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Designing Educational Instructional Materials for Industrial Technology Program using Mobile-Based Application

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The COVID-19 pandemic created opportunities to design educational instructional material for industrial technology programs using a mobile-based application to improve the quality of teaching and learning. The use of learning mobile tools is one of the essentials in industrial technology. This design shall transform the paper-based instructional materials module into a mobile-based application. A systematic literature review was used to support the system design model of a mobile-based application using three-tier architecture to aid the researcher in designing the model. In addition, semi-structured interviews with industrial technology teachers and information technology experts were conducted and were collated, clustered, and analyzed. The design of instructional materials was categorized as a graphical user interface, system operation, and security features, content management, and assessment. The findings revealed 100 percent agreed that the graphical user interface should be user-friendly interface and attractive to the learners. The system operation should be fast and easy to upgrade. Furthermore, 100 percent showed that the content management module should encourage critical thinking and active skills. And 80 percent agreed that assessment is a must. The adoption of this design for the development of instructional material will enhance the instruction and interest of the students.

Keywords: designing, industrial technology, instructional materials, mobile-based application.

1. Introduction

Changes in the educational landscape due to the COVID-19 pandemic open opportunities to create instructional materials that will make teaching and learning easier. COVID-19 affected all academic institutions, specifically higher educational institutions not only in the Philippines but also in other countries. Educational interventions are undertaken to continue educating the students despite the COVID-19 predicaments. Most of the higher education institutions adopt blended learning modality, flexible learning while others utilize pure online learning to respond to these challenges. To address these challenges, the majority of higher education

institutions use blended learning, flexible learning, or purely online learning. The transformation of teaching and the learning process from face-to-face to online learning has a chain reaction (domino effect) to the management, teaching and non-teaching staff and students. This considers the learning management training for teachers and internet connectivity of students. One of the essentials in the online learning environment is to have a learning tool which provides a community where everyone meets, access materials, collaborate, and facilitate learning virtually [1]. As technology advances, using gadgets like smart phones, ipads, tablets and other mobile devices is becoming popular among people today as the rise in technology is overwhelming. Recently, mobile technologies are playing an increasingly significant role in tertiary level students' academic lives. Moreover, the popularity of mobile technologies among higher education institutions (HEIs) students is increasing dramatically. Many higher education institutions (HEIs) now use mobile technologies and create mobile-optimized versions of their websites or build stand-alone applications that can be downloaded from mobile application stores. [2] The schools in Sibuyan Island of Romblon offer an Industrial Technology program encounter a problem with the decreasing enrolment in industrial technology because the students lack interest in this course. There are no adequate and current textbooks used by students. There is no mobile-based application used for instructional materials that makes teaching and learning more interesting and effective. The same problem is being experienced by students in the secondary level specifically in technology and livelihood education where electrical technology is one of the areas of specialization. The use of mobile-based application may fill the gaps and needs to improve the quality of instruction in the K-12 program. This will eventually make Sibuyan schools restore its banner program in the area of technology.

The Industrial Technology programs, with instructional delivery in the department greatly influenced the students to have been more equipped with the skills they have acquired as they also proved that their skills acquired from the university as a whole prepared them into their professional career and employment. It also implies that the skills acquired by the graduates are manifested to how the instruction are delivered and how the department maintains the quality of their teachers, curriculum, and facilities [3]. This study provides answers to strengthen the Industrial Technology program of the institution especially the skills standards and enrolment. This will further motivate students to study and eventually get employed. Thus, there is a need to design educational instructional materials.

2. METHODOLOGY

The researcher used the descriptive method in the study. The descriptive method is collecting information by interviewing a sample of individuals [4]. It was utilized to describe the current condition and study [5]. In essence, the researcher, used such a descriptive method to understand and interpret easily the respondents had easily answered questions in the interview. It involves investigations that back up current acts regarding the type and condition [6]. And it was adopted since it involves an in-depth explanation of a situation Siedlecki, 2020.

The researcher conducted a semi-structured interview to identify the necessary elements of the system design model and the features of the proposed system. The interview involved two groups, five IT experts and five Industrial Technology teachers. The interviewees provided

relevant contents for the instructional materials to be integrated in the proposed system.

In addition, a systematic literature review was utilized to validate the system design model of mobile-based applications. This systematic literature review was conducted to identify published observational [7]. It includes a structured execution of the review and a high degree of transparency in the review methods applied. These measures enable the readers and reviewers of such studies to trace and understand better the review results Hiebl, 2021. Conducting a systematic literature review is an essential research activity in ensuring a good piece of research ([8]

Further, the responses from the interview and the data from the literature reviews were collated, clustered and analyzed in order to come up with a holistic system model.

3. RESULTS AND DISCUSSION

Based on the semi-structured interview that was conducted among the Information Technology experts and Industrial Technology teachers, the researcher considered the response of the participants.

Five Information Technology experts were asked of their opinion regarding the system. These are their responses and point of views. 100% agreed that the system should be user friendly. Only 60% agreed that the system should be attractive to learners. Only 20% believed that the GUI involves innovation. Moreover, only 20% stated that the system operation should be fast. While 40% said that it should be easy to upgrade.

Also, five Industrial Technology teachers were asked of their thoughts about the Content Management. Only 20% suggest that it must have the inclusions of vision and mission goals. 100% said that the module should encourage critical thinking. Only 20% state that it must have the provision of exercises and activities. And 40% required that every exercise and activity are included in the goal. All of them are 100% agreed that exercises and activities should be active skills. Only 20% said that contents should be arranged. Around 60% said that the subject outline of the syllabus should be developed. Also, 80% believed that assessment of the module is a must and 20% stated that the objective must be specific and measurable. However, only 20% said that objective must be SMART. And also 20% suggests that it should include short evaluations and quizzes and the same 20% stated that it must also include assignments as enrichments.

Based on the analysis the researcher considers Graphical User Interface as user-friendly and attractive to learners. A GUI is a visual way of interacting with a computer using items such as windows, icons, and menus, used by most modern operating systems. The interface allows users to interact with electronic devices, such as computers, laptops, smartphones, and tablets, through graphical elements. To develop a mobile user interface applied design principles and enhances user perceptions of quality. using design principles improved the aesthetic appeal and usefulness of mobile interfaces for users. It assisted users in precisely completing specified tasks in addition to pleasing the user's eyes. Multimedia is the integration of various media such as text, numerals, graphics, images, video, animation, and sound in a digital environment. It has the ability to enable users to achieve interactivity requirements without the sequence. ([9]) In the analysis, the researcher considers System Operation and Security Features as fast

and easy to upgrade the operation, System operation covers the complete area of activities for operating electric power systems, including security, control, and quality in terms of fixed technical standards, principles, and procedures, but also the synchronous operation of interconnected power systems. The instructional content, procedure, relevance, knowledge and practical applications, clarity, development of higher thinking skills, and alignment with the thrusts and goals and objectives ([10]). Based on the analysis the researcher considers content management must encourage critical and active thinking, provide exercises and activities and the module should be arranged from basic to advance. Content management occurs when teachers manage space, materials, equipment, the movement of people, and lessons that are part of a curriculum or program of studies. Media has become an integral part of education. Mobile technologies offer the opportunity to embed learning and used mobile devices such as smartphones are becoming widely used on schools. ([11]). Based also on the analysis, the researcher considers Assessment as to provide exercises and laboratory to enhance skills and it has a specific objective, evaluation, and assignment with references. Assessment refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students. The need to improve the teaching and learning in secondary schools necessitated to assess the adequacy, availability and extent of utilization of instructional materials in the teaching and learning in secondary schools. ([12]).

In connection with the results of interviews among the Information Technology Experts and Industrial Technology teachers, the responses were clustered and analyzed. There were the bases for the development of the graphical representation of the system framework shown below:

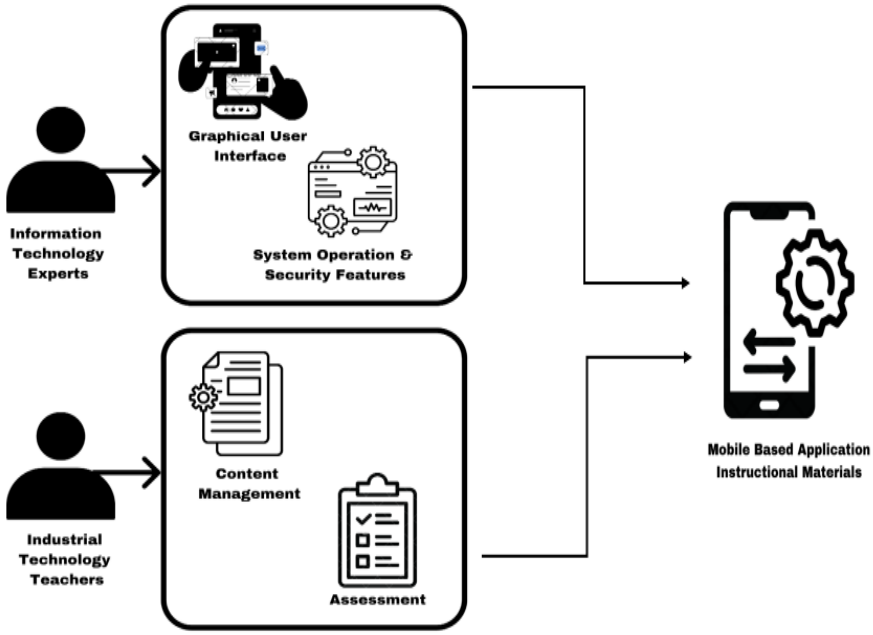

Figure 1. Proposed System Framework of Instructional Materials Mobile-Based Application

This proposed system framework shows the flow in the development of the instructional material mobile-based application. The first part is the identification of the graphical user interface and along with it is how the operation is performed including the system operation and security features. These parts were provided by the five (5) information technology experts identified by the researcher. On the other hand, the content management and assessment were provided by the five (5) industrial technology teachers. Their suggestions were studied and if it was found necessary, they were included. As a result, with the help of the experts and teachers, the researcher has designed instructional material mobile-based applications.

After considering the highlights and notes coming from the IT experts and Industrial Technology teachers which were clustered and analyzed, the researcher uses this as a guide to having a detailed representation of an instructional material design. The proposed system modeling will be displayed using Three Tier Architecture were used to describe the processes that occur in the proposed application, then apply class diagrams to database model table relationships.

Propose Mobile – Based Application Instructional Materials System Architecture

Three-tier architecture is a very popular software architecture pattern mostly because it is easy to get started building applications using this pattern. It is a well-established software application architecture that organizes applications into three logical and physical computing tiers: the presentation tier, or user interface; the application tier, where data is processed; and the data tier, where the data associated with the application is stored and managed

In the proposed Mobile-Based application Instructional Materials for Industrial Technology Program shown in Figure 2, the end user (teacher) uses mobile platforms to incorporate the lessons and create educational instructional materials to help students visualize and understand challenging subjects. The end user (student) access the system over the online network. The mobile application interface request inputs from the user such as account management, topic, exercises, and assessment. These system functionalities accept user information, and processes, and save them in the system.

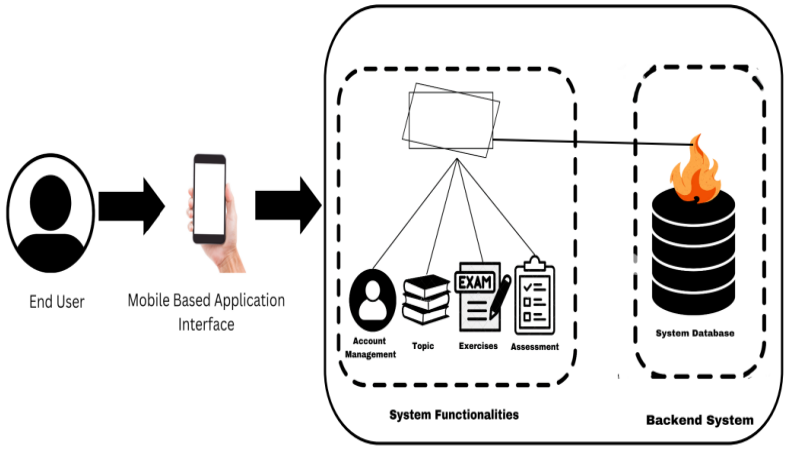

Figure 2 Mobile-Based Application Instructional Materials for Industrial Technology Program Three-Tier Architecture

The end user will install the application interface on their respective device. The application can be opened by creating an account, then once the account is created the user will sign in using the username and password. The topics will now appear according to complexity or difficulty. The user will now select and click the first lesson for them to study. This will be followed by exercises or examinations to evaluate the learnings of students. The assessment will constitute the laboratory or practical side of each of the topics. All information will be stored in the database of the application.

The application interface of the instructional materials was identified and designed based on the methodology of the research.

In line with the recorded notes coming from the IT experts and Industrial Technology teachers which were clustered and analyzed, the researcher used this class diagram as a guide in the functionality of the system provides to end-users to have a detailed representation of a database model.

A class diagram showing the entity class diagram which aims to show the class relations, each of which is represented as a table in the database. In the database design model, as shown in this figure. There are 4 classes or 4 tables, namely Trainee, Security, Training, and Assessment.

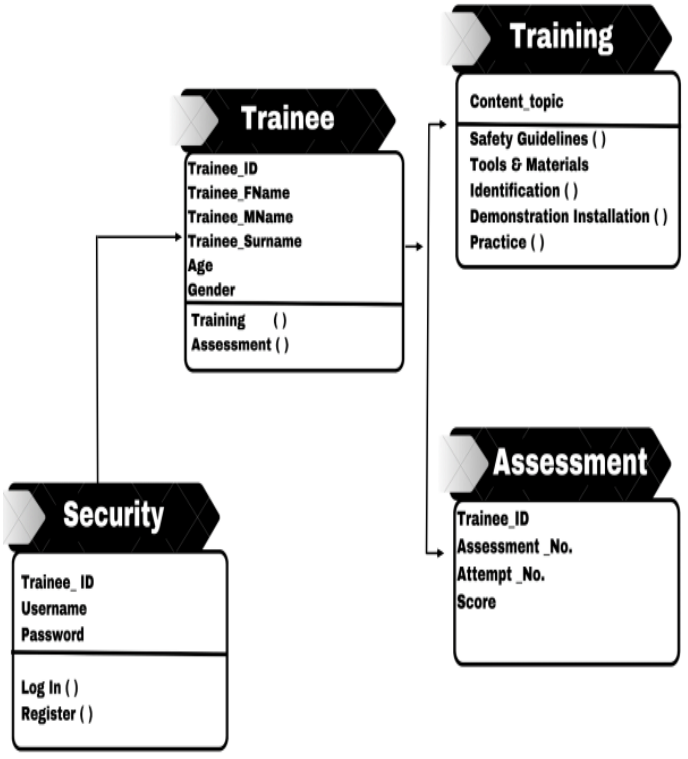

Figure 3 Class Diagram of the proposed system model

Figure 3 is a class diagram showing the entity class diagram which aims to show the class relation, each of which is represented as a table in the database. The database design model as shown in Figure 3. The following is a details description of each class or table.

In the trainee table, there are various types of attributes, there are Trainee ID, First Name, Middle Name, Surname, Age, and Gender. This attribute is the system knows about user information that uses mobile applications. And then in multiplicity from trainee to training content topics 1(one), while training content topics to trainee 1…*(one to many) because one trainee has a lot of training content topics while many training content topics only have one trainee. The next is table security. In the table security are content attributes such as trainee ID, username, and password. The relationship of multiplicity in the table trainee is 1…*(one to many) while the security is 1…1(one to one). In the training topics, there are several types of attributes, namely Safety and Health Practices Guidelines, Tools and Materials Identification, Basic Shop Processes Tool/Equipment, Demonstration Installation and Assisted with Installation Instruction of Training Content Topics that will be carried out by the trainee and so that trainee also see it in more detailed to see this training content topics. And then in table multiplicity training content topic 1…* (One to many) because one Training content topic has many assessments. And the last is the assessment table. In the following table, the attributes are Trainee ID Number, Attempt Number, and Score. The relationships of multiplicity are in the table. Assessment to the Training is 1…*(one to many) while the training for the assessment is 1----1(One to One).

4. CONCLUSION

This study concluded that the IT experts and IT teachers provided relevant inputs for the contents in designing and in the development of educational instructional materials for the Industrial Technology program using the mobile-based application.

Further, the literature reviews concluded that instructional materials integrated in the mobile-based application were essential because it assisted the users in learning the lessons easier with enjoyment likewise served as a teaching tool for a more flexible and engaging teaching-learning environment. In addition, the functions and scope of the system or application were illustrated in the created system design as a guide to the mobile-application.

Thus, implementing the system model and three-tier architecture could enhance the skills and knowledge of teachers in the development of mobile-based application as a form of instructional materials. This could be a training ground for teachers to become technology oriented.

It is recommended to adopt the design model for the development of the mobile-based instructional materials in the Industrial Technology program in order to support and help them in the teaching-learning process.

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