Students' Evaluation of an Interactive Multimedia Courseware

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Abstract:

Educational researchers usually study students' performance in order to better understand whether their test scores would improve after they have been exposed to certain technologies that aid learning. Students' role in such studies cannot be undermined especially that they can be a valuable resource in the evaluation of coursewares for their own classes. This study aimed to develop and evaluate an interactive multimedia courseware in the teaching and learningof Fundamentals of Problem Solving and Programming. Descriptive survey method were used which involved questionnaire, interviews, and observations. Eighty students enrolled in the subject served as respondents. Theywere asked to evaluate the courseware for content, manner of presentation, and usefulness of the materials.

Findings of the study showed that,developed courseware facilitates and enhances learning process in the classroom; arouses and maintains positive attitude of students toward learning the subject because of novelty of the materials used; and contributes consistent improvement in the ability to define and measure students' attainment of educational goals. These results could encourage teachers and researchers in developing their own coursewares.

Keywords: Interactive Multimedia Courseware, Teaching and Learning Fundamentals of Problem Solving and Programming, Teaching Technologies, Courseware Evaluation, Descriptive Research Philippines

INTRODUCTION

The momentum of the technological revolution creates rapid and disruptive changes in the way in which people live, work, and play. As the pace of technological advance shows no sign of slowing, the challenge is in learning to adapt to changes with the minimum of physical and mental stress. To make this possible, the learning systems and those who manage them must prepare people to work with new technologies competently and confidently. They need to expect and embrace constant change to skill requirements and work patterns, making learning a natural lifelong process.

Learning is made more convenient because the stimuli are powerful to arouse the attention of the students. The major goal of Computer education is for the students to develop positive attitude towards the subject and to develop new techniques in problem solving which are of high importance. To this point of discourse, it is an obvious fact that instructional materials contribute to the progress of an effective classroom teaching and to make learning develop a strong impact. Success in teaching depends to a large degree upon the skills in selecting and organizing content and materials of instruction. Instructional materials, whether visual or audio-visual, can substitute

for the firsthand experience of the students and enhance understanding in which they are considered as integral part of the learning activity (Umstold, 1984).

Today, new and emerging technologies challenge the traditional process of teaching and learning, and the way education is managed. Information technology, while an important area of study in its own right, is having a major impact across all curriculum areas. Easy worldwide communication provides instant access to a vast array of data, challenging assimilation and assessment skills. Rapid communication, plus increased access to IT in the home, at work, and in educational establishments, could mean that learning becomes a truly lifelong activity—an activity in which the pace of technological change forces constant evaluation of the learning process itself.

Developments in communications technology and the increase in personal ownership of technology will allow learning in schools and colleges to integrate with learning elsewhere. The boundaries between one institution and another and between institutions and the outside world will become less important. Crucially, technology will remove the barrier between school and home.As technology provides easier access for students to material previously supplied by the teacher, it enhances the role of the teacher as manager of the learning process rather than source of the content. It gives access for students to information, tutorials, and assessment, together with the use of IT tools such as word processors and spreadsheets, will help them learn more productively. There will be a clear split in the way schools and colleges organize learning. In areas of the curriculum that are structured and transferable to electronic format, students will work at different levels and on different content. By removing the burden of individualized learning from schools and colleges, time will be freed for teachers to concentrate on the many other learning activities requiring a teacher as catalyst.

As part of the IT curriculum, learners are encouraged to regard computers as tools to be used in all aspects of their studies. In particular, they need to make use of the new multimedia technologies to communicate ideas, describe projects, and order information in their work. This requires them to select the medium best suited to conveying their message, to structure information in a hierarchical manner, and to link together information to produce a multidimensional document.Significantly, academe is trying its best to design programs in all areas that will produce globally competitive professionals, one of which is the development of modules or workbooks in all subjects.

The researcher, as information technology instructor, embarked upon an idea of developing and evaluating an interactive multimedia courseware in Fundamentals of Problem Solving and Programming through modeling and programming in order to make the IT Curriculum in Leyte Normal University more relevant and significant to the changing times.The researcher finds that new form of instructional methodology like interactive multimedia courseware must be adopted to suit the needs, abilities, and interest of the students in order to enrich and enhance the learning process in the classroom.

Theoretical Framework

Multimedia courseware is a well-known tool for teaching and assisting students in learning. An effective courseware is actually a product of excellent pre-development processes. Hence, understanding the required design and learning theories are crucial before developing the courseware.This study adopts as its theoretical underpinning the Cognitive Load Theory, Elaboration Theory and ADDIE Model.

The *Cognitive Load Theory* (Sweller, 1999), suggests that learning happens best under conditions that are aligned with human cognitive architecture. The theory' helps in instructional

design and is concerned with the way a learner's cognitive resources are guided during learning or problem-solving situations. Cognitive load theory aims to assist course designers to reduce redundant cognitive load caused by poor course design or learning material.Information is first processed in the working memory before moving on to the long-term memory. Therefore, course designers need to consider the limited capacity of the working memory in order to make their courses effective. Here are some courseware design recommendations based on cognitive load theory:

- *Chunk the content:* When loads of content is dumped, the content becomes very complex and difficult to understand. Therefore, break the course content into smaller chunks in a way that it minimizes the cognitive load on the working memory.
- *Consider learner profile:* Based on whether learners are novice or experienced, you can decide on how to present the content and how much technical information can be included.
- *Use visual and auditory aids:* Use relevant audio visual aids that help in learning. These aids help boost the capacity of the working memory.
- *Use worked out examples:* Worked out examples are powerful means to build knowledge for long-term memory. Use examples that learners can easily relate to. This helps them to understand the content better as it reduces cognitive load.
- *Avoid redundancy:* Avoid redundant and repetitive information in the course as it reduces the load on the working memory.

Keeping these guidelines in mind while designing the interactive multimedia courseware will help reduce cognitive load that can be managed effectively. It has been proved that when instructional material is designed keeping in mind the cognitive load theory, effective learning takes place.

Another theory adopted is the *Elaboration Theory*(Reigeluth, 1999), suggests that instruction should be organized in increasing order of complexity for optimal learning. The theory essentially says that to create effective instructional designs, we should sequence content from simple to more complex. As applied to courseware development in order to increase effectiveness of instructions contents will be organized from general and broader idea to detailed and narrower ideas in gradual progression. This process will customize rather than standardized instruction that is learner-centered, based on authentic tasks.

The ADDIE Model by Steven J. McGriff (Dick, W. & Carey, L., 1996)as presented below will also be adopted in this study.

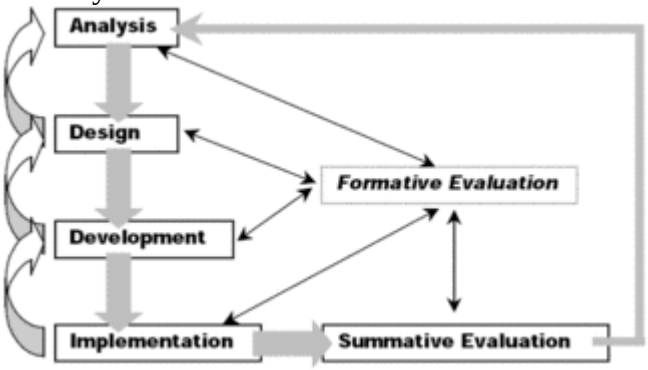

Figure 1 ADDIE Model Diagram

The ADDIE instructional design model is the generic process traditionally used by instructional designers and training developers. It consists of five cyclical phases—Analysis, Design, Development, Implementation, and Evaluation. These processes represent a dynamic, flexible guideline for building interactive multimedia courseware.

Analysis. In the analysis phase, the instructional problem is clarified, the instructional goals and objectives are established and the learning environment and learner's existing knowledge and skills are identified.

Design. The design phase deals with learning objectives, assessment instruments, exercises, content, subject matter analysis, lesson planning and media selection. The design phase should be systematic and specific.

Development. The development phase is where instructional designers and developers create and assemble the content assets that were blueprinted in the design phase. In this phase, storyboards are created, content is written and graphics are designed. If e learning is involved, programmers work to develop and/or integrate technologies.

Implementation. During the implementation phase, a procedure for training the facilitators and the learners is developed. The facilitators' training should cover the course curriculum, learning outcomes, method of delivery, and testing procedures.

Evaluation. The evaluation phase consists of two parts: formative and summative. Formative evaluation is present in each stage of the ADDIE process. Summative evaluation consists of tests designed for domain specific criterion-related referenced items and providing opportunities for feedback from the users which were identified.This is the idea of receiving continual or formative feedback while instructional materials are being created. This attempts to save time and money by catching problems while they are still easy to fix.

The theories cited above are the benchmark in the development and evaluation of an interactive multimedia courseware in teaching and learning Fundamentals of Problem Solving and Programming.

Statement of the Problem

This study aimed to develop and evaluate an interactive multimedia courseware in Fundamentals of Problem Solving and Programming (FPSP).More specifically, it sought to answer the following questions:

1. Which topics in FPSP are of functional interest to the BS Information Technology students?
2. What are the difficult topics on FPSP for BS Information Technology students?
3. How will the interactive multimedia courseware in FPSP be developed?
4. What is the students' evaluation of the FPSP courseware in terms of:
   4.1 Content
   4.2 Manner of Presentation
   4.3 Usefulness of the materials

METHOD

Research Design

The research method used by the researcher in this study was the descriptive method, which involved a questionnaire to evaluate the developed interactive multimedia courseware.

Research Procedure

The researcher followed this procedure in the conduct of the study.

Gathering of Data. The availability and reliability of data are very important to this study. The researcher with his four years of teaching FPSP lessons had compiled, course notes, examples and presentation slides he used through the years of teaching the subject. Information from the Internet and Reference books were also taken to enrich the concept development of the courseware.

Organization of Lessons. The researcher organized the lessons and ensured that the content of the courseware is sufficient and the presentations are progressive. A tutorial approach was employed to address the needs of the students.

Identifying Software for Multimedia Production. The selection of tools used in the development of the FPSP courseware was initially based on the availability of and familiarity with particular software titles. The researcher made use of Asymetrix Toolbook II Assistant 7.

Template Construction. The design of the courseware was made through the imaginative and creative idea of the researcher. As the study developed, the researcher consulted some faculty members and his students for the improvement of the courseware design. The comments and suggestions were appropriately incorporated in the courseware.

Encoding of Objectives, Concept Development, Exercises and Assignments. The courseware was designed for both group and individual instructions. The size of texts, visual effects, links and other features were carefully considered so that learners can effectively comprehend the lessons contained in the courseware.

Testing. The courseware was tried out for almost five (5)timesin the class sessions of the researcher of all the three sections enrolled in the subject FPSP. As certain obstacles and bugs were encountered, the courseware was constantly improved.

Respondents of the Study

The respondent of the study includes all First Year BS Information Technology students enrolled in the subject FPSP which has atotal of eighty (80) students. These were composed of three sections in which the two sections had twenty five (25) studentseach and the other section was composed of thirty (30) students.

Data Gathering Instruments

The main instruments used in this study were a questionnaire, interview schedule and observation sheets.

The Questionnaire.Two sets of questionnaire was designed to determine the respondents perceptions on the topics FPSP of functional interest and perceived difficult, as well as evaluation on the developed interactive multimedia courseware in terms of: (1) Content (2) Manner of Presentation and (3) Usefulness of the materials.

Interview Schedule. The researcher conducted unstructured interviews. This was done simultaneously with the administration of the questionnaire. When there were doubts about the responses of the respondents, the researcher, verified and clarified their answers through the interview. Items left unanswered by the respondents were answered during the interview.

Observation Sheets. These were considered from the students in order to note their reactions and attitude toward the interactive courseware while trying it out.

Statistical Treatment of Data

Upon completion of the data gathering, responses were tabulated to facilitate the analysis during the interpretation of data.

*Percentages.*This was used to determine the respondents' perception on the topics in FPSP, which are considered of functional interest and perceived difficult.

$$P = \frac{f}{n} \text{ x } 100$$

where:

P = is the percentage
f = is the frequency
n = total responses

Mean ($\overline{x}$) The mean was obtained by adding all the answer per item in the set divided by the total number respondents.

$$\overline{x} = \Sigma fw / n$$

where:

$\overline{x}$*is the computed mean*

Σfw*is the sum of all scores in the set*

n*is the total numbers of respondents*

This was used to determine the respondents' evaluation of the courseware in terms of content, manner of presentation, and usefulness of the material. The qualitative description was determined using the following scales:

Limits of Scale	**Qualitative Description**
4.20 – 5.00	Strongly Agree (SA)
3.40 – 4.19	Agree (A)
2.60 – 3.39	Neutral (N)
1.80 – 2.59	Disagree (D)
1.00 – 1.79	Strongly Disagree (SD)

RESULTS

This section contains the presentation of the steps involved in the development of an interactive multimedia courseware in FPSP. It also presents the analysis and interpretation of data gathered by the researcher through the survey questionnaires on respondents' perception on the topics in FPSP which of functional interest and perceived difficult as well as evaluation of the courseware in terms of content, manner of presentation and usefulness of the materials.

1. Topics in FPSP which are of Functional Interest and Perceived Difficult

Table 1

Distribution of Respondents on the Topics considered OfFunctional Interest and Perceived Difficult

FUNDAMENTALS OF PROBLEM SOLVING AND PROGRAMMING (MAJOR TOPICS)	**Of Functional Interest**		**Perceived Difficult**	
	Frequency	**%**	Frequency	**%**
Getting Started & Structure of a C++ Programs				
- Structure of a C++ Program	77	96.25	3	3.75
- C++ Elements	73	91.25	7	8.75
The Basic Data Types & Operators				
- Basic Data Types	70	87.50	10	12.50
- Operators	65	81.25	15	18.75
C++ Statements				
- Sequential	69	86.25	11	13.75
- Control	69	86.25	11	13.75
- Iteration	60	75.00	20	25.00
Functions				
- Functions	63	78.75	17	21.25
Structures and Classes, Pointes				
- Structures and Classes	49	61.25	31	38.75
- Pointers	41	51.25	39	48.75
Arrays				
- One Dimensional	37	46.25	43	53.75
- Rectangular	28	35.00	52	65.00

Topics in FPSP, which are of Functional Interest

The data in Table 1 reveals that the highest percentage was 96.25 percent with the topic "Structure of a C++ Program", this was followed with 91.25 percent with the topic "C++ Elements" and the third was 87.50 percent with the topic "Basic Data Types".Topics that comes next has an average difference of 70.78 percent, while "Rectangular Arrays" with 35.00 percent was considered last from the list of functional interest. The data implies that respondents finds easy in understanding the topics.

Topics in FPSP, which are Perceived Difficult

The data in Table 1 shows that the most perceived difficult topic in FPSP was "Rectangular Arrays" with 65.00 percent. This was seconded with the topic "One Dimensional Arrays" with 53.75 percent and the third was "Pointers" having 48.75 percent.A topic on "Structure of a C++ Program" was perceived least difficult with 3.75 percent. The data implies that respondents had a difficulty in understanding the topics and that serves the researcher in giving more emphasis on the development of interactive multimedia courseware.

2. Development of the Interactive Multimedia Courseware Material

The researcher utilized the ADDIE model by Steven J. McGriff (Dick, W. & Carey, L., 1996)on the development and evaluation of the interactive multimedia courseware that include Analysis Phase, Design and Development Phase, Implementation Phase and Evaluation Phase.

2.1 Analysis Phase

During this phase the researcher conducted a study to assess the overall scope of the courseware and the students who were made as respondents of the study. The researcher reviewed data and information gathered from the respondents, undergone surveys on the existing textbooks on "Fundamentals of Problem Solving and Programming" to identify the features of a good and effective multimedia and to determine the different topics that were included in the study of the course.

2.2 Design and Development Phase

The information gathered in the preceding phases was conceived then the researcher identified the software that was used in the development of the interactive multimedia courseware. Fortunately, the researcher made use of Asymetrix Toolbook II Assistant 7. The design of the courseware was made through the imaginative and creative idea of the researcher. As the study developed, the researcher consulted some faculty members, and his students for the improvement of the courseware design. The comments and suggestions were appropriately incorporated in the courseware.

2.3 Implementation Phase

As the courseware was developed, the researcher exposed the materials to his students during class sessions to remedy any flaws that would be found and for possible revisions or solutions that would be made.

2.4 Evaluation Phase

As the goalof courseware evaluation is to ensure that a new application or productbeing produced is usable and pleasing to the users, the usabilityevaluation was specifically designed to evaluate the consistency of theinterface and the interaction of a system with the user. Practically,usability evaluation was done through "subjective user experiences" with a self-evaluation questionnaire" comprising three evaluation criteria which are content, manner of presentation and usefulness of the interactive multimedia courseware. A rating scale of 1 to 5 on each of the criterion was followed. The ratings were informal estimates, to the best of the knowledge of the user; no precise yardsticks exist to place a coursewarealong these criterion.

Students are given the courseware in the form of a multimedia CD-ROM. This works as a supplementary material for the course. The idea is to help student understand the course better, especially when they are studying on their own at home. At the end of the semester, students was ask to answer the instrument that will evaluate the content, manner of presentation and usefulness of the interactive multimedia courseware.

3. On the Evaluation of the students on the Interactive Multimedia Courseware in terms of Content, Manner of Presentation and Usefulness of the Material.

Table 2

Evaluation on the Content of the Interactive Multimedia Courseware

CONTENT OF THE COURSEWARE	$\overline{x}$ (Students)	Interpretation
1. The explanation of the concepts in the courseware is simple and understandable.	4.33	Strongly Agree
2. The examples and exercises provided in the courseware are relevant and sufficient.	4.22	Strongly Agree
3. There are enrichment activities provided in the courseware.	4.15	Agree
4. The lectures in the courseware answer most of my questions.	4.13	Agree
5. The activities are suited to the level of comprehension of the students and can be performed with lesser supervision.	4.14	Agree
OVERALL WEIGHTED MEAN	4.19	Agree

Table 2 reveals that the highest average mean among the criterion on the evaluation of the courseware in terms of its content is 4.33 or with an interpretation of “strongly agree” which is“The explanation of the concepts in the courseware is simple and understandable”. This was followedwith an average mean of 4.22 or “strongly agree” which reflects“The examples and exercises provided in the courseware are relevant and sufficient”. The statements“There are enrichment activities provided in the courseware”, “The activities are suited to the level of comprehension of the students and can be performed with lesser supervision” and “The lectures in the courseware answer most of my questions” had an average mean of 4.15, 4.14 and 4.13 respectively, which means, “agree”.

The overall weighted mean of 4.19 implies that the student “agree” on the content of the interactive multimedia courseware.

Table 3

Evaluation on the Manner of Presentation of the Interactive Multimedia Courseware

CONTENT OF THE COURSEWARE	$\overline{x}$ (Students)	Interpretation
1. The courseware is easy to access.	4.33	Strongly Agree
2. The courseware is well organized.	4.29	Strongly Agree
3. I prefer to use the courseware to a textbook that covers the same material.	4.09	Agree
4. The courseware supports the course in a way that a textbook cannot.	4.10	Agree
OVERALL WEIGHTED MEAN	4.20	Strongly Agree

Looking at the table, it could be seen that statement "The courseware is easy to access" obtained with the highest average mean of 4.33 with and interpretation of "strongly agree" followed with the statement "The courseware is well organized", with an average mean of 4.29 or "strongly agree". The statements "The courseware supports the course in a way that a textbook could not" and "I prefer to use the courseware to a textbook that covers the same material" which has an average means of 4.10 and 4.09 respectively, which describes as, "agree".

The overall weighted mean of 4.20 or "strongly agree" shows that the students "strongly agree" in the manner of presentation reflecting on the interactive multimedia courseware.

Table 4

Evaluation on the Usefulness of the Interactive Multimedia Courseware

CONTENT OF THE COURSEWARE	$\overline{x}$ (Students)	Interpretation
1. The courseware helps me to learn the concept and principles of the lessons at my own rate.	4.32	Strongly Agree
2. The activities provided help me understand and master the subject matter effectively.	4.39	Strongly Agree
3. The examples and illustrations provided for each topic help me understand and solve problem and exercises.	4.34	Strongly Agree
4. The courseware is useful for the learners.	4.56	Strongly Agree
5. A courseware would be helpful for other courses.	4.00	Agree
OVERALL WEIGHTED MEAN	4.32	Strongly Agree

It can be gleaned on Table 4that among the criteria, the statement "The courseware is useful for the learners" ranked as the highest average mean of 4.56 or "strongly agree". This was followed with statements "The activities provided help me understand and master the subject matter effectively", "The examples and illustrations provided for each topic help me understand and solve the problem and exercises" and "The courseware helps me to learn the concepts and principles of the lesson at my own rate" with an average mean of 4.39, 4.34, and 4.32 respectively having an interpretation of "strongly agree". It can be disclosed that the lowest average mean is 4.00 or "agree" for criterion "A courseware would be helpful for other courses".

The overall weighted mean of 4.32 or with an interpretation of "strongly agree" implies that the students find very useful the developed interactive multimedia courseware in studying the subject.

Altogether student respondents take a general weighted mean of 4.23 or with an interpretation of "strongly agree" on the evaluation of the content, manner of presentation and usefulness of the courseware. The data disclosed that the developed interactive multimedia courseware is a relevant instructional material for the subject "Fundamentals of Problem Solving and Programming".

DISCUSSION

This study was conducted to develop and evaluate an interactive multimedia courseware in Fundamentals of Problem Solving and Programming for the first year BS Information Technology students. The findings were:Evaluation of the respondentson the content, manner of presentation, and usefulness of the materials are 4.19, 4.20 and 4.32, which correspond to qualitative descriptions of "Agree", "Strongly Agree" and "Strongly Agree", respectively.

Based on the findings of the study, the developed courseware facilitated and enhancedthe learning process in the classroom,arouses and maintained positive attitudes of students in learning the subject because of the novelty of the materials used, and contributed consistent improvement in the ability to define and measure student attainment of educational goals.

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