publications Office of the European Union.

Gamanik, N. M., Sanjaya, Y., & Rusyati, L. (2019). Role-play simulation for assessing students' creative skill and concept mastery. *Journal of Science Learning, 2*(3), 71-78.

Gardner, H. (1991). *The unschooled mind: how children think and how schools should teach.* New York: Basic Books Inc.

Gardner, H., & Hatch, T. (1989). Educational implications of the theory of multiple intelligences. *Educational Researcher, 18*(8), 4-10. doi:10.3102/0013189X018008004

Geijsel, F. P., Sleegers, P. J., Stoel, R. D., & Kruger, M. L. (2009). The effect of teacher psychological and school organizational and leadership factors on teachers' professional learning in Dutch schools. *The elementary school journal, 109*(4), 406-427.

Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of Research in Science Teaching, 48*(10), 1159–1176. doi:10.1002/tea.20442

Hampden-Thompson, G., & Bennett, J. (2013). Science teaching and learning activities and students' engagement in science. *International Journal of Science Education, 35*(8), 1325–1343. doi:10.1080/09500693.2011.608093

K to 12 Science Curriculum Guide (2016). Retrieved from http://www.deped.gov.ph/wp-content/uploads/2019/01/Science-CG_with-tagged-sci-equipment_revised.pdf

Kaput, J. J. (1989). Supporting concrete visual thinking in multiplicative reasoning: Difficulties and opportunities. *Focus on Learning Problems in Mathematics, 11*, 35-47.

Lueddeke, G. R. (2003). Professionalising teaching practice in higher education: A study of disciplinary variation and teaching-scholarship. *Studies in higher education, 28*(2), 213-228. doi: 10.1080/0307507032000058082

Maltese, A. V., & Tai, R. H. (2010). Eyeballs in the fridge: Sources of early interest in science. *International Journal of Science Education, 32*(5), 669–685.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370-396.

McNeal, P., Petcovic, H., & Reeves, P. (2017). What is motivating middle-school science teachers to teach climate change? *International Journal of Science Education, 39*(8), 1069–1088.

National Research Council. (1996). *National Science education standards.* Washington D.C. National Academy Press.

Osborne, J., & Collins, S. (2000). *Pupils' and parents' views of the school science curriculum.* London: Kings College London.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*(9), 1049–1079.

Oxford, R. L., & Celce-Murcia, D. M. (2001). Teaching English as a second or foreign language. *Language learning styles and strategies, 4*, 359-366.

Porter, C., & Parvin, J. (2008). *Learning to love science: Harnessing children's scientific imagination.* York: Chemical Industry Education Centre, University of York.

Rogayan, D.V., Jr. (2019). Biology learning station strategy (BLISS): Its effects on science achievement and attitude towards biology. *International Journal on Social and Education Sciences, 1*(2), 78-89.

Sabroso, M. S., & Mina, W. S. (2013). Attention as a learning motivation strategy: Basis for a proposed compendium of strategies. *IAMURE International Journal of Multidisciplinary Research, 4(*1).

Sarmiento, C. Q. (2010). Teaching strategies to enhance science learning among diverse and multicultural learners. JPAIR Multidisciplinary Research Journal, 4(1).

Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2008). *Motivation in education. Theory, research, and applications.* Upper Saddle River, NJ: Pearson/Merrill Prentice Hall.

Shirazi, S. (2017). Student experience of school science. *International Journal of Science Education, 39*(14), 1891–1912. doi:10.1080/09500693.2017.1356943

Tuan, H. L., Chin, C. C., & Shieh, S. H. (2005). The development of a questionnaire to measure students' motivation towards science learning. *International journal of science education, 27*(6), 639-654. doi:10.1080/0950069042000323737

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