Development and Validation of an Electronic Module in Linear Motion for First Year College Students of Iloilo City

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Abstract
This study aimed to develop and validate an electronic module in physics for first year college students of Iloilo and find out if there would be a significant difference in the performance of students before and after using the electronic module. The e-module was composed of one topic with two sub-lessons in linear motion (kinematics). The participants of the study were classified into three groups: the Subject Matter Experts who are physics instructors who suggested the content, physical appearance, and limitations of the e-module; the IT experts who are active both in teaching and developing computer programs; and 28 students divided into two groups, 15 in the pilot group and 13 in the final test group. A researcher created 30 items checklist form (difficulty of sample problem, comprehension, application and definition of terms) was prepared and validated by the experts in subject matter for gathering data. To test the difference in student performance in physics, the researcher prepared an achievement test containing 25 items, multiple choices. The findings revealed that there was an increase in the performance of students in the pretest and post-test. T-test results revealed that there was a significant difference in the test scores of the students before and after using the module which can be used as a future reference for linear motion as additional teaching tool in physics.

Keywords: Electronic module, kinematics, linear motion, physics

Introduction

Physics occupies a unique position in the school curriculum of every institution. It is defined as the study of the properties, behavior, and interaction between matter and energy and natural phenomena; it investigates and formulates the fundamental laws of nature[1, 2]. According to Condonar, physics is a central core of physical science since it can relate to other sciences such as chemistry, ecology, and biology. In spite of the importance of physics to learners, student performance in both secondary and tertiary level has been poor [3, 4]. The desire to know the causes of students' poor performance in physics has been the focus of this study.

According to Lardizabal et.al, teaching methods and different teaching techniques affect the learning process and conventional teaching is not sufficient to make the student easily learn science concepts. Breitborde, and Swiniarski stated that the teacher sifts the subject matter and decides what is to be taught to students and the transfer of ideas from the teacher to student is done through a particular teaching method [5]. By means of teaching methods, the students are guided as to what parts of the subject matter are to be appreciated and what attitudes are needed to be developed [5]. Through it, the student acquires new knowledge, habits, rote associations, and skills. The teaching method guides the learning process of students [6, 7, 8].

Lardizabal et.al also stated that a teacher should make good use of teaching devices or materials. A device is a little method and a teaching aid or a tool to facilitate instruction that makes the teaching clearer, more meaningful, and more interesting. Pictures, flashcards, and technology like a computer are examples of devices [9, 10].

In this study, the researcher developed and used interactive modules that provided information in a multimedia fashion. The subject matter content of e module was validated by the Subject Matter Experts composed of Physics teachers and the content and faced validation was validated by IT experts.

During the entire process, the teacher assumed the role of a guide and the computer assumed the role of a platform [11]. A computer-assisted instruction was used to supplement conventional teaching resulted to higher achievement than using conventional instruction alone. Furthermore, using e-module promotes sequenced learning within groups can lead to more in-depth processing of course content and more retention of information and it is for the aforementioned reasons that this study was conducted, to develop and validate computer-assisted instruction to supplement physics instruction [12,13]. The computer-assisted instructional materials developed by the researcher was based on Robert Gagne's Nine Learning Events, Commission of Information and Communications Technology (CICT), together with the Bureau of Alternative Learning System (BALS), and SEAMEO INNOTECH [14].

The results of the study revealed that teaching with the use of the e-module can increase student understanding about the subject matter discussed by the teacher. It gives a clearer picture of how things work out. In addition, using computer-assisted instruction as a supplement to conventional teaching results in the development of skills that leads to mastery of the subject matter.

Theory

According to Lardizabal, in the educative process, there are three important factors involved: the learner, the teacher, and the subject matter. The teacher provides guidance to achieve proper learning and transmit knowledge and information through the subject matter. The teacher develops some teaching strategies and styles that can cope with the demands of the students to enable them to appreciate the subject matter. Through this method, the learner is guided as to what parts of the subject matter are to be appreciated and what attitudes are to be developed [8, 16].

Indeed, the classroom teacher is the key persons in the educational enterprise and directly involved in the instructional process in the classroom setting [9]. It also occupies strategic positions in the school system, for in their shoulders lie the responsibility of translating the curriculum into concrete learning experiences[10, 11]. Through the process of teaching and learning, the learners are given the opportunities to gain knowledge and understanding, develop habits and skills, acquire attitudes, and appreciate values [12].

Redesigning physics instruction in the 21st century must include not only what is taught but also the way it is taught. The use of technology and other modern equipment in order that physics teaching and learning are enjoyable and interesting to students resulting to be effective, innovative, and beneficial to the learners [17,18].

Using Electronic Module as Computer-assisted Instructional Material in Physics

Computer-assisted instruction has existed for decades, but it has not been widely used in education especially by schools resulting to low-quality education [19].The use of computer system in education opens more chances and opportunities for both teacher and students to develop good strategic plans in teaching and learning better the subject matter. In fact, today, every school teacher from elementary to college levels use computer-aided technology as a method that would help students learn the concepts easily. This method is called a computer- assisted instruction (CAI).According to Fernandez, CAI can teach biology, history, foreign language, mathematics, physics, and numerous other subjects and instruction supplemented by properly designed CAI is more effective than instruction without CAI [6,10,21]. Computer-assisted instruction can play an important role in classrooms and laboratory work, not as a substitute for other activities but as an additional tool.

According to Eggen, and Kauchak, learners retain new knowledge better when the curriculum was presented with a combination of formats of text, sound, graphics and video and using a computer as a method of instruction. Computer may be used to deliver instruction, reinforce practice, and provide feedback. It can also provide an individualized the learning environment in which students can learn or practice according to their own pace or the computer can be used as a remedy for students who lack the pre-requisite abilities to practice basic skills [16, 17].

In a typical electronic module system, each student sits in front of the computer. The computer presents instructions and lessons on the screen and through pre-recorded sound messages. A student responds by typing his answers on the keyboard or by using a mouse in marking and clicking the right answers [16]. The computer takes the students through a lesson step by step to master the subject matter. The computer can drill, tutor, or carry on a dialogue in which the student's makeup problems and allows them to solve their problems [18, 19]. At the end of the lesson, the computer judges the student's performance and provide the feedback faster. Computer think faster than human beings, approach students more objectively, address different senses, and realize drudgery work more effectively [16,17].

Guidelines/ Criteria in the Preparations of an Instructional Module

According to Celis, an outline of a standard module has criteria that have a title that is brief, comprehensive, and interestingly stated. It has a purpose that is specific and has an overview that gives the students a birds-eye-view of the topic being covered by the module. It has objectives that are clear, comprehensible and formulated and its instruction are clear, simple and specific to the learner. The entry behavior and prerequisites skills should enable the learner to use it successfully. It provides a preliminary assessment of whether the module is within the learners' capacity or not. Pretest that is purposely given to determine the initial learning of the learner about the presented topics and pretest feedback that determine whether the answer is correct, a total score is counted that give the learner guidelines if he passes or fails. Posttest also included after the learners have done all the learning activities. Posttest feedback that just like the pre-test presents the total score of the students and improvement of the test score by the student is most likely to occur at the end of the module[8, 21].

There are 3 stages in the production of the modules according to SEAMEO INNOTECH. STAGE 1. Development of the self-instructional materials and production of the modules that have four stages namely: design, construction, validation, and revision. STAGE 2. Construction Stage. This involves the actual writing of the module and the construction of the post-test. Table of Specifications must be used as the basis for the construction of the achievement test. This includes the setting up of behavioral objectives, selection of teaching strategies, and construction of the illustrated sample problem in each lesson. STAGE 3. The Learning Activities for Each Module. These may be done individually or by group (if they are at the same pace) [20, 23].

Characteristics and Principles of Styles of Writing a Module as a Program Instruction

According to Arce, a clearer understanding of the programmed instruction is obtained from a description of the basic characteristics of programmed instruction that are focus, organized, complete packaged, and relates to student's needs. Program instruction is self-contained that student does not have to go to the teacher and ask what to do next or what materials he or she should use. It should be an individualized that reflects a logical and systematic flow of programmed instruction content with a definite beginning and end. Programmed instruction includes learning experiences and objectives. Experiences are provided to assist each student in mastering specified objectives as efficiently as possible [24]. A module should be readable that create a warm and friendly atmosphere. Using familiar words (be precise and specific in writing) and strong action verbs helps a lot. The writing should be plain, simple and direct [2, 20, 21.]

Research Design and Methods

The development and validation of the e-module have two phases. The phase I which is the development of the electronic module and the validation by subject matter experts and phase II which is the validation of the Electronic Module by IT Experts and Try-Out Students. In Phase, I, the participants of the study was five physics instructors from three universities and colleges in Iloilo City. The subject matter experts were the ones who first validated the initial form of e-module through a checklist provided by the researcher. In Phase II, the participants were IT experts and students grouped into two, the pilot group and the final testing group. The IT experts were composed of five IT experts in different universities in Iloilo and Roxas City. They were the ones who rated the developed e-module through a different checklist prepared by the researcher. For the case of a pilot group of students, 15 students of Iloilo Doctors College and the University of Iloilo. They were the ones who tested if the developed e-module that had undergone validation of subject matter and IT experts could be ready for use by the students. Their performance in the achievement test would attest if the e-module was ready for final testing. For the final test group, 10 BS Marine Engineering students of St. Therese MTC College- Magdalo branch and one student each from West Visayas State University, University of the Philippines, and John B. Lacson Maritime University. Their performance in the pre-test and post-test would determine if the developed e-module was reliable for use and could help them improve their performance. Convenience sampling was used in assigning the participants to student groups for both the pilot and final test.

For Phase I, an initial draft for the electronic module was prepared as a modular instruction that supplements physics instruction. The preparation and development of the electronic module involved three stages. Stage I, the Planning Stage; Stage 2, the Development Stage, and Stage 3, the Revision and Evaluation Stage from the subject matter experts. To construct an electronic module, a power point presentation was made before it was presented to the graphics artist for graphic design and animation. It consisted of slides discussing the main topics which were linear motion and its two sub-lessons which were kinematical quantities for Lesson 1 and kinds of linear motion for Lesson 2. Each slide contained a number that started from the title of the module to the last lesson presented. The same number was used for the storyboard that provided the sequence of the topics including the title of the module. The storyboard was a set of pictures and illustrations which showed what would happen in the e-module. The programmer developed e-module from power point presentations to flash animation. A voice-over was inserted in the program for audio and video purposes that added attraction to the developed e-module. The lessons presented in the module were sequentially arranged, from a simple discussion to a more difficult lesson which was to be explained in a simple, clear, and interesting manner (Fig.1).

The Electronic Module Structure

Steps	Electronic Module
1	Title: The Moving World
2	Objectives
3	General Instructions
4	Introduction to Main Lesson
5	Introduction to Lesson 1
6	Pre-test
7	Start in Frame for Lesson 1 (kinematical quantities) and includes illustrated sample problem and advance animation for every topics)
8	Post-test for Lesson 1(includes student feedback)
9	Introduction to Lesson 2
10	Pre-test Lesson 2
11	Start in Frame for Lesson 2(Kinds of Linear Motion) and includes illustrated sample problem and advance animation for every topics)
12	Post-test for Lesson 2 (includes student feedback)

Figure 1. The general structure of electronic module in linear motion.

For Phase II, the materials used were the achievement test and the questionnaire-checklist. A 25 items multiple-choice test was administered at the beginning of the module after the objectives of the study were illustrated that underwent validation process based on Table of Specification and syllabus in physics of Iloilo Doctors' College, University of Iloilo, and St. Therese MTC College- Magdalo branch. The pre-test was incorporated at the beginning of every lesson and post-test was given at the end of every lesson inside the module. Two different checklists for two different groups of participants, namely; IT experts and students. It underwent a validation process by experts and to be used as an instrument for the evaluation by IT experts and students of the developed e-module. For Phase I (Validation Testing of the Research Material) the instruments needed were based on the survey form by the National Education Technology Standards (NETS) developed by the International Society for Technology in Education (ISTE) based on the book Integrating Technology into the Curriculum by Frei et. al. For Phase I, the researcher revised the survey form to fit from her own study. The questionnaire was given to subject matter experts for validation purposes. For Phase II, the instruments needed were the achievement test in linear motion and the questionnaire-checklist. For the achievement test, content and face validation of the test items were made possible with the help of physics professors. After long deliberation, 25 items out of 50 questions in the multiple-choice format were retained and included in the final draft of the electronic module for students' tests in each lesson. This test served as the pre-test of the e-module; the same test was used as the achievement post-test. However, the test items were arranged in a parallel manner but covering the same learning content. The pre-test had a reliability of .38, which was within the acceptable reliability coefficient level of 0.20-0.80 [28].

The questionnaire-checklist given to both the IT experts and students who underwent content and face validation by the subject matter experts.

Data - gathering Procedure

There are 3 stages in developing computer-assisted instruction of e-module. Stage 1 was the Planning Stage, Stage 2 was the Development Stage, and Stage 3 was the Revision and Evaluation Stage by Subject Matter Experts. For Phase I and Stage I which is the planning and preparation of the E - module. Using a course outline in physics instruction and consultations with five subject matter experts, an outline of computer-assisted instruction was made. Stage 2 which is the construction of the module. An initial draft of the module was prepared, completed and presented to subject matter and IT experts, for comments and suggestion. The first revised copies were submitted to the research adviser for comments and suggestions. The second revised copies were then submitted to the five subject matter content experts for content and face validation. The third copies were submitted to five IT experts for another review. The fourth revised copies were used by the researcher to the Pilot and Test group and to test their performance using the electronic module. The final copies were submitted to the members of the panel. The final form of the e-module was made after the suggestions, comments, and recommendations of the advisers, of the five subject matter content and five IT experts, students, and of the panel of professors were considered.

The E - module

The e-module in linear motion consisted of objective of the study used as guide in preparing the pre-test and posttest. The pre-test was validated by different evaluators who are experts in physics and teaching for more than five years. The researcher prepared a table of specifications and a checklist as a guide for test validation. Different questionnaires/ instruments were provided for both Phases I and Phase II. A checklist for the subject matter, IT experts, and student experts for validation of the developed e-module. The content of e-module, consisted of two lessons, the first lesson consisted of seven frames including the pretest and post-test; Lesson two had six frames, including the post- test. For Stage 3 which is an electronic module validation (Content and Face Validation) by the subject matter experts. The criteria for evaluation which were physical features, module objectives, instruction to the learners, learning activities, and evaluative measures. The panels members were asked to rate each lesson in the module as excellent, very good, good, fair, or poor. Comments from experts were also included in the instruments to serve as guides for the improvement of the e-module. In addition, the achievement tests included in the e-module underwent validation thru suggestions and rates of different valuators (Fig 2).

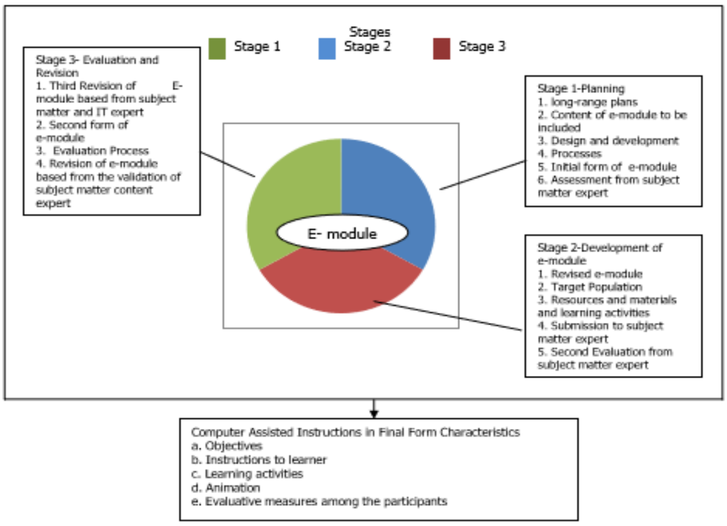

Figure 2. Development of E-module and Its Validation by Subject Matter Experts. Diagram is based on the Instructional Planning Cycle from the book entitled Teaching Strategies: A Guide to Effective Instruction by Orlich, et al., 2010.

After the approval by subject matter experts who validated the researcher instruments, permission letter was sent to every institution that is willingly participated in the study. Convenience sampling was used in choosing the respondents to test the validity of the develop module to improve students' performance and help supplement physics instruction. Then it went through the Phase II process which was the validation by IT experts and Try-out Students.

Phase II. Use of Instructional Module. Stage I which is the development of e – module. In this stage, the e-module was developed on the basis of the needs and diverse demands of physics students that underwent validation by three different groups of experts, namely: Subject Matter experts, IT experts, and a group of students who would help the researcher come up with a good electronic instructional material. This e- module would supplement the lesson in Linear Motion. Stage II the validation by subject matter experts, IT Experts and Students. Again, it was submitted to another five Subject Matter experts, IT experts and students for second validation. The Subject Matter experts were five professors and instructors who had more than five years in physics teaching. A program checklist was given to them as a guide for validation. The five Subject Matter experts were not members of the team that helped the researcher to develop the electronic module, while the IT experts were IT and Computer Software instructors who were active both in teaching and developing computer programs. Another set of program checklist was prepared as a guide for IT validation. The last validation was done by nine students who rated whether the developed electronic module was valid and suited to students as instructional material and supplementary lesson in Linear Motion. Students were given a program checklist as a guide for validation. Subject Matter Experts, IT experts, and the students were given sheets for their comments and suggestions. Comments and suggestions from three specialists were considered by the researcher as a guide for another revision of the electronic module. Stage III which is the revision of E – module which is according to the comments and suggestions of the three specialists. Stage IV is the try-Out among students were a certain topic was discussed by the instructor and with the use of the e-module. Lesson plan was prepared as a guide to make sure that the topic discussed by the teacher and e-module as enrichment lesson were the same. The distribution of developed computer-assisted instructional(e-module) materials in the pilot group where a pre-test was included to assess the students' skills before reading the main lessons of e-module. A post-test was included to assess student's skills after reading the main lessons in the developed e-module. If the pilot testing would be successful, then the developed e-module would be conducted to the test group composed of students that would assess if it was reliable to improve student performance. Stage V is the revision of the e-module according to students' suggestions. A program-checklist was prepared for validation after reading the electronic material. Stage VI is the tryout of the effect of the electronic module on students' performance in physics using the Linear Motion Achievement Test (Fig 3).

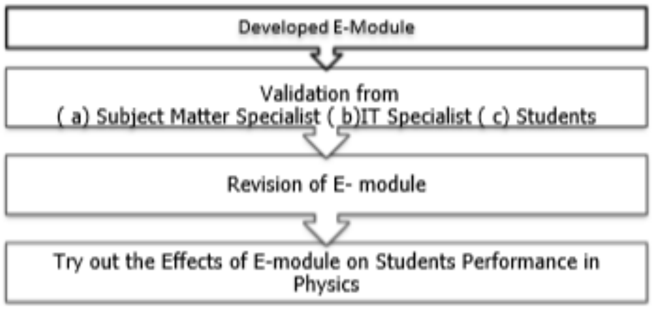

Figure 3. The Paradigm in Phase II is based on the theoretical framework of Dr. Vilma Templora but the researcher did some revision to fit in her own study.

Permission to conduct the Validation of Electronic Module to the students was sent to every participating institutions. After the official request was granted, another letter of request for the subject teacher to conduct the pilot study on how the students perceived the developed electronic module was made. Convenience sampling was used in choosing the participants for both the pilot study and final testing. Checklists were used to measure the validity and students were instructed to rate the developed e-module.

The e-module was tried out among 28 students in six different colleges and universities of Iloilo City. Pilot testing was conducted to 15 first year students who had taken Physics 1 during the time where the study is conducted and they were instructed to use the e-module until the lesson was finished. Students answered the assessment directly to the e-module.

Since the results were good, the researcher decided to conduct final testing of the e-module among thirteen first year students of the participating institutions. The results from the final test group served as the basis for the usability of the e-module as instructional material to supplement physics instruction. (Fig.4)

(UI, St. Therese MTC College-Magdalo branch, IDC, JBLMU, WVSU,UP)

Scores in Pre-test and Post-test	Rating Scale
21-25	Excellent
16-20	Very good
11-15	Good
6-10	Fair
0-5	Poor

Figure 4. Rating scale used for pretest and posttest of student score.

The frequency was used to determine the ratings of the research material given by the subject experts and to interpret data gathered. It is also used to determine the pre-test and post-test scores of students in linear motion. The mean was used to describe the ratings done by the teachers on the research material and determine the level of achievement of the students in the pre-test and in the post-test. Standard deviation was used to show the dispersion of the scores from the mean. Percentage was used to ascertain the total number of respondents who agreed to accept every item included in the instruments given to evaluate the developed electronic module. In order to quantify the evaluation of the electronic module, the researcher assigned corresponding weights to each description to facilitate computation of the mean. Since every item was answerable by yes or no, the total percentage was translated according to scale and to its equivalent description (Fig 5).

Scale	Descriptive rating
100% - 80% - 5	Excellent
79% - 60% - 4	Very Good
59% - 40% - 3	Poor
39% - 20% - 2	Fair
19% - 0% - 1	Good

Figure 5. A constructed scale with the equivalent descriptions for interpretation purposes.

t-test for dependent samples was used to show whether there was a significant difference in the test scores of the students before and after using the modules; .05 alpha level was used as the level of significance to help determine the significant difference in the student's pre-test and posttest.

Results

Subject Matter Expert Validation

The subject matter experts rated the instructional electronic module "excellent" as shown in the overall obtained a mean of 5.0. In the actual rating percentage, every criterion was rated as "excellent" based on percentage equivalent given (Fig. 6)

Criterion	Actual Rating	Equivalent Rating	Description
1. General Program of the Module	80	5	Excellent
2. Objectives	88	5	Excellent
3. Content	90	5	Excellent
4. Appropriateness	88	5	Excellent
5. Motivational Aspect	87	5	Excellent
6. Appropriateness of the Assessment Strategies	80	5	Excellent
Average	85	5	Excellent

Percentage Equivalent	Scale	Descriptive rating
100% - 80%	5	Excellent
79% - 60%	4	Very Good
59% - 40%	3	Good
39% - 20%	2	Fair
19% - 0%	1	Poor

Figure 6. Overall rating results of subject matter expert's validation.

Information Technology Experts Validation

The IT experts rated the instructional electronic module as "excellent" with the over-all obtain mean of 5.0. With a total of five IT experts, four experts rated it as "excellent" with the obtained mean of 5 .0 and only one rated the instructional module as "very good" with the obtained mean of 4. (Fig.7)

Results of the IT Expert Validation

Criterion	Equivalent Rating	Description
1. Technical Quality	5	Excellent
2. Start up Implementation	5	Excellent
3. Graphics and Audio	5	Excellent
4. Simulations	4	Very good
5. Ease of Use	5	Excellent
Average	5	Excellent

Percentage Equivalent	Scale	Descriptive rating
100% - 80%	5	Excellent
79% - 60%	4	Very Good
59% - 40%	3	Good
39% - 20%	2	Fair
19% - 0%	1	Poor

Figure 7. Overall rating results of IT experts validation

Student Validation

Based on the student validation, students rated the whole instructional electronic module as "excellent" with the over-all obtain mean of 5.0. Thirteen students tried out the electronic module and were given an instrument to rate it. The electronic module draws positive reactions from the students based on the criteria for evaluating the module.

Criterion	Equivalent Rating	Description
1. General Program of the Module	5	Excellent
2. Objectives	5	Excellent
3. Content	5	Excellent
4. Appropriateness	5	Excellent
5. Motivational Aspect	5	Excellent
6. Appropriateness of Assessment Strategies	5	Excellent
7. Technical Quality	5	Excellent
8. Start-up and Implementation	5	Excellent
9. Graphics and Audio	5	Excellent
10. Simulations	5	Excellent
11. Ease of Use	5	Excellent
Average	5	Excellent

Percentage Equivalent	Scale	Descriptive rating
100% - 80%	5	Excellent
79% - 60%	4	Very Good
59% - 40%	3	Good
39% - 20%	2	Fair
19% - 0%	1	Poor

Figure 8. Overall rating results of student's validation

The final form of e-module is Entitled: "The Moving World" from the original title "Motion along the Straight Line". This module was prepared by the researcher and her team of experts which are validated by the Subject Matter and IT experts in different areas of physics and computer software and a group of students from the physics and IT program.

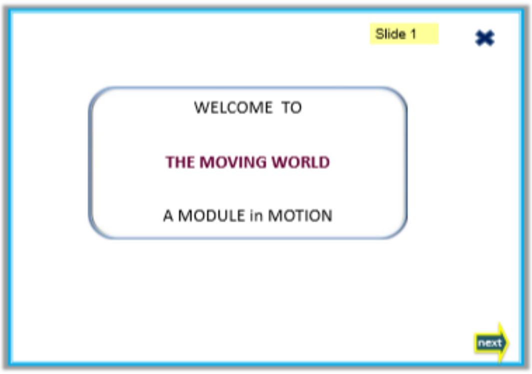

Figure 9. The final form of the module where the first frame is the title of the electronic module.

The program-checklists for the Subject Matter experts were validated by professors from universities and colleges in Roxas and Iloilo City. On the other hand, the IT expert's instruments were validated by professors in the colleges and universities in Iloilo City. Their comments and suggestions were considered until the final form of the program-checklist was made. The students' checklist was also validated by experts in their chosen fields in Iloilo City.

Based on the results of the initial pilot testing of the module, the pre-test mean score and the post-test mean score in Lessons 1 and 2, respectively, of 15 pilot students fell under the p-value of 0.000, meaning, there was a significant difference in the pre-test and post-test score of the students before and after exposure to the e-module. This evidence supports the content and construct validity of the e-module (Fig 10).

Pre-test and Post-test Pilot Testing Result on the Use of Electronic Module

Test	Mean Score	N	S.E.M.	t-value	P-value	Interpretation
Pre-test (L1)	12.20	15	2.68	-9.911	0.000	Significant
Post-test (L1)	18.93					
Pre-test (L2)	8.67	15	2.63	-9.668	0.000	Significant
Post-test (L2)	17.67					
Overall Impression	Lessons 1 and 2 of the e-module are effective as teaching tools. This finding supports both the content and construct validity of the module as a teaching tool.					

Figure 10. Pilot Testing results of students pretest and posttest

Based on the results of the final testing of the module, the pre-test mean score and the post-test mean scores in Lessons 1 and 2, respectively, of 13 students fell under the p-value of 0.000, meaning, there was a significant difference in the pre-test and post-test scores of students before and after exposure to the e-module. This evidence supports the content and construct validity of the e-module (Fig 11).

Pre-test and Post-test Final Testing Result on the Use of Electronic Module

Test	Mean Score	N	Std. Dev.	P-value	t-value	Interpretation
Pre-test (L1)	13.46	13	3.28	0.000	-8.605	Significant
Post-test (L1)	21.31					
Pre-test (L2)	14.62	13	3.48	0.000	-5.333	Significant
Post-test (L2)	19.77					
Overall Impression	Lessons 1 and 2 of the e-module are effective as a teaching tool. This finding supports both the content and construct validity of the module as a teaching tool.					

Figure 11. Final Pilot Testing results of students pretest and posttest

In this study, the electronic module as instructional material to supplement physics instruction was found to be "excellent" by all of the respondent users in the research study. It was also found out that the developed module is valid as instructional material to supplement physics instruction.

Conclusions

This is an instructional material development and quantitative study on modules in linear motion in physics for first-year college students. Results revealed that an instructional electronic module was personally developed, designed and constructed by the researcher to supplement physics instruction that was prepared, validated, revised, tried out, and administered by experts and students to determine its usability as instructional material. Based on the results of students' pre-test and post-test, develop an electronic module was found appropriate to supplement physics instruction. The average mean rating of subject matter experts as excellent was supported by the fact that the electronic module is a new teaching tool to help teachers make teaching and learning enjoyable and interesting for learners. The IT experts rated it also as "excellent", a significant indication that the e- module encourages instructional module developers to design an electronic module that helps teachers and students improve their individual performance in physics. Students rated the e-module "excellent" and had a positive reaction to it. They find it amazing and enjoyable as a new teaching strategy wherein the lesson is presented in a modernized way since the e-module uses the flash animation program. There was a significant difference in the students' performance in physics after the use of the electronic module. The t-value results with a probability value below .000 was found, indicating that the post-test results increased at a statistically significant level ($p<.05$). There was a significant difference in the pre-test and post-test scores of the students before and after exposure to the e-module. This evidence supports the content and constructs the validity of the e-module.

The findings of this study support the fact that modular instruction helps supplement conventional classroom instruction and deserves greater consideration in the field of education to improve the teaching-learning process. Research findings revealed that the electronic module is valid for use inside the classroom by students who have different backgrounds and attitudes towards the subject matter like physics. E-Module is one of the solutions to the problem of physics instruction on the way lessons must be discussed to make them more fun and interesting to students enrolled in physics and may change these perceptions towards the subject.

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