TOWARD ENHANCING E-MODULES IN TEACHING PROBLEM-SOLVING IN THE ALTERNATIVE LEARNING SYSTEM

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Abstract

The Alternative Learning System (ALS) has employed the use of e-modules as the new delivery mode in teaching out-of-school learners. The purpose of this pre-experimental research is to determine whether an e-module would improve the problem-solving skills of ALS learners and to evaluate its overall effectiveness to recommend the way forward for enhancing the e-modules.

The participants were 67 learners from the three districts of a city schools division. No randomization was employed as to the selection of samples and assignment of treatments to the groups. Standardized instruments were used in the study. Learners were given a pre-test before their engagement in the e-module. Afterward, the post-test was administered. The experiment covered five e-learning groups of ALS learners and five e-learning facilitators. The statistical tools used were the mean, standard deviation, and T-test. The hypothesis was tested at 0.05 level of significance.

A significant difference was obtained on the increment in the scores of the learners engaged in the e-module. The usability characteristics of the e-module as a substantial contributory factor to its effectiveness in the improvement of the numeracy skills of learners were likewise underscored based on the perception of the learners themselves and their e-learning facilitators.

Studies may concur that adoption of new mode of teaching may not immediately boost learner performance but striking advancement is possible when the monumental power of the e-module is projected. It can be said that e-modules have displayed the benefits of using Information and Communications Technology (ICT) as the main platform for learning more specifically for subjects that require complicated tasks such as problem solving.

Keywords: e-modules, teaching problem solving, alternative learning system

INTRODUCTION

More than half a century past, one of the greatest, if not the most, essential tools in the mathematics kit of teachers is the chalk. When Information and Communications Technology or ICT crossed the threshold of the 21st Century vocabulary as a catchword in the field of education, many teachers were enthused to treat ICT as their chalk. Mathematics teachers are at the forefront of integrating ICT as they recognize it as a powerful educational tool (Johnson, 1999). Anybody working at teaching and learning in a mathematics classroom with access to puissant computational tools can do statistical data analysis, graphical displays and drawing experiments, numerical approximations and spreadsheet analyses, modeling, and simulation and more complicated tasks larger than what teachers, facilitators or instructional managers can handle on their own (Fey, 2003). Collectively, such complex tasks are introduced in today's digital age with the use of computers, the internet, and the implementation of new technologies.

Educational undertakings carried out by individuals or groups working online or offline, and synchronously or asynchronously via networked or stand-alone computers and other electronic devices are incorporated in *e-learning* (Naidu, 2006). With the emergence of this new mode of teaching and learning is the birth of electronic learning modules or e-learning modules, simply coined as *e-modules.*

In this study, e-modules are the digitized core print modules of the Bureau of Alternative Learning System (BALS), a bureau of the Department of Education (DepEd), in conjunction with the Bureau of Elementary Education and Bureau of Secondary Education. Considered as the biggest content development initiative in the country, the content development process was undertaken in partnership with the Human Capital Development Group (HCDG) of the Commission on Information and Communications Technology (CICT) that contracted State Universities and Colleges (SUCs) and Developers and Reviewers to convert the print modules to e-learning modules in support of the Alternative Learning System (ALS) Accreditation and Equivalency (A&E) program of BALS under the eSkwela Project.

The Accreditation and Equivalency Program of BALS is a Non-Formal Education (NFE) program that provides certification of learning for out-of-school children, youth and adults who are unable to avail of education in the formal school system, or who have dropped out of formal elementary or secondary education.

The core of the eSkwela Project is the eSkwela Instructional Model, which was designed essentially as a concrete application of ICT integration in education, customized for the ALS learners. It is meant to provide ICT-enabled opportunities and integrate ICT to broaden access to basic education. This is in response to the increasing number of school-age Filipinos that are out of school. In 2003, DepEd estimated that there were 1.84 million school children with ages 6 to 11 years and 3.94 million young people ages 12 to 15. That yields a total of 5.18 million out-of-school children and youth in the country (Guerrero, 2004). To reduce the digital divide which incriminatingly hinders the path toward the vivid realization

of universalizing literacy (with the ultimate goal of eradicating illiteracy) by the year 2015 in consonance with the goals of "Education For All (EFA)" is the impetus behind the efforts to produce and the use of interactive multimedia learning materials (eSkwela 1.0, 2011, p.6).

The Project Terminal Report for the period August 2007 to June 2011 entitled *eSkwela 1.0* is a detailed account of the eSkwela Project, from its inception until its closure, as it was officially turned over to DepEd last April 29, 2011. The turn over aimed to institutionalize the project as a regular delivery mode of the ALS A&E Program. The eSkwela Project yielded 283 targeted e-learning modules certified by BALS.

The e-modules certified by BALS are particularly focused on the development of life skills specifically designed for Filipino out-of-school youth and adults. The e-modules, when used appropriately, are expected to enhance teaching and learning in the ALS curriculum and provide learning according to the learner's pace in an exciting, innovative, and meaningful way. The ALS core print modules in each of the five learning strands or subject areas in the ALS context were digitized, including those of Learning Strand Two (2)– Critical Thinking and Problem Solving. Critical thinking is the counterpart of the Science subject in the formal structure. This study is related to the Problem Solving or Numeracy component of the learning strand two, which is parallel to the Mathematics subject in the formal school system.

In other developments, the eSkwela project team saw that the ALS curriculum and e-modules' initial assessment revealed some hindrances to ICT adoption in the ALS context. The hindering factors can be grouped into two – those that are related to the NFE A&E Curriculum and those that are related to technology.

Based on the focused group discussions, e-learning facilitators interviewed generally think that "the digital modules are not effective when teaching Math skills (eSkwela, 2011, p.186)." It was inferred that to ensure that learners are indeed solving the problems, more examples would be necessary supplemented by board work. It was discovered that the e-modules work best for communications since the conversations help in improving pronunciation. Features of the e-modules that allow learners to see and hear interviews likewise build the life skills of learners (eSkwela, 2011, P.187)."

This study which investigated a module on math skills – a learning strand on problem-solving – would suitably research on the effectiveness of the Problem-Solving e-module in the learning experiences of the learners and how would this impact their rate of achievement in terms of the observed increments in the pre-test and post-test administered to them. Since a formal study is lacking to look into the effectiveness of the e-modules in improving the mathematical skills of the learners, the infusion of this innovation is tackled accordingly.

This is of particular significance because, amidst the infusion of powerful tools as e-modules, expectations for learning as well as instructional practices of learners are still at large, remarkably similar to those of a half a century earlier in terms of syllabi, teaching, and examinations. Equipping learners with computers and e-modules does not automatically

generate a significant and extensive impact on learners' achievement in numeracy, neither does it spontaneously guarantee successful delivery of instruction. It is, therefore, imperative that the understanding of the learners' mathematical concepts, skill proficiency, and problem-solving abilities are assessed through tests, interviews, projects, hands-on tasks, and observation of their daily work. Assessment in this context "is the process of gathering evidence about a learner's knowledge of, ability to use, and disposition toward *Problem Solving* and of making inferences from the evidence for a variety of purpose" (NTCM, 1995). A sound instructional decision is a result of a comprehensive assessment program that can provide relevant data that allows for the evaluation of learning outcomes. Standardized tests and instruments were utilized in the study to identify the level of significance in which e-modules affect respondent-learners' achievement. The instructional and presentational design, along with the content of the e-module as a product of technology, may only be some of the variables that affect the teaching-learning environment. Results may likewise be interrelated within a complex variety of dimensions, including but not limited to the learning environment, learner issues, delivery of instruction as well as the employment of strategies in the delivery of the tool by the e-learning facilitators.

Considering the comprehensive assessment and the complexities of evaluation of e-modules in this era when most are endowed with limited skills, time, and resources, it is practicable to consider profound recommendations to enhance e-modules in teaching Problem Solving. Such recommendations can serve as model and pattern in asking the right questions and making the right choices whether one is an administrator, policymaker, educator, or a simple user of the e-modules within and outside the realm of mathematics and problem-solving.

Notwithstanding the favorable results produced in many experimental settings and pilot implementation sites, with an ample budget invested by the bureau in the e-modules, the level that it created impact upon the learner and facilitator achievement was the foundation of this study. It is contrived to address the problems and difficulties affecting the learner's and facilitator's teaching-learning achievement in the use of e-modules.

This study primarily aims to recommend points and steps to enhance the existing e-modules in teaching learners in problem-solving under the Alternative Learning System (ALS) Program.

It sought to answer the specific objectives as follows 1) to determine the extent of improvement of the learners in problem-solving associated with the use of e-modules in teaching; 2) to describe how the learners evaluate the e-modules in terms of learning problem solving; and 3) to illustrate how the facilitators evaluate the e-module.

In addition, the following hypotheses were tested:

H_o: There is no significant difference in the pre-test and post-test scores of the ALS learners associated with the use of e-modules in teaching problem solving

H_1: There is an improvement in the pre-test and post-test scores of the ALS learners associated with the use of e-modules in teaching problem solving

H_2: There is a significant difference in the pre-test and post-test scores of the ALS learners associated with the use of e-modules in teaching problem solving

"Simply putting computers into school is not enough to impact student learning," this encapsulates the first session of the Learning Facilitator's training on eSkwela conducted by the Commission on Information and Communications Technology (CICT) in September 2009. This was intended for e-learning Facilitators among the ALS implementers nationwide engaged in e-learning as a mode of delivering the ALS Accreditation & Equivalency (A & E) Program.

Equipping schools with computers does not automatically generate a significant and extensive impact on schooling. The same is true not only in the local setting but throughout the world (reference may be made in the studies of Pelgrum, 1996; Prometeus, 2001; Venezky & Davis, 2002). According to De Corte, as cited in Bottino and Robotti (2007), the limited impact is mainly rooted in technology being an auxiliary to an existing, unchanged classroom setting. Utilization of technology, therefore, should be considered not merely to bring into completion a specific task and or development of specific and compartmentalized abilities but should be progressively regarded as integrative and holistic teaching and learning activity. The digitization of the print modules to provide learners with fun, interactive and meaningful means of acquiring problem-solving and numeracy skills is therefore rooted in the acquisition of mathematical skills for personal and social effectiveness and demonstration of knowledge and skills related to solving real-life problems.

E-learning addresses the changing way learners acquire knowledge and skills and interact with one another is seen to be beneficial in the current educational system as well as the overall global competitiveness of the country. A delivery model that allows for instant access, real-time interactivity, active participation, and mobility yields a digital knowledge society – a virtual environment that can be created almost anytime and anywhere. Such acculturation aimed at the achievement of wide media reach, fast-paced research and development, rapid changes, and increased globalization entails globally competitive knowledge workers. However, Dr. Teh Ying Wah (2007) suggested in his study solutions to problems in the current e-learning system. He suggested integrated based or online simulation as the key to teaching mathematics in the e-learning system in today's education.

Although Problem Solving in this study refers to one of the components of Learning Strand 2 – Problem Solving and Critical Thinking in ALS, which is equivalent to the subject Mathematics in the formal education, this term has been conferred increasing attention as a focus of mathematics instruction. Margaret Taplin extensively discussed the Problem-Solving Approach in her study and how such an approach can contribute significantly to the outcomes of mathematics education. Thatcher (1991) stated that this focus on problem-solving implies a change in philosophy and practice for mathematics teaching. Moreover, the Professional

Teaching Standards defines this transition by stating, "This is a major shift from learning mathematics as accumulating facts and procedures to learning mathematics as an integrated set of intellectual tools for making sense of mathematics situations" (NCTM, 1992, P.2). Many writers have attempted what is meant by a problem-solving approach to teaching mathematics. The National Council of Teachers of Mathematics (NTCM) says that this is because problem-solving encompasses skills and functions, which are an important part of everyday life (NTCM,1980). It, therefore, creates a context that simulates the real-life and consequently justifies mathematics as a means rather than treating it as an end itself. The e-modules, as standardized instruments utilized in this study, are focused on problem-solving. Learner's encounter with Problem Solving modules engaged them into a careful balance between the development of problem-solving abilities and skills proficiency and its impact on their social effectiveness and confidence in facing and solving real-life problems. In this manner, learners envision numeracy skills as effective tools for problem-solving itself.

Alternative Learning System, as a bureau of DepEd, employs the same evaluation system used by the public schools in the Philippines. This is geared toward finding out whether the evaluation system employed is being used as a constructive dynamism directed to better learning outcomes on account of a better teaching-learning environment vis-à-vis a balanced curriculum. In effect, the evaluation system should deliver feedback that is needed accordingly (De Vera, 1996). Analysis of test question follows the same rudiments, whether digitized or in print. Hopkins and Antes (1990) wrote that accumulated information about item difficulty, discrimination powers of items, balance, specific, and objectivity is significant in improving future tests. The enhancement of the quality of any instructional and assessment tool rests in appraisal information to strengthen test items through proper revision. Test analysis, according to Thorndike and Hagen (1991), may be done in two ways. The first is from the standpoint of what the results reveal about what the learner is learning or how successful instruction has been. In this study, this is reflected in the learners' pre-test and post-test scores. Second is the evaluation of the test as a measuring instrument. Items can be analyzed either quantitatively in terms of content and form, or qualitatively, that is on account of their statistical properties. Quantitatively, this study employed standardized pre-test and post-test embedded in the e-module to ensure that tools are valid and reliable. However, recommendations on enhancing the e-module are the ultimate end of the investigation; therefore, analyzing the results in terms of the range of its content in consultation with the competencies at which learners must operate is an essential step in designing a test of high validity and reliability. A test's validity is determined by how well it samples the range of knowledge, skills, and abilities that students were supposed to acquire in the period covered by the test. The reliability of a test depends upon grading consistency and discrimination between students of differing performance levels.

Alongside quantitative information on the difficulty and discriminating power of each test embedded in the modules, the study similarly considered the respondents' feedback on the problems and difficulties encountered on the use of e-modules based on a standardized rubrics guide as a useful evaluation tool.

Johnson (2001) wrote that teachers of Mathematics are the vanguard of integrating computers and calculators in the school curriculum. It has been the resolve of the National Council of Teachers of Mathematics (NTCM) anent the availability of computers that students should learn to use the computer as a tool for processing information and performing calculations to investigate and solve problems (NTCM, 1989, p.9). Jensen and Williams (1993) report that the use of didactical tools like calculators and computers has a positive effect on "both problem-solving achievement and attitudes towards the activity of problem-solving. "It is in this context that ICT learning resources such as e-modules have to be progressively appraised to become valuable sources of inputs and activity platforms to deliver the learning results for all types of learners, especially in teaching mathematical concepts and numeracy. "Logical definition and relationship between the learning goal, resources input, choice of instructional strategy or methodology, the targeted product, and the means to validate and verify," must be altogether embedded in the delivery mode (O' Bannon, et al., 2007).

The ability to plan and deliver instruction that provides the rich environment that meets that varied needs of either all the pupils and students in a classroom of a formal school set-up or of all the learners in a community learning center of ALS, is the key to a teacher's or literacy facilitator's success. "The final success of any teacher is the integration of theory and practice" (NCTM, 1991).

Central to the enhancement of Problem Solving e-modules is the development of critical thinking and problem-solving ability of learners in the ALS, concurrent with their becoming functionally literate individuals and lifelong learners. This entails the appraisal of e-modules through analysis and evaluation to become a valuable source of input and activity platform to deliver the learning results for all learners.

Specific studies concentrated on the e-learning environment system in the domain of teaching problem solving and mathematics. Bottino (2007) introduced models for eliciting ideas in ICT-based learning systems on account of the framework of educational theories, the functions of the characteristics of ICT-based systems and the users' expectations and the relationships supported. Wah (2007) focused on how simulation may help in the e-learning system in the teaching-learning environment of mathematics. It also tackled the main problems of e-learning and the solution to the problems.

Hopkins and Antes (1990) similarly explored the item difficulty, discrimination, power, and balance toward improved test items in the future.

The different studies above relate to the present study in the enhancement of e-modules in teaching Problem Solving in the Alternative Learning System. However, e-modules subject to this study, which is uniquely developed and designed for ALS out-of-school learners, marks this paper's distinction from other studies. The e-modules, the development of which, the researcher has been a part of, are subjects that other studies did not deal with.

The fundamental principle antecedent to conceptualizing the enhancement of Problem Solving (Numeracy) e-modules in the Alternative Learning System is the e-learning theory of Holmes, et al. (2001) that the enhancement and development of the existing learning opportunities would be essential as everyone is, at all times, called upon to learn and create new knowledge, learn new ways of doing things and to a great depth, create new ways of learning per se.

Having collated all the foregoing studies, the use of e-modules in improving ALS learners' competencies is now at large. It is the main motivation of this study to evaluate further the use of e-modules in the teaching and learning process. This will be measured based on the results of standardized pre-test and post-test administered to them. Accordingly, the results shall be the basis for determining whether instructional objectives are met in specific content areas based on the table of specifications as set in the ALS curriculum in Problem Solving.

As per the project terminal report of the eSkwela Project Team (the developers of e-modules in this study), "As yet, no formal study has been done to look into the effectiveness of the e-modules..." This study is an effort towards that.

This study aims to recommend steps to enhance existing e-modules in teaching problem-solving in the Alternative Learning System.

Specifically, it determined if improvement in scores is evident in the performance of the learners after using the e-modules based on the difference of their pre-test and post-test scores. Further, it provides data as to the difference between the two groups' increments in scores at 0.05 level of significance. It also outlined the difficulties and problems experienced by both the learners and facilitators in the utilization of the e-modules.

The study also accounted for the problems encountered both by the respondent-facilitators and respondent-learners in the delivery and utilization of the e-modules, respectively. It is intended to provide recommendations in improving the e-modules toward increased learners' achievement in one of the core learning strands of ALS, which is Problem Solving. It highlights the significant role that e-learning facilitators play in planning the courses given to learners.

BALS, in general, may also benefit from this study with respect to the improvement of instructional designs of the e-modules, which may perhaps yield increased achievement rate for ALS learners.

At the division level, the study may be used as a basis for planning future investments in training and instructional materials development. E-learning centers may be institutionalized by the district to examine further how its use will impact learners' achievement in a wider scope across learning areas apart from Problem Solving strand or Mathematics subject.

This study will also serve as a guide for teachers using e-modules and related media of instruction in providing more meaningful ICT-enhanced learning experiences, which is simplified, localized and contextualized according to the learners' felt learning needs.

The emergence of e-modules and employing these as a new mode in delivering basic education opens a window of opportunity for education research innovation that may change education policies for improved classroom and community learning center practices.

Figure 1 sums up the conceptual framework of this study.

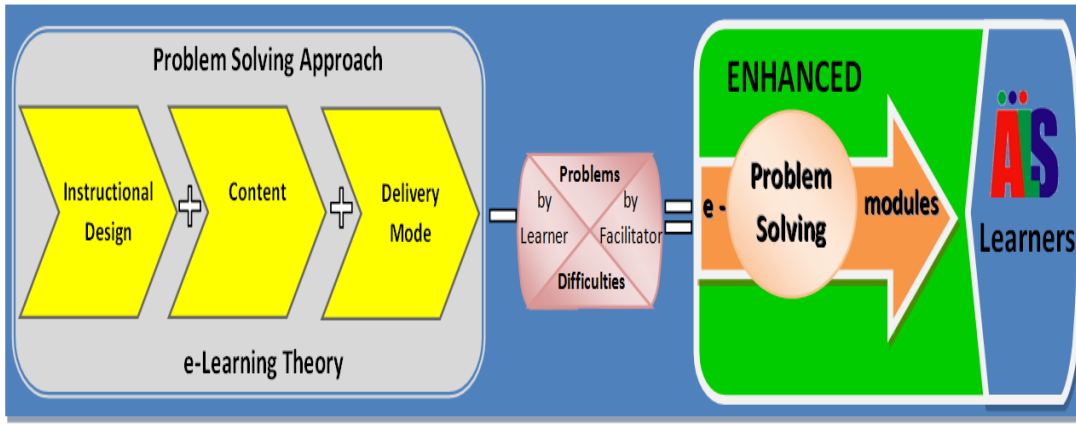

Figure 1. Conceptual Representation of an Attempt to Enhance e-Modules in Problem Solving in the Alternative Learning System

The preceding framework represents an equation that depicts the goal of this study. Conjoining instructional design, content, and delivery mode defines the current problem-solving e-modules being used by the Bureau of ALS with the e-learning and problem-solving approach as the underpinning theories on which the development process is anchored. Problems and difficulties of the learners and facilitators in the use of the e-modules, when diminished, are deemed a viable basis for yielding eventual enhancement of the problem-solving e-modules. Such emendation is expected to exhibit ALS learners with improved critical thinking and problem-solving ability.

In line with obtaining a better appreciation of this study, the following terms are defined as conceptually and operationally. Unless otherwise indicated, the conceptual definition is used as the operational meaning.

ALS Mobile Teacher. This refers to a teacher, employed by DepED, who conducts community-based ALS programs for the out-of-school children, youth and adults who are willing to learn basic literacy skills or other desired and necessary competencies for continuing education.

Alternative Learning System (ALS). Based on the definitions taken from the Governance Act of Basic Education (RA 9155), Alternative Learning System (ALS) is a parallel learning system that provides a viable alternative to the existing formal education instruction. It encompasses both the non-formal and informal sources of knowledge and skills. This refers to the third bureau of the Department of Education (DepED), alongside elementary and secondary bureaus, from which the respondents of this study are enrolled.

District ALS Coordinators. This refers to a formal school teacher employed by DepED and locally designated either full-time or part-time, to coordinate the ALS program implementation in the district.

e-Learning. As defined in the European e-Learning Action Plan, e-learning is the use of multimedia technologies and the Internet to improve the quality of (teaching and) learning by facilitating access to resources and services as well as remote exchanges and collaboration. In this study, this refers to an alternative delivery mode of providing ICT-enhanced educational opportunities to Filipino out-of-school youth and adults, which aims to help reduce the digital divide and enhance their capacity to be successful participants in a global and knowledge-based economy.

e-Learning Center. This pertains to the community-based learning centers that provide out-of-school youth and adults access to an ICT-based alternative learning program. Also called eSkwela center, the term is a play on the vernacular equivalent to "school."

e-Learning Facilitator. This is the Learning Facilitator trained in facilitating and mentoring techniques in the delivery of the ALS e-learning project.

e-Modules. The letter e" in e-modules stands for the word "electronic." The e-modules are also called e-learning modules. In this study, e-modules are the duly certified digitized core modules of the DepEd-Bureau of Alternative Learning System (BALS) developed in coordination with the Commission on Information and Communications Technology (CICT). The modules are covered by the Creative Commons License Attribution-Non Commercial-Allow Derivatives/Share-Alike 2.5 (creativecommons.com, 2011).

Enhance*.* Generally, this means to improve, increase, or augment. In this study, it shall mean fostering a culture of quality in the e-modules based on relevant content and mode of delivery, learner-centered needs assessment, and enrichment of learning environments.

Formal Education. RA 9155 defines Formal Education as the systematic and deliberate process of hierarchically structured and sequential learning corresponding to the general concept of elementary and secondary level of schooling, including education for those with special needs. At the end of each level, the learner needs a certification in order to enter or advance to the next grade/year level.

Informal Education. This is a lifelong process of learning by which every person acquires and accumulates knowledge, skills, attitudes, and insights from daily experiences at home, at work, at play, and from life itself.

Learner. This refers to any individual seeking basic literacy skills and functional life skills or support services for the improvement of the quality of his/her life. In this study, it specifically refers to those enrolled in the ALS.

Learning Facilitator. This is the key learning support person who is responsible for supervising/facilitating the learning process and activities of the learner.

Non-Formal Education. This is an organized, systematic educational activity carried outside the framework of the formal system to provide selected types of learning to a segment of the population.

Problem-solving. Problem-solving is the process of identifying the causes of a problem and seeking solutions to that problem (Naidu, 2003/2006). In this study, this refers to one of the components of learning strand 2 – **Problem Solving** and Critical Thinking in ALS, which is equivalent to the subject of **Mathematics** informal education.

Evaluation. This is the rating given by the learners and facilitators on the conduct of the e-module using standardized evaluation instruments.

METHOD

This study followed the guidelines of the *pre-experimental one-group pretest-posttest design,* and the orientation of the evaluation was *quantitative*. This approach of evaluation aims to test and validate the e-modules, focusing on assessing how the tool works toward the mastery of competencies assets in the ALS Curriculum, specifically for problem-solving e-modules. To verify the results of the tests, this study utilized the descriptive-evaluative strategy. It is the purpose of the study to observe relevant information related to the difficulties and problems encountered in the use of e-modules so that recommendations toward enhancing the same shall be produced accurately and with sufficient details and bases. Below is the pre-experimental design used:

One Group Pretest Post-test

O_1	**X**	**O_2**
Pretest	e-modules	Posttest

Symbols used:

X = intervention/treatment/manipulation

O = Observation

There were 67 respondents in the study. They are from the five learning groups of ALS implementers in the three districts of a city schools division, which consist of 27 learners from the North District, 25 and 15 learners from West and East Districts, respectively. There is no randomization employed as to the selection of samples and assignment of treatments to the groups. The respondents are the learners enrolled under the e-learning delivery mode of the ALS Accreditation and Equivalency Program. The composition of the respondents of this study is found in Figure 2.

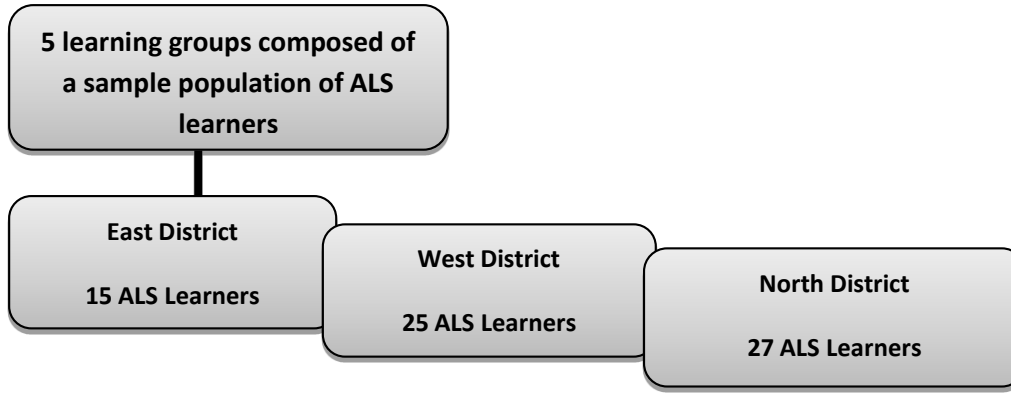

Figure 2. Composition of the Respondents of the Study

The respondents of this study are secondary level learners, 28 female, and 39 male, enrolled under the e-learning program. The youngest respondent is 16 years old, while the oldest is 30 years old. The majority of the respondents that account for 55 percent are in the 20-24 age group, followed by the 16-19 age group that accounts for 28 percent of the respondents, and the remaining 14 percent are respondents aged 25-30 years old. Respondents are among the young people who are considered gadget-savvy who own a cellular phone, use the internet, have an email, and have a social networking account. As e-learners, they are all computer literate and are well-oriented in the use of digitized modules. Respondents considered in the study are those with sufficient knowledge and experience in the use of e-modules equipped to make appropriate judgments and evaluate the design and content of the e-modules.

The Alternative Learning System (ALS) learners represent the respondents of this research whose pre-test scores were compared with their post-test scores to determine the significant difference and rate of improvement after engaging them in the use of e-modules in the Problem Solving Strand. The extent of learning is determined by the post-test scores, as well as the evaluation results from the facilitators and learners themselves. The learners' and facilitators' evaluation and post-test results are used as relevant factors in coming up with recommendations in enhancing e-modules in teaching Problem Solving.

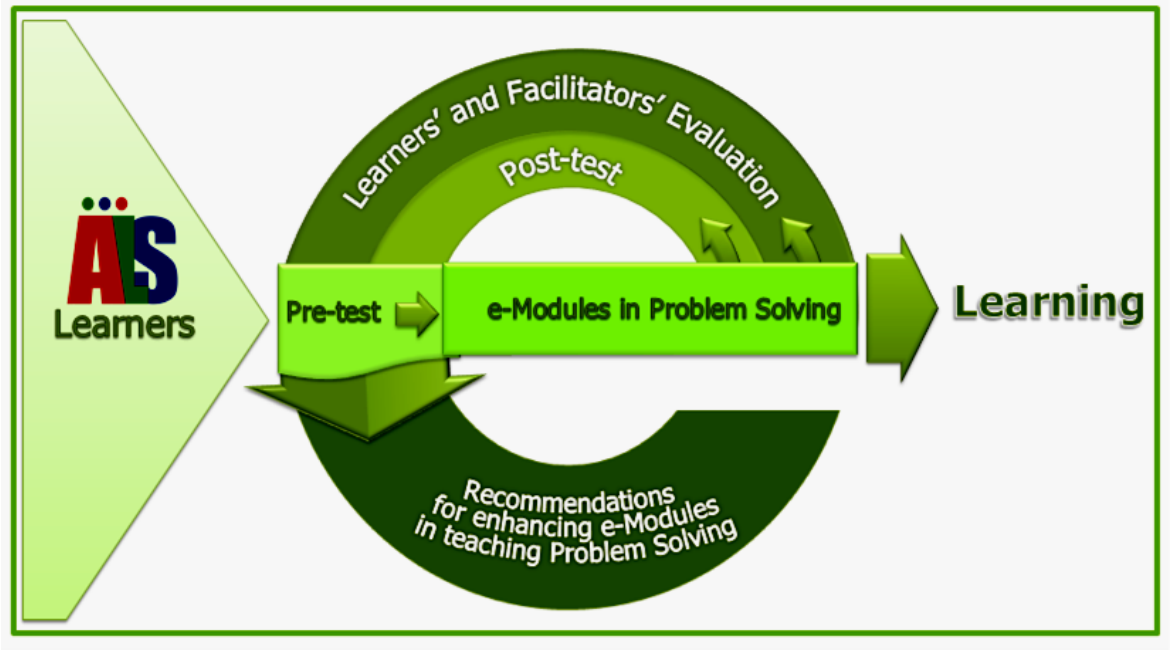

Figure 3. Procedural Representation of An Attempt to Enhance e-Modules in Teaching Problem Solving in the Alternative Learning System

Measurement Tools and Procedures

The research employed standardized instruments. The development of test questions on selected e-modules was uncalled for since each digitized module has its built-in assessment feature, which is standardized pre-test and post-test. Each of the test items is grounded on the ALS learning competencies contained in the ALS Curriculum subdivided into a terminal, enabling, and sub-enabling objectives.

Data were taken from the pre-test, and post-test scores of the respondent-learners in the standardized pre-test (Appendix B) and post-test (Appendix C) embedded in the e-modules and standardized questionnaires called User Evaluation Form (Appendix D) administered to the respondent-learners and ICT4E Usability Assessment Rubric (Appendix E) for facilitators.

The questionnaire for respondent-learners included personal assessment as to the difficulties and problems encountered in the utilization of the e-modules. This standardized rubric delved on questions involving the presentation of the module with a focus on the appropriateness of the e-modules' content and links (visuals, audio, interactions, text, animation, or video). The form has for its response scale as follows:

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

The ICT4E Usability Assessment Rubric for the respondent-facilitators cover the usability characteristics of the e-modules as to instructional design, learning content, use of multimedia, and learner interface.

The standardized assessment rubric for the respondent-facilitators has the following response scale:

Very Good	Good	Needs Improvement	Cannot be determined
4	3	2	1

Score interpretations for the average rating for each of the standardized evaluation forms that account for the perceptions of the learners and facilitators were based on Creswell's interpretation of a four-choice descriptive survey (2007).

3.60 – 4.00	Highly Accepted
2.60 – 3.59	Moderately Accepted
1.60 – 2.59	Fairly Accepted
1.00 – 1.59	Minimally Accepted

Permission was obtained from the Bureau Director of ALS (Appendix A) for the utilization of the certified ALS digitized modules or e-modules, specifically, those related to Problem Solving (numeracy) of Learning Strand 2 – Critical Thinking and Problem Solving. Moreover, permission was likewise secured for the employment of the Rubric guide, the standardized User Evaluation Form, and ICT4E Usability Assessment Rubric in assessing feedback of respondents related to the use of e-modules.

Specific documentation on the matrix of the table of specifications for learning strand on problem-solving was acquired from the Bureau of ALS in an "ALS eLearning Consultative Conference" participated in by the researcher with the content development review committee, module guide writers, eSkwela Regional Coordinators, and eSkwela Trainers held on December 2 to 4, 2009 at Development Academy of the Philippines (DAP), Tagaytay City. This matrix was significant in analyzing each of the items in the modules as contributory to the recommendations made in the study. The measurement procedure is summarized as follows:

Pre-test Administration

Guidelines and procedures in the conduct of the test administration were properly set. Components of the pre-test were first discussed to the respondents by the researcher. As an e-learning facilitator trained by the Commission on Information and Communication Technology Human Capital Development Group (CICT HCDG), the researcher deemed it necessary to conduct the administration of tests as well as the standardized tools herself in proper coordination with the e-learning facilitators to ensure strict adherence to the required procedures. Respondents were told that the pre-test aims to diagnose their level of comprehension relative to the Problem Solving strand.

To ascertain that no questions shall be left unanswered by the respondent-learners, each of them was given a hard copy of the pre-test before being engaged in the e-module and then the post-test afterward, where they were asked to write their answers. It is noted that they would have easily skipped the questions in the digitized form by simply using the navigation buttons like *skip* and *next.*

The pre-test consisted of 10 items, as shown in Appendix B.

Facilitation of the e-Modules

After the administration of the pre-test, learners were instructed to take up the e-module entitled "Anna's Weight Adventure Part 1." This e-module is all about measuring the weights of objects and persons. The objectives of the e-module are for the learner to be able to 1) identify the units for measuring weight in the metric and English system; 2) measure, read and record the weights of objects and persons; and 3) convert smaller units of weight to bigger units and vice versa.

About the ALS Curriculum, the e-module entitled "Measuring Weight 1" in the print module has for its Terminal Objective the demonstration of knowledge and skills in using measuring devices in solving real-life problems. The Enabling Objective of the module is to demonstrate an understanding of the meaning of mass and weight. As for its Sub-enabling Objectives, it aims to enable the learner to state the meaning of mass and weight and its practical application, read and record measures of mass and weight of objects using standard measuring devices and indigenous ways, estimate mass and weight by lifting and by comparing familiar objects considering the shape, diameter, and height of other containers to determine if the seller gives the right amount of materials for the money, use appropriate units of measurement of weight, convert smaller units of weight and mass to bigger units and vice versa, convert standard units of weight and mass from the English to the Metric System and vice versa, compare weights using standard and indigenous measures, and solve everyday problems using knowledge and skills on weight and mass.

Figure 4. ***Screenshot of the e-module Anna's Weight Adventure Part 1***

The setting of the e-learning center provided the learners with a virtual classroom. Each of them worked individually, having one is to one student to computer ratio.

Learners from five learning groups of Alternative Learning System (ALS) Facilitators were covered in the study. Administration of the tests in each of the e-learning centers followed logical procedures, ensuring that each of the groups had similar conditions upon taking the tests. This was to safeguard those other extraneous variables will surface. Throughout the engagement of respondents to the e-modules, e-learning center policies and procedures were enforced at all times, and a conducive learning environment was ensured. The facilitator also guaranteed that hardware, software, and the systems of the center are in good working order.

Respondents were asked to look into the module overview outlining the brief description, learning objectives, and topics or lessons covered in the module. The delivery mode employed was blended learning, with the presence of an e-learning facilitator who guided the learners. The learning was self-paced within the two hours allotted to an e-learning session.

Post-test Administration

After taking the module, respondents were asked to answer the post-test. This was a standardized test parallel to the pre-test embedded in the modules.

Evaluation

Proper orientation was given to the learners in answering the User Evaluation Form. Proper coordination with the e-learning facilitators was undertaken to ensure that the standardized ICT4E Usability Assessment Rubric will be properly filled out.

Data Collection and Analysis

To ensure that meaningful comparisons can be made between the pre-test and post-test, only the scores of the respondent-learners for item numbers 6, 7, and 8 were considered. Since some items of the pre-test were multiple-choice items and all of the items in the post-test were worded problems, adjustments had been made so that the pre-test shall consist of contents parallel to the post-test, which is provided in Appendix C.

Homogeneity of these test items was looked into in order to ensure inter-item consistency using Kuder-Richardson 21, a reliability estimate for dichotomous responses. The scores of the respondent-learners were processed through the Statistical Package for Social Sciences (SPSS). Scores were converted through the process of score transformation. The re-computed values were used based on the eight-item post-test to which it was paired in ascertaining the significance of the relationship between the two.

Data obtained from the pre-test and post-test scores of the respondent-learners were analyzed using SPSS. A summary of the respondents' scores was determined. The pre-test scores were then correlated with the post-test scores. These scores were compared using a t-test at 0.05 level of significance to determine if there is a significant difference between the pre-test and post-test scores of the respondent-learners.

The tabular value, computed t-value, and p-value were also determined for the pre-test and post-test. This is to ascertain the magnitude of difference between the means of the scores and to determine the learners' extent of learning based on the test scores.

Classical test of hypothesis for one sample mean comparison test was employed using both the one-tailed and two-tailed tests. A one-tailed test, also known as a directional hypothesis, is used to compute for the significant difference between scores in one direction. The two-tailed test or non-directional hypothesis, on the other hand, is used to compute for the significance in the relationship between variables in either direction, testing any indication of significant improvement on the increment scores. It makes the computation more sensitive and able to detect more subtle differences.

Summary of Data Gathering Procedure and Data Analysis by Research Problem

Problems / Objectives	**Source of Data and Method of Acquisition**	**Data Analysis /Statistical tool**
1. Describe the prior learning of the respondent-learners.	Respondent – learners' Pretest Scores (Table 1 and Table 2)	Mean Standard Deviation t-value (one-tailed and two-tailed)
2. Identify the extent of learning of the respondent-learners after undertaking the e-module	Respondent-learners' Post-test Scores (Table 1 and Table 2)	Mean Standard Deviation t-value (one-tailed and two-tailed)
3. Determine the extent of difference between the pre-test and post-test scores of the respondent-learners.	Reliability Coefficient between the Pretest and Posttest (Table 3)	Kuder-Richardson formula 21

Problems / Objectives	**Source of Data and Method of Acquisition**	**Data Analysis /Statistical tool**
4. Describe the areas in the e-module as evaluated by the learners and facilitators	User Evaluation Form (Table 4) ICT4E Usability Assessment Rubric (Table 5)	Mean Standard Deviation Variance

RESULTS

Respondent-Learners' Pre-test and Posttest Performance Using the One-Tailed Test

Table 1
Performance of the respondent-learners in the pre-test and post-test (One-tailed test)

No.of Learners	**Test**	**Mean Scores**	**Standard Deviation**	**One-Tailed T-test**		
				Tabular t-value	**Computed t-value**	**P-value**
67	Pretest	3.3831	2.80767	1.668	2.115	0.19105
	Posttest	3.9552	2.46449			

Table 1 reflects the general performance of the respondent-learners in the pre-test and post-test. Their mean scores increased by 0.5721 after using the e-module. As to the dispersion of the scores, the decrease of 0.34318 in the standard deviation during the post-test hinted that the spread of the scores slightly narrowed. The t-value was computed at 2.115, which is greater than the tabular t-value of 1.668 at 0.05 level of significance.

Respondent-Learners' Pre-test and Posttest Performance Using the Two-Tailed Test

Table 2
Performance of the respondent-learners in the pre-test and post-test (Two-tailed test)

No.of Learners	Test	Mean Scores	Standard Deviation	Correlation	Two-Tailed T-test		P-value
					Tabular t-value	Computed t-value	
67	Pretest	3.3831	2.80767	0.653	±1.997	-2.115	0.03821
	Posttest	3.9552	2.46449				

The non-directional test of the hypothesis indicated any significant improvement on the increment scores. Table 2 verifies the computed t-value of 2.115 under a two-tailed test in which the tabular t-value is at 1.997. This supports the claim in the alternative hypothesis that there is a significant difference between the pre-test and post-test scores of the ALS learners associated with the use of e-modules in teaching problem-solving.

Reliability Coefficient between the Pretest and Post-test

Table 3
Reliability coefficient between the pre-test and post-test

Statistics	Pre-test	Post-test
Mean(μ)	3.38	3.96
Standard Deviation	2.79	2.45
Variance	7.76	5.98
Reliability Coefficient	**0.86**	**0.76**

The reliability coefficient between the pre-test and post-test was determined. The decrease in the variances between the pre-test and post-test made them more reliable. The reliability index of 0.86 was obtained for the pre-test, which means that the results of the test

are reliable. As for the post-test, the reliability coefficient of 0.76 indicates that results are good for a classroom test; in the range of most. However, it is also indicated that some items can still be improved.

User Evaluation

Table 4
Respondent-learners' evaluation of the e-module

	English	Ave. Rating	Interpretation
1	I was able to understand the lessons presented in the module.	3.39	Moderately Accepted
2	The words used in the module were easy to understand.	3.18	Moderately Accepted
3	The narrator helped me understand the lessons better.	3.67	Highly Accepted
4	The visuals, pictures, animations – helped me understand the lessons better.	3.51	Moderately Accepted
5	*The animation* helped me understand the lessons better.	3.60	Highly Accepted
6	The narrator helped me how to use the module.	3.54	Moderately Accepted
7	I need someone to explain or show me how to use the module.	3.12	Moderately Accepted
8	I was able to select the lessons that I want to learn about.	3.33	Moderately Accepted
9	The text was easy to read, it was not too big or too small.	3.43	Moderately Accepted
10	The pictures and graphics were very clear and detailed.	3.49	Moderately Accepted
11	*For modules with videos*: I was able to clearly see and hear the videos in the module.	3.49	Moderately Accepted

Table 4 continued…

	English	Ave. Rating	Interpretation
12	The voice over was clear and loud enough for me to hear and understand.	3.34	Moderately Accepted
13	The background music was not distracting.	2.75	Moderately Accepted
14	All media were complete and working in the module.	3.33	Moderately Accepted
15	I was able to click all the buttons and/or links in the module.	3.30	Moderately Accepted
16	I was able to go from one screen to the next.	3.27	Moderately Accepted
17	I was able to go back to the main menu after each lesson.	3.30	Moderately Accepted
18	It was easy to select and/or place answers in the module.	3.33	Moderately Accepted
19	I liked the colors used in the module.	3.27	Moderately Accepted
20	I liked the layout used in the module.	3.33	Moderately Accepted
21	I enjoyed using the module.	3.54	Moderately Accepted
22	I will recommend it to my fellow learners/friend/parents.	3.60	Highly Accepted

Using the standardized User Evaluation Form, learners evaluated the e-module in learning problem-solving. Table 4 presents how respondent-learners evaluated the e-module. Data show that they give high regard in making them understand the lessons better through the help of the narrator and the animation with ratings of 3.67 and 3.60, respectively. Likewise, they would strongly recommend the use of e-modules to their fellow learner, friends, and parents rated at 3.60. It is also important to note that ALS learners generally enjoyed the use of the e-module with a 3.54 rating.

On the other hand, the respondent-learners found the background music to be quite distracting, rating it at 2.75. the clarity of words spoken in the e-module is scored at 3.18, which suggests that instructions are not fully understood. This implies that learners did not

perform all instructions independently. They needed some support from the facilitators, as suggested by the score of 3.

Usability Assessment

The usability characteristics of the e-module were assessed by the e-learning facilitators. Table 5 exhibits the respondent-facilitators' evaluation of the e-module, specifically on instructional design, learning content, use of multimedia, and learner interface. As perceived by the e-learning facilitators, the way the e-module presented the content is in line with the learning objectives as specified, having scored this 3.8 under the Instructional Design category.

As regards learning content, the e-learning facilitators agreed that there is proper sequencing of topics, rating this at 3.8. The e-module was perceived to have conveyed the lessons as it covers the learning scope prescribed in the learning curriculum reflected in an authentic and situational context.

As to the use of multimedia, the e-learning facilitators found the media elements to be of high visual and aural quality, the same not biased to any learning style based on the 3.8 average ratings that they indicated. Multimedia presentations were likewise relatively helpful in helping learners construct inter-related knowledge causing no misconceptions or misinterpretations by the learners, being scored 3.6.

It was generally observed by the e-learning facilitators that as to learner interface, the e-module provided clear instruction on the proper use of the material as the icons used for navigation reflects its actual use. This was given a score of 3.8. The consistency in the design was manifested in the responses and reactions of the learners in that they decide on what they need to learn, what order, and how they want to concentrate on the specific topics, rated at 3.8.

All of the e-learning facilitators, five of them, affirmed that they would favorably recommend the use of the e-module.

Table 5
E-learning facilitators' evaluation of the e-module

Usability Characteristics	Ave. Rating	Interpretation
A. Instructional Design (30%)		
1. The learning objectives and goals of the e-learning application are defined and clearly stated.	3.60	Highly Accepted
2. The presentation of the content supports the specified learning objectives and goals.	3.80	Highly Accepted

Table 5 continued…

3. The organization of the content, including all related activities, accurately reflects the learning objectives and	3.20	Moderately Accepted
4. The learning objectives and goals of the e-learning application match the specific standards of learning competencies	3.40	Moderately Accepted
5. The instructional content of the digital material addresses various needs of the students. (introduction,	3.60	Highly Accepted
6. The instructional content can be used in varied settings	3.40	Moderately
7. The e-learning application supports the desired	3.60	Highly Accepted
8. The digital material provides a clear measure of achieving/meeting learning objectives and goals.	3.80	Highly Accepted
9. The e-learning application encourages and supports reflection, deep thinking, knowledge integration and	3.40	Moderately Accepted
10. Its scope is appropriate for the intended learning objectives and intended learners.	3.60	Highly Accepted
B. Learning Content (40%)		
1. There is proper sequencing of topics.	3.80	Highly Accepted
2. Its presentation (of the lesson) is clearly conveyed.	3.60	Highly Accepted
3. It facilitates the user's exploration of the area of knowledge both within and beyond the learning	3.40	Moderately Accepted
4. It appropriately identifies the intended learner/s (1st, 2nd,	3.20	Moderately
5. It provides adequate information to meet the intended	3.40	Moderately
6. It is accurate and error free.	3.40	Moderately
7. It covers the learning scope prescribed in the	3.60	Highly Accepted
8. It reflects authentic and situational context (e.g. cultural	3.60	Highly Accepted
9. It reflects best practice and contemporary understanding of the discipline and the knowledge	3.40	Moderately Accepted
Average Rating for Learning Content	3.49	Moderately
C. Use of Multimedia (10%)		
1. The multimedia presentations used are clear, no misconceptions, nor misinterpretations by the learners.	3.60	Highly Accepted
2. Multiple representations are used to help learners construct inter-related knowledge.	3.40	Moderately Accepted
3. Media elements are of high visual and aural quality.	3.80	Highly Accepted
4. Multimedia materials are not biased to any learning	3.80	Highly Accepted
Average Rating for Use of Multimedia	3.65	Highly Accepted
D. Learner Interface (20%)		
1. The design (of the e-learning application) is visually	3.60	Highly Accepted
2. The design is consistent relative to the responses and	3.80	Highly Accepted
3. There is clear instruction on the proper use of the	3.80	Highly Accepted
4. The (design) program responds appropriately to	3.40	Moderately
5. There are multiple forms of navigations.	3.40	Moderately
6. Icons used (for navigation) reflect its actual use.	3.80	Highly Accepted
7. These icons are readily clickable and lead to desired	3.60	Highly Accepted

Table 5 continued…

8. Learners decide what they need to learn, what order and how deeply they want to concentrate on specific	3.80	Highly Accepted
Usability Characteristics	**Ave. Rating**	**Interpretation**
Average Rating for Learner Interface	3.65	Highly Accepted
OVER-ALL RATING	3.58	Highly Accepted
Are you recommending the use of this digital learning material		5 out of 5 stated "YES"

The usability characteristics of the e-module were assessed by the e-learning facilitators. Table 5 exhibits the respondent-facilitators' evaluation of the e-module, specifically on instructional design, learning content, use of multimedia, and learner interface. As perceived by the e-learning facilitators, the way the e-module presented the content is in line with the learning objectives as specified, having scored this 3.8 under the Instructional Design category.

As regards learning content, the e-learning facilitators agreed that there is proper sequencing of topics, rating this at 3.8. The e-module was perceived to have clearly conveyed the lessons as it covers the learning scope prescribed in the learning curriculum reflected in an authentic and situational context.

As to the use of multimedia, the e-learning facilitators found the media elements to be of high visual and aural quality, the same not biased to any learning style based on the 3.8 average ratings that they indicated. Multimedia presentations were likewise relatively helpful in helping learners explicitly construct inter-related knowledge causing no misconceptions or misinterpretations by the learners, being scored 3.6.

It was generally observed by the e-learning facilitators that as to learner interface, the e-module provided clear instruction on the proper use of the material as the icons used for navigation reflects its actual use. This was given a score of 3.8. The consistency in the design was manifested in the responses and reactions of the learners in that they decide on what they need to learn, what order and how they want to concentrate on the specific topics, rated at 3.8.

All of the e-learning facilitators, five of them, affirmed that they would favorably recommend the use of the e-module.

DISCUSSION

Humanity has been struggling for all kinds of computational devices to aid in solving the intricate undertaking of computation and accomplish it more conveniently, rooted in this attempt is the conception of the modern computer (Padasas et al., 2000). Capitalizing on this, innovations and researches emerged and have become so prolific, seeking means of utilizing such technology to impact teaching and learning at all levels. This is specifically true in a subject that challenges the finer capacities of the mind, such as the study of Mathematics or problem-solving in the Alternative Learning System (Solomon cited in Cuaresma, 2011).

Being the very first ICT in education intervention for the alternative learning system in the country, content development efforts of eSkwela that produced 283 e-modules that included Problem Solving e-modules, had such a spacious room for pioneering innovations and experimentation.

Underpinning the innovation above, this study considered determining the extent of how e-modules are made to create an impact on learners in the Problem Solving learning strand as it is contrived to address the problems and difficulties affecting the learner's learning achievement and the issues encountered by the facilitators in the use of e-modules. Based on the analysis of the achievements of ALS learners in Problem Solving e-modules, sound recommendations geared at enhancing potential flaws on the content of e-modules juxtaposed ALS Curriculum on the Problem Solving component of Learning Strand 2 are recommended.

The engagement of learners in the e-module on Problem Solving learning strand in ALS influenced their rate of achievement, and apparent contradictions were found. In contrast to the general perception during the focused group discussion of the eSkwela Project team that "the digital modules are not effective when teaching Math skills (eSkwela 1.0, 2011, p.186)," the results of this study indicated that the use of e-module significantly increased the rate of achievement of the learners in Problem Solving. Significant improvements were reflected by the increased mean scores of the learners on the post-test. Consistently the improved mean scores were strengthened by the smaller value of standard deviation, which is an indication that the dispersion of the scores on the post-test was less spread out, thus increasing the chances of rejecting the conjecture of non-significance of e-module as an intervention. It yielded a significant difference in the increments of pre-test and post-test scores associated with the e-module as an innovation in improving the achievement rate of learners in Problem Solving, specifically in answering worded problems. Analysis of the data also reflected a positive correlation between the pre-test and post-test. Such a definite correlation minimized the standard error of the differences.

Engaging learners in the hands-on, minds-on learning experience is believed to be an effective tool in reinforcing the academic performance of students. Problem-solving is a highly interactive skill to perform. According to Dr. Max Walsh (2014), specific characteristics of the problem-solving approach entails interactions between students and teachers to

establish background or intent of the problem, and that students clarify, interpret, and attempt to construct one or more solution processes. Sufficient information has to be provided to encourage students to make generalizations about rules and concepts, a process that is central to mathematics.

Regarding the basic elements of practice, Institute for Research on Learning underscored that "Knowledge is inseparable from practice. It is not possible to know without doing. By doing, we learn." This is exemplified by an extract from a student teacher's journal after three problem-solving sessions on a study of Taplin (n.d.). The account stated that "*seeing patterns envelop before my own eyes was a powerful experience: it had a stimulating effect*." The same can be inferred from the way the respondent-learners answered the pre-test in the e-module. Most of them answered correctly items that were illustrated through examples like the conversion from grams to kilograms for item number 7 and conversion from ounces to pounds for item number 8. For item number 6, which required further mathematical processing on converting pounds to kilograms then kilograms to tons, the learners seem to have easily given up since they were not able to see an immediate solution for the problem and that no example of the same nature was provided in the e-module. In this circumstance, "presenting a problem and developing the skills needed to solve that problem is more motivational than teaching the skills without a context" (Taplin, n.d.). Seemingly, the examples and illustrations provided in the e-module became the contextual pillars to which most of the learners have drawn their reason for learning and motivation to solve the given problems. Moreover, a little less than one-fifth of the learners answered item number 6 correctly. For this 19.4 percent, the problem had been quite a challenge in that they had to search into the depths of their prior learning and memory to recall the knowledge required for them to solve the problem correctly successfully.

Moreover, assessment of conversion from metric to English system may be mistakenly thought not to have any accompanying discussion of the matter probably because only the distinction between the metric and English system of measurement was provided, including the word meaning of pound and ounce. The discussion of the examples was embedded in the provision of a help menu, which happened to be represented by a small avatar "weighing scale man," which may be ignored due to its size. The help menu also seemed to be optional as it bears the captions – "Learn more" and "Close help," thus, some learners may opt not to explore it at all. This is shown in Figure 5.

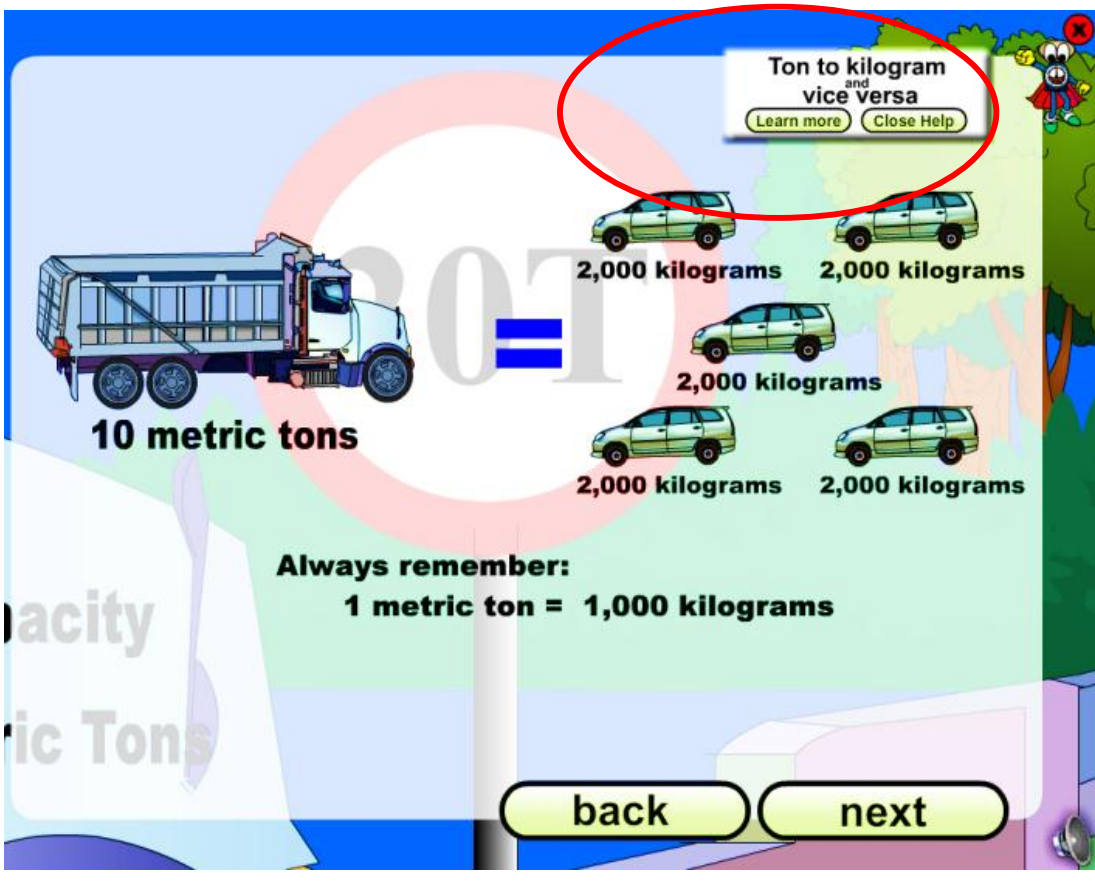

Figure 5. Screen Shot of the e-Module with Help Menu

Such is aggravated by the "next" navigation button, which would easily move the learner to the next screen even without opening the help menu. A screenshot to better illustrate this is shown in Figure 6.

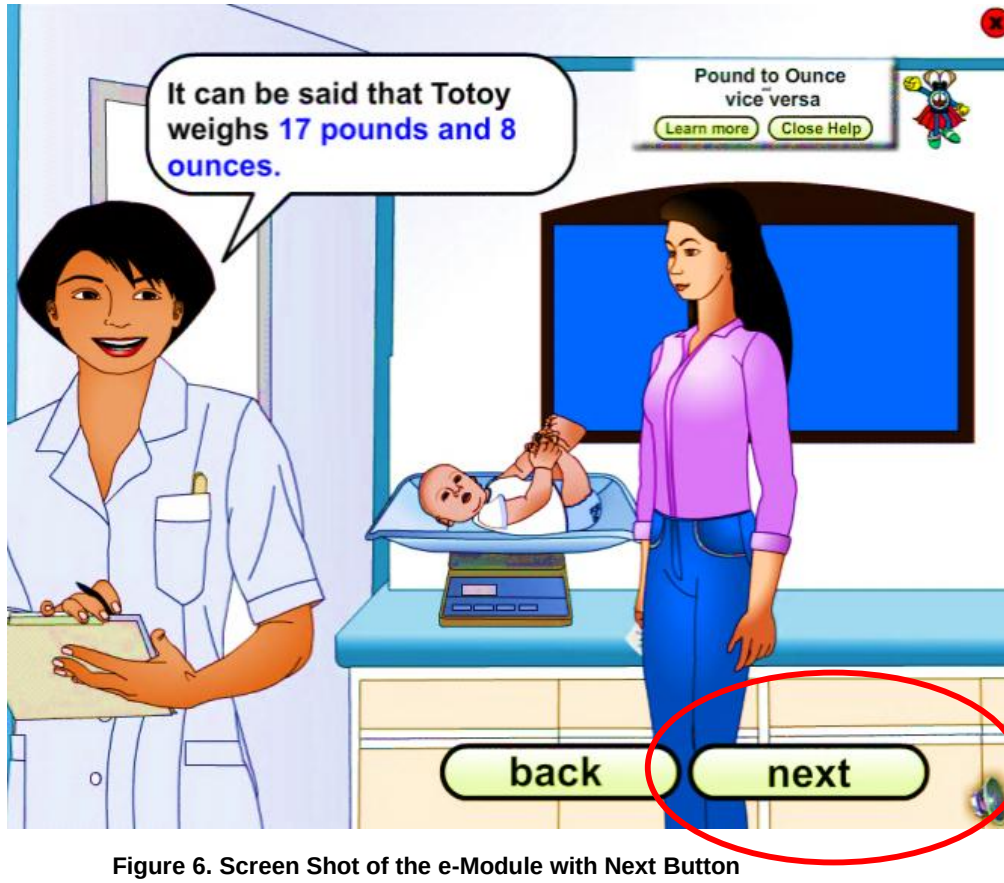

Figure 6. Screen Shot of the e-Module with Next Button

The type of problem used for the assessment is a word problem, where the idea is implanted in a real-world situation, and the learner is required to spot a suitable algorithm or rule (Taplin, n.d.). These items have allowed the learners to discriminate what knowledge is required for certain situations as compared to directly asking the learners to perform the operations on unit conversion.

The e-module is one interactive means to promote the practice of skills and mastery of competencies as what resulted in this study. Learners could distinguish the qualities necessary for e-modules. Instructions were generally orderly but lacked clarity in terms of the language used. This implies that the English language was a barrier to the thorough comprehension of the learners. The Alternative Learning System (ALS) learners probably had limited English vocabulary in which some important words were not properly understood. This

may also be supported on the need of most students of a personal assistant in following the directions.

On the lighter side, the students appreciated the voice prompt and animation parts of the e-module. The improvement of the problem-solving competencies of the learners may be attributed to these elements of the e-module. This suggests that the audio-visual component of an e-module plays a very significant role in learning. The theoretical rationale of using audio-visual or any other multimedia "is based on dual coding theory, which posits that information held both in verbal memory and in visual memory is retained better than information held in only one memory system" (Baddeley, 2004; Mayer as cited in Slavin et al., 2014).

Dr. Lloyd Espiritu, Project Content Development Consultant for the eSkwela project, viewed that the appropriateness of the module encompasses inquiries as to whether the right media is used to describe or explain the topic and whether the media used depict the intended meaning concerning the topic. As one of the content experts and reviewers, it is suggested that topics as important as illustrating examples, especially in Problem Solving modules should be underscored by putting this as display menus (applies within a single screen) rather than just pop-up menus (applies only when needed). It must be noted that as for visuals, animations are intended to concretize abstract ideas for better visualization, and therefore, sizes should be big enough to be noticed by the learners.

The content development team of the producers of e-modules has adhered to the required competencies, as indicated in the ALS Curriculum. The process allowed for the integration of outputs on standards related to the development process and quality of output, and in turn, the formulation of concrete recommendations, especially those dealing with the e-modules for the basic education sector.

Developing fitting and appropriate ICT resources to broaden access to quality education and make learning fun, interactive, and more engaging supported the general objective of providing Education for All (EFA). Further, such endeavors supported the strategic direction set to capacitate field implementers for the successful delivery of the Accreditation and Equivalency (A&E) Program. No doubt that the development of e-modules has proven to be one of the most successful initiatives to provide meaningful ICT education to the underserved sector of educationally marginalized Filipinos. Further, the project targeted a 100 percent increase in the number of A&E Test passers among the learners in its implementation areas.

As an e-learning facilitator herself, the researcher has seen the great power of the e-modules, especially that the 100 percent increase had been realized in her e-learning center for the comparative data of A&E Test for 2010 to 2012, with a significant increase across performance indicators.

The improved performance in Alternative Learning System (ALS) across enrolment, rate of test-takers and test-passers both in Elementary and Secondary Level Accreditation

and Equivalency Program in an e-learning center covered by the research reveals that in 2010, among the 38 enrolled in the program, 25 took the test and 12 successfully passed the exam which is equivalent to 48 percent passing rate. In 2011, enrolment increased to 62, and 41 took the test. Passers of the test was 25, equivalent to 61 percent. In 2012, enrolment went as high as 93 with 51 test-takers, and 31 passed, which is again a 61 percent passing rate.

As concluded in a study on the impact of information and communication technology on the management of future schools, technology delivers the prospect of making changes, but the decision to keep on is essentially a human one (Makela et al. n.d.).

This study simply aims to elucidate that e-modules, as the main resource used by ALS learners in the e-Learning Center, deserve to be tested. Significantly, if the educational system finds a way to establish standards in its development, teaching, and learning, specifically the complex task of problem-solving, will improve.

Director Carolina Guerrero, BALS Director, signified that DepEd-BALS is embarking on the development of additional e-learning module packages since it targets to reach 10 Million out-of-school children, youth, and adults through an ICT-enabled learning paradigm by 2015 (Guerrero, 2011). As such, this study proposes various recommendations for enhancing e-modules specifically for Problem Solving strand as these remains to be a work in progress.

Develop localized e-modules in Problem Solving in Filipino and even in local dialects

For answering worded problems, reading comprehension is key. Proficient reading, however, depends on the ability to recognize words quickly and effortlessly (Fielding & Pearson, 2003). The e-modules rendered in the Filipino language would augment word recognition for learners. Familiarity with the language used would lessen much of the processing capacity for learners to read individual words, thus allowing them to comprehend and understand better the problems. Constructing mental schema through e-modules in a language of their own would greatly impact the learner's ability to approach new and complex mathematical concepts.

Use Scaffolded Instruction as Useful Instructional Strategy for Problem Solving e-Modules

The concept of Scaffolded instruction is an offshoot of studies dealing with how individuals learn (Collins, Brown, & Newman, 1986; Vgotsky, 1978). As learners come from various walks of life with varying age and literacy levels, the concept of support in scaffolded instruction would help enable them to perform and complete tasks on their own. Help can emanate from the learning facilitator, but the same can be incorporated in the e-module itself. It may be how the lessons in an e-module are organized in a theme, the manner how the prior knowledge of the learner is activated and stimulated, the way how the problems are worded, and the nature of the responses learners are encouraged to make when engaged in the e-module.

Current e-modules on Problem Solving, though, are already presented in a thematic organization, where learners can build on their knowledge with every selection as these relate to real-world situations within their social context. However, more illustrations and examples of these real and familiar problems are further suggested since these provide patterns for learners to enhance their retention and learning. The more examples they see, the more likely the concepts are understood. Examples, instead of being written on the board, may be incorporated in the e-module itself so that facilitators are assured that learners are learning how the problems are solved.

Simplify and Chunk learning episodes in the e-Module

"Long sequences of anything is bad (Calub, 2011)." An "average" e-module consists of a maximum of 50 screens with a maximum of 1-hour video or 40 illustrations or 10-minute purely 2D animation or a combination of all these using the following conversion: 30-minute video equals 5-minute animation equals 20 illustrations (eSkwela 1.0, PP. 81-82, 2011). For this reason, e-modules are recommended to be further simplified and downsized. The e-module may be chunked into 15-20 minute' learning objects' or learning episodes (Calub, 2011). Concise content would optimize the learner's contact time and engagement in the module. A great writer George Orwell, once wrote: "If it is possible to cut a word, always cut it." Learners, in general, are impatient readers. They are common after the meaning and relevance of the content of the e-modules, across all learning strands. Difficult and complex language confuses them. This is aggravated by the short attention span that is common to ALS learners. Time is every e-learning facilitator's scarcest resource. Simplified e-module that is direct-to-the-point would gain learners' interest better.

Integrate a Feedback Mechanism in the e-Module learning package

Modification and improvements for the e-modules, specifically based on the perception of the learners would be obtained once a feedback mechanism is integrated into the e-module. In the process of communication, feedback refers to a response from the receiver of information, which gives the communicator an idea as to the reception of the message and whether this needs to be modified. In the context of e-learning, such feedback may refer to the output, result, or impact that the e-module had on the learners. This may allow for suggestions regarding the effective use of the customized instructional model as well as the appropriate strategies and procedures needed so that e-modules will be truly designed as simple, local, and contextual to the learner's needs.

Enhancing the e-modules is indeed a long-term endeavor that requires continuing trivial developments. The recommendations cited in this study are just some of the components that may work toward enhancing the Problem Solving e-modules in optimizing learners' learning experience and achievement in the Alternative Learning System.

As a work in progress, though, e-modules would still need continuous evaluation and enhancements. With various stakeholders embarking on this task, much promise awaits this era's viable instructional tool, the 21st Century chalk of the modern teacher – the e-module.

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