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STUDENTS' PERFORMANCE IN GENERAL PHYSICS I: A BASIS FOR DEVELOPING CONCEPT MAP PACKAGE FOR INTERVENTION

Author's Name: Mark Christopher P. Molina

Affiliation: Faculty member of Narvacan National Central High School, Narvacan, Ilocos Sur, Philippines

E-Mail ID: markchristopher.molina@deped.gov.ph

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Abstract

This study is focused on the development of concept map package for intervention based on the performance of the Senior High School students in General Physics I. The development of concept map package for intervention included three phases namely: planning phase, development phase, and validation phase. The planning phase involved the conduct of an achievement test. This was analysed as an input to the development of concept map package for intervention. Results of the achievement test revealed that the students got a satisfactory level of performance in General Physics I. On the development phase, concept map package for intervention were developed based on the result of the achievement test. Lastly, on the validation phase, the final draft of the concept map package for intervention was subjected to evaluation by the identified pool of experts in the field of Science/Physics Education. The developed concept map package for intervention in General Physics I was assessed as very much valid, thus it is recommended for use and be tested in the field to further validate its effectiveness.

Keywords: *Concept mapping, concept mapping strategy, intervention material*

INTRODUCTION

The rapid advancement of science and technology provides significant challenges to the entire humanity. In meeting the demands of the highly competitive and scientifically inclined society, merely acquiring advance facilities and technologies will not be enough; it also requires the acquisition of basic knowledge and enhancement necessary skills. However, some reports say that mastery of the basic skills needed to learn science and its specific fields have not been met by some of the students here in the country. Obviously, without these basic skills, one cannot go to a higher learning when some of the basic knowledge and concepts needed to understand the field have already been forgotten. It is imperative for the teacher to do an immediate solution to an emerging problem in the mastery of the basic skills and knowledge needed to become a globally competitive individual. These solutions must be anchored on well-designed strategies to ensure quality education. One instructional strategy which probably has the potential to offer opportunities to address the problems of effective teaching and learning of basic Science is the utilization of concept maps. Novak & Cañas (2006) defined concept map as a visual representation of information which shows concepts and the relationships among them. Concept mapping includes concepts, usually enclosed in circles or boxes of some type and relationships between concepts are indicated by a connecting line linking words. Several studies also proved that concept mapping strategy not only enhances students' academic achievement but also promotes better acquisition of Science process skills such as remembering and understanding. In response to the problems mentioned, the researcher developed a concept map package for intervention in General Physics I based on the performance of Senior High School students. This tool will help teachers gather meaningful information in relation to the content areas where the students perform well or poorly, and it will

enable them to teach the subject better since the goal of this concept map package is to aid the conceptual understanding of the students. The researcher believed that studying Physics is much more meaningful if the concepts were properly understood and utilized in real life context. Lastly, this tool will enable the students perceive and make connections among key concepts not only in science but also in other disciplines as well.

LITERATURE REVIEW

Students' Performance in Physics

In Physics, truly understanding a concept or principle is the same thing as being able to apply it to a variety of practical problems. Findings of the study conducted by Garcia (2005) on concept mapping and Physics performance of college students revealed that after the exposure to the two teaching methods (traditional teaching and concept mapping strategy), the Performance of the students in the experimental group improved from "Fair" to "Satisfactory". She further concluded that the significant difference that existed between the performance of the students exposed to the use of concept mapping and traditional lecture method pointed out the effectiveness of concept mapping as a teaching strategy in improving students' performance. Thus, she forwarded the following recommendations: 1) Since the use of concept mapping as strategy was found effective in improving students' performance, it is recommended that teachers should use this method in teaching all subjects; and 2) Faculty members in Physics should develop more instructional materials such as concept maps or other related teaching resources. This could help students become more actively involved in class discussions which eventually could lead to improved learning.

Manuel (2016) found out that in terms of physics performance, majority of the students obtained a "low" rating. Aggregated by topic, the students obtained "Fair" performance in Physics and Measurement, Motion, Force, and the Laws of Motion while they obtained "Low" level of performance in Work and Energy, Momentum and Collision, and Circular Motion and Gravitation. In terms of cognitive skills, the students obtained "Fair" level in Remembering and Applying but "Low" level in Understanding and Analyzing. In addition, in the study of Palomares (2010), she concluded that the student-respondents obtained "Satisfactory" performance in Physics showing a good level of understanding concepts in Mechanics. She attributed the performance of the students to the type of curriculum the Philippine Science High School System has, wherein as early as second year they already have a Physics subject and since the students were screened before entering the school. Moreover, in the study of Abile (2004), as cited by Abalos (2013), she found out that the Physics performance of the students in selected private high schools in Metro Vigan is satisfactory in the content areas in Mechanics, Thermodynamics, Electricity and Magnetism, Wave motion, and Modern Physics. Among the schools included in her study, the students of St. Paul College of Ilocos Sur had the highest Physics performance while the lowest Physics performance was achieved by the students of Divine Word College of Vigan.

Definition and Characteristics of Concept Map

Concept mapping is a teaching and learning strategy that has been developed by Joseph Novak at Cornell University in 1972. It is a graphical tool for organizing and representing knowledge in networks of concepts and linking statements about a problem or subject. It is also a pedagogical or metacognitive tool designed to help students learn how to learn. Concept mapping includes concepts, usually enclosed in circles or boxes of some type and relationships between concepts are indicated

by a connecting line linking words. There are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links. They are useful tools in representing the structure of knowledge in a form that is psychologically compatible with the way in which human beings construct meaning (Novak & Cañas, 2006). In addition, Safdar et al. (2012) pointed out that concept maps can be used for knowledge construction (how students construct their knowledge), learning, evaluation (to evaluate how students

organize their knowledge), assessment (used as a pre-post assessment of what students have learned), record of understanding, problem solving, application, integration, and Instruction.

Akcay (2017) in his study entitled "Constructing Concept Maps to Encourage Meaningful Learning in Science Classroom", elaborated that often students learn science concepts but do not know how they are related to each other. Teachers can use concept maps to determine what students already know about a topic. Furthermore, Vanides et al. (2005) elaborated that Concept maps give students an opportunity to: (1) think about the connections between the science terms being learned, (2) organize their thoughts and visualize the relationships between key concepts in a systematic way, and (3) reflect on their understanding. In sum, concept maps allow students to think deeply about science by helping them to better understand and organize what they learn, and to store and retrieve information more efficiently. Concept mapping naturally integrates literacy and science by providing a starting point for writing about science; this can be particularly helpful for English language learners. Concept maps are also valuable tools for teachers because they provide information about students' understanding.

Studies on the Development of Concept Map

Some researchers have evaluated the effectiveness of using concept mapping instructional strategy in improving achievement of secondary school students in different subject areas. The findings generally tend to favor students who received instructions using concept mapping as opposed to the use of conventional teaching methods.

Garcia (2005) found out that students exposed to the use of concept mapping (experimental group) performed significantly better in posttest than students exposed to traditional lecture method (control group). She recommended that teachers should use concept mapping in teaching all subjects since it was found effective in improving the performance of the students. Moreover, ffindings of the study of Erdogan (2016) revealed that concept mapping produced a better acquisition of science understanding than the traditional method. As all mentioned research results and this research revealed that concept mapping has a positive effect on academic success. His finding is consistent with the results of other national and international meta-analysis studies.

Findings of the conducted research in general science, physics, biology, chemistry, mathematics, and basic science are consistent. This implies that concept mapping can be utilized as a useful and effective strategy for both teaching and learning for all grades. On Physics, Luchembe et al., (2014) compared the effectiveness of concept mapping strategy to the tutorial sheets strategy. A statistical difference was observed between the experimental and control groups. The experimental group performed better than the control group. The results showed that concept mapping was a better

method to use than tutorial sheets when teaching circular and rotational motion to undergraduate students. This study also showed that students had positive attitude towards concept mapping. On Biology, Ajaja (2011) as cited by Bot & Eze (2016) conducted a study on the effect of concept mapping as a study skill on students' achievement in biology. The findings from the study revealed a significant increase in average scores of the students who were taught concept mapping as a study skill considered to be useful element in understanding and achieving better results in biology. Lastly, on Chemistry, the study of Singh & Moono (2015) asserted that that concept mapping teaching method is more effective in students' achievement in chemistry than the traditional teaching method. The mean scores from the results are clearly stating that the concept map teaching is more effective than traditional teaching method.

Theoretical Foundations of Concept Map

Concept maps were developed in 1972 during Novak's research program at Cornell where he sought to follow and understand changes in children's knowledge of science. During this study, the researchers interviewed many children, and they found it difficult to identify specific changes in the children's understanding of science concepts by examination of interview transcripts. This program was based on the learning psychology of David Ausubel. The fundamental idea in Ausubel's cognitive psychology is that learning takes place by the assimilation of new concepts and propositions into existing concept and propositional frameworks held by the learner. Thus, was born a new tool not only for use in research, but also for many other uses (Novak & Cañas, 2006).

CONCLUSION

The result of the achievement test shows that there is a need for an intervention material that could improve the low performance in General Physics I among senior high school students taking up Science, Technology, Engineering and Mathematics (STEM) strand of the selected National High School in the Division of Ilocos Sur along content areas and cognitive levels. In response to this, the researcher developed a concept map package for intervention in General Physics I for senior high school students based on the learning competencies covered in the first quarter.

To further identify the extent of validity of the developed concept map package for intervention, Aiken's V for concept map quality was computed. Aiken's V with 1.0 indicates very much valid content validity for the measure. Overall, the computed value shows that V-value is equal to 1. This means to say that the evaluators have selected the highest possible rating in these categories. The result of the evaluation of the pool of experts further supports the finding of Garcia (2005) that the use of concept mapping as strategy was found effective in improving students' performance and it is recommended that teachers should use this method in teaching all subjects. It is also consistent with the study of Broggy & McClelland (2009) almost all the respondents in the group agreed that concept mapping is a beneficial tool in the classroom, whether integrated as an assessment or instructional tool.

Based on the findings and conclusions, it is recommended that the developed concept map package for intervention in General Physics I for senior high school students be used, be tested in the field to further validate its effectiveness, and concept map package for intervention in other subjects be developed by the teachers.

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