MODULE DEVELOPMENT IN PHYSICS 1 (MECHANICS)

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ABSTRACT

This study developed a module in physics covering ten major areas in mechanics. This was anchored on the ADDIE model (analyze, design, develop, implement, and evaluate). The module was subjected to content validation by physics major instructors and module design evaluation by selected faculty and students. The results of the evaluation show a positive response from the instructors and students. They all agreed and were satisfied on the format of the module which covers the general appearance, appropriateness of illustration, readability of the materials and organization of the topic. Also, same result to its organization and content which covers the topics, instructional objectives, activities/exercises, clarity, assessment device and its comprehensibility.

Keywords: Mechanics, Module, Development

INTRODUCTION

Mechanics is an area of science concerned with the behavior of physical bodies when subjected to forces or displacements, and the subsequent effects of the bodies on their environment. This area of physics is the foundation of physics. Through this, it is important to note that it will help individuals be acquainted and even master mechanics which is considered to be one of the challenging subjects one has to pass. Moreover, an instructional material in a form of module is a big help to enhance the learning of the students and to understand better physics - mechanics. It can be used in any social setting suitable in the learner. The education scholars and researchers of the developed and developing countries of the world have recognized module as the most beneficial and effective learning resource. In fact, modules were recommended for the training of educational personnel in the five years plan of ASEAN countries. Thus, this study endeavors to develop a module for physics – mechanics as an instructional aid in the teaching of physics most specifically mechanics.

Despite the importance of Physics and its applications in various fields, it is a reality that this subject is not quite attractive to most students. Students choose to avoid the subject unless they are provided with alternative strategies and materials that can entice their interest towards the subject. In many countries, there has been reduction in the number of students wishing to continue with Physics (Ho and Boo, 2007). Critics have claimed that students' academic performance in Physics has not been encouraging (Ogunleye, 2000 and Umeh, 2002). The teaching of physics in schools has not been promising due to the abstract nature of the subject that is why the use of instructional materials is needed to facilitate students' learning of physics. Also, Oladejo, Olosunde, Ojebisi and Isola (2011) stressed that mastery of physics concepts cannot be fully achieved without the use of instructional materials. Instructional materials help teacher meet individual differences of the learners in the class by using aids that appeal to different senses (Olawale, 2013). These are used to supplement verbal explanation of concepts or any description so that the lesson could be

real to the students. Aside from this, many educationists agreed that instructional materials bring about improvement in the teaching/learning process as well as permit teachers and students to interact as human beings in a climate where people control their environment for their own best purposes (Eniayewu, 2005). These not only provide members of a group with a common or joint experience but also break language barriers and ease difficulties and in the end make the lesson more meaningful. They save time; and thus, students are able to grasp ideals more effectively and easily. Likewise, the material helps to simplify and emphasize facts and clarify difficulties. Furthermore, although there are some modules available nowadays, there is still a need to develop a module particularly in Physics - Mechanics which suits to the needs of the students in this University where the study is conducted. The module focuses on lessons in mechanics with the incorporation of algebra since some of the students do not have calculus subject. In addition, the existing modules do not usually include laboratory experiments since the subject in mechanics separate the lecture and laboratory. In the university where the module will be implemented, the lecture and laboratory are considered as one subject.

Hence, it is in this premise that the researcher advocates the use of a variety of instructional materials such as the use of modules in teaching Physics specifically on Mechanics to amplify deeper understanding of the subject. This material will be designed to help the teacher lessen their burden in imparting knowledge about physics. Through this teaching-learning material, students can learn to manipulate and do hands-on activities.

LITERATURE REVIEW

Chandrajeet (2008) defined Physics as a natural science which explores concepts like mass, energy, matter and its motion. Omosewo (2009) considered Physics to be science of measurement that deals with the study of the entire natural and physical world; while Kola, (2010) viewed Physics to be a study of the relationship between matter and energy. Wambugu and Changeyiwo (2007) stressed that one cannot really over-emphasized Physics for it is considered to be the backbone of all sciences and as science, it is considered to be absolute tool widely recognized as being of great importance for the development of the economic well-being of any nation. This stressed the fact that Science and technology are interwoven. As Kola (2010) has claimed, science has been regarded as the bedrock which modern day technological breakthrough is built. In many countries, it was found out that there was a reduction in the number of students wishing to continue with Physics as stated by Ho and Boo, (2007). Ogunleye (2000) and Umeh (2002) were of the opinion that students' academic performance in sciences subjects especially Physics has not been encouraging.

With this, Aina (2012) suggested that there is equipment which can be used in teaching physics and can also be improvised. In order for the teachers to encourage students to deal with this complex subject, physics teacher should endeavor to utilize and improvise the use of discarded resources around as their teaching aids. More so, studies revealed that there are already existing instructional materials which are of great help to the teachers and can cater individual differences of the learners in the class which appeal to different senses (Olawale 2013). Olawale (2013) defined Instructional Materials as the materials of visual, audio and audio - visual category that helps to make concepts abstracts and ideas concrete in the teaching/learning process. They are also materials which the teacher used in supplementing classroom discussion. In addition, many

educationists agreed that instructional materials bring about improvement in the teaching/learning process as well as permit teachers and students to interact as human beings in a climate where people control their environment for their own best purposes (Eniayewu, 2005). Also, according to Adewoyin (2000), most educators largely give their positive response with regards to the creative use of variety of instructional materials such as modules that it effectively increases the probability of student learning pace and even bring about the skills they are expected to perform. Apart from their ability to process meaningful sources of information, these Instructional materials help the teacher with the means for extending his horizon of experience as well as providing him with rich sources of procuring communicative materials which could be produced jointly by the teacher and the students (Osalusi, 2003).

Oladejo (2013) added that instructional materials do supplement the teachers and even complement their verbal explanations in providing comprehensive discussions on the topics that should be covered by them. Through this, teacher and students are able to transmit and acquire knowledge and skills in learning the lesson. Aside from this, the teacher is considered to have a great role to portray for this requires their resourcefulness and improvisation in making the said materials. The ability of the teacher to make use of "local" materials in place of "standard" ready-made materials makes lesson more effective and improved students' achievement.
In connection with this, Franzer, Okebukola and Jegede (2013) stressed one cannot be an effective and efficient teacher if that teacher cannot even provide materials necessary in transferring knowledge to her students.

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Naval (2014) stressed that it is truly a fact that most high school students find physics difficult to understand especially those who lack skills in computation. This is so because mathematics is considered to be a pre-requisite in delving and understanding physics. More so, it is accounted that Physics use mathematics as its language, and thus requires learners to be adept in computation. Misunderstandings and misconceptions among students arises when physics concepts are not properly explained. In connection with this, Ganiron (2015) suggested that one best way to promote learning is through the use of module based learning resource. This will ease student's difficulty in understanding the lesson particularly in physics. Through its interactive activities like solving a problem and any related computation activities along with comprehensive discussions, the teacher as well as the students is able to easily acquire skills necessary in understanding and even enjoy learning the lesson. Furthermore, Goldschmid (2005) as cited by Evangelista et al., (2011) exposed that modular instruction promises a more efficient mass education by offering more effective individual instruction at a time when teacher is faced with problem learning in a large group all at the same time. In other words, the use of the modules as learning materials ensures learners to understand the lesson better, especially when a classroom has a great number of students.

METHODOLOGY

Research Design

This study utilized the developmental method of research evaluation process. The process enabled the researcher to identify the materials, process focus, use context, tools and techniques, research methods and the nature of the conclusions.

Evaluator and Validator

Purposive sampling was used in choosing the validators and evaluators of modules. The researcher tapped four Physics teachers from the state universities in Surigao del Sur and Agusan del Sur to validate the content of the module being developed. The seven content validators are teaching college physics and all have Master's Degree in Physics. The validators also served as module design evaluators. In addition, the researcher tapped faculty who already developed and produced a module in their graduate program. Moreover, students who already took up physics course during the A.Y. 2014-2015 from the three colleges were also asked to evaluate the module. The students from CECST were selected based on their physics performance/grades to see to it that they have knowledge about physics mechanics. Thus, the block A section was chosen. The students were comprised of 41 BS Civil Engineering students and 41 BS Computer Science students from the College of Engineering Computer Studies and Technology, four third year BS Education major in Physical Science students from the College of Teacher Education and 14 third year BS Math students from the College of Arts and Sciences. Thus, there were a total of seven content validators and 109 module evaluators.

RESULTS

Validation of the Module Content

Table 1 presents the result of validation on the contents of the module. The validators rated the contents very satisfactory with numerical rating of 4.42. The topics on Dynamics of Rotational Motion, the designed Laboratory activities and answers key for the problems each topic are all rated outstanding. The discussion, presentations, and activities prepared for the topic are excellent.

Table 1
The Content Validation of the Module.

Content	Mean	Description
1- Units and Physical Quantities	4.18	Very Satisfactory
2- Vectors	4.38	Very Satisfactory
3- Motion in a Straight Line	4.44	Very Satisfactory
4- Motion in Two or Three Dimension	4.23	Very Satisfactory
5- Force and motion	4.41	Very Satisfactory
6- Work and energy	4.38	Very Satisfactory
7- Impulse and Momentum	4.35	Very Satisfactory
8- Rotation of Rigid Bodies	4.29	Very Satisfactory
9- Dynamics of Rotational Motion	4.53	Outstanding
10- Periodic Motion	4.42	Very Satisfactory
Laboratory Activities	4.68	Outstanding

AnswerKey	4.86	Outstanding
Grand Mean	**4.42**	**Very Satisfactory**

Evaluation of the Module Design

The results of evaluation on the module design by physics students and college instructors are presented in Table 2 and Table 3 respectively.

Table 2
Students' Evaluation on the Module Design

	Mean	***Description***
A. Format	**4.32**	**Agree**
General Appearance	4.34	Agree
Appropriateness of Illustrations	4.41	Agree
Readability of the materials	4.17	Agree
B. Organization and Content	**4.25**	**Agree**
Topics	4.24	Agree
Instructional Objectives	4.21	Agree
Activities/ Exercises	4.23	Agree
Clarity	4.17	Agree
Assessment Device	4.40	Agree
Comprehensibility	4.39	Agree
Role of the Teacher	4.27	Agree
Role of the Students	4.63	Strongly Agree
Grand Mean	**4.26**	**Agree**

Table 2 shows that the students agree on the design of the module, its format and organization of its content, with an average mean of 4.26. They strongly agree particularly on the role of the students in the module as reflected with a mean of 4.63. The results imply that based on students' view, the module satisfied or meet the minimum requirements for a module. The module was also found to be above what is required as to the role of the students as key players and independent learners in the design learning activities.

Table 3
College Instructors' Evaluation on the Module Design

	Mean	***Description***
A. Format	**4.29**	**Agree**
General Appearance	4.15	Agree
Appropriateness of Illustrations	4.44	Agree
Readability of the materials	4.56	Strongly agree
B. Organization and Content	**4.40**	**Agree**

Topics	4.46	Agree
Instructional Objectives	4.22	Agree
Activities/ Exercises	4.36	Agree
Clarity	4.49	Agree
Assessment Device	4.67	Strongly agree
Comprehensibility	4.50	Strongly agree
Role of the Teacher	4.11	Agree
Role of the Students	4.11	Agree
Grand Average Weighted Mean	**4.38**	**Agree**

The teachers' evaluations as shown in Table 3 also conform to the evaluation of students in Table 2. Both results have adjectival rating of agree which corresponds to the average mean of 4.38 for teachers and 4.26 for students. The teachers strongly agree on the readability of the materials, assessment device and comprehensibility of the modules. This means that the module along these areas meet more than what is required. However, as reflected in Table 3, the teachers rated the module higher than the students' rating in some indicators. These can be credited to the teachers' higher experiences in evaluating things.

DISCUSSION

The result of the study got positive feedback from both students and teachers; with this, the material can be a great help to the performance in the students. Olawale (2013) revealed that there are already existing instructional materials which are of great help to teachers and learners. Bayle (2004) made an activity manual and studied the effects in the student's performance; she found out that the said manual effectively increased the performance level of the students. As a final point, many educationists agreed that instructional materials bring improvement in the teaching/learning process and permit teachers and students to interact for their own best purposes. The module was subjected to content validation by the physics major college instructors and to design evaluation by selected faculty and students. Both the faculty and students agreed with how the module was designed based on the criteria for modules. The evaluation results have an average mean of 4.38 and 4.26 respectively. In the content validation, the whole module has an average mean of 4.42 which means that the contents are very satisfactory. The topic on Dynamics of Rotational Motion, the Laboratory activities and answers key are rated outstanding by the validators.

CONCLUSIONS

In the aforementioned findings, it is concluded that the modules being designed can be used by faculty and students for better learning in physics - mechanics. It can be adopted or utilized by the university as an institutional instructional material for the course.

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