RITVET

The Development of a Web-Based Self-Learning Module for a Split Unit Air-Conditioning System

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Abstract: Self-learning is a learning process carried out by students where the students have the authority to manage the process of knowledge absorption without being bound by place and time. Despite this, the diversity of learning styles among the students as well as the lack of self-learning modules catalyzed the product development of this research. The objective of this study is to design and develop a web-based self-learning module for the topic of Split Unit Air Conditioning Systems. The development of this learning module uses Google Sites software to provide results that are easier and more suitable for users. This study also uses the ADDIE Model as a product development reference as well as Gagne's Nine Events of Instruction Model as a product content reference. Furthermore, the research product has gone through a functionality evaluation among three technical design experts, and two content experts as well as a usability evaluation among 27 students. Based on the analysis, the level of functionality of the product is rated as high among the experts involved. Next, for testing the usability of the product, students rated it as high for all aspects which are presentation design, content, and user-friendliness. This self-learning module is expected to be used to increase understanding as well as revise material among students for that topic. Nevertheless, future researchers can continue by studying the effectiveness of student learning using the module.

Keywords: Self-learning, Web-based Learning, ADDIE, Gagne's

1. Introduction

It is well known that the rapid development of information and communication technology (ICT) in the world has affected the education system in our country nowadays. The rapid development of ICT has brought many changes and reforms in the education system especially. This is because the teaching and learning process has become easier and it's also given opportunities to all levels of society to get educational facilities regardless of their age. According to Razlini (2017), the rapid development of ICT has created a new phenomenon by leading to an increase in the quality of public service delivery around the world. According to Hinostroza (2018), this situation also creates competition among developing countries to empower the use of ICT in the field of education, especially from the aspect of support systems, infrastructure, and so on.

In addition, the use of ICT in education such as web-based self-learning modules is one of the alternative ways that can be applied by teaching staff so that students can experience for themselves the opportunity of a more conducive and interesting learning session. This can indirectly increase knowledge and understanding among students. According to Sunita (2020), the use of technological elements in education such as digital learning modules is in the form of independent learning materials where they have been arranged in an orderly manner in several learning units to achieve the learning objectives that have been formulated. This is supported by Sulaiman (2021) that through creative and innovative teaching and learning methods, the teaching staff can attract students' interest to learn the learning content more deeply.

Apart from that, the Topic of Split Unit Air Conditioning Systems is a core technical course that must be studied and mastered by students with a bachelor's degree in vocational education (Refrigeration and Air Conditioning), UTHM. This course has a lot of facts that cover the basic cycle, basic components, installation, maintenance as well as fault detection related to split unit air conditioners. In addition, the students will undergo the Malaysian Skills Certificate (SKM) assessment which involves the installation and maintenance of split unit air conditioning. From that, the researcher will develop a web-based self-learning module for the topic of Split Unit Air Conditioning Systems to help students strengthen their understanding as well as make revised material for that topic. Not only that, but this module is also a web-based self-learning module it is in digital mode, and the learning content is developed by the learning standards that have been set by the university itself.

However, each student has a different learning style. Rijal and Bachtiar (2015) said that everyone will use all three forms of learning styles which are visual, auditory, and kinesthetic, but one will be more prominent depending on the person's desire, personal characteristics, and learning style. This is supported by Norazlin and Siti Rahaimah (2018) who also said that everyone has differences from one another in terms of knowledge, interest, and learning style. Furthermore, the students will obtain results that are not encouraging in academic achievement if they adopt an ineffective learning style throughout the learning process, Kamarul Azmi & Zaharuzzaman (2018). This is stated by Rosalia Harnita (2017) that one of the main factors that determine a student's success in learning is the usage of an appropriate and effective learning style.

In addition, the next problem is the lack of digital reference materials. Not only that, but the existing reference materials are also mostly in English, which provides minimal understanding to almost all students, especially for students who are weak in the language. According to Ilias et al., (2016) the lack of material resources results in students lacking exposure and preparation for teaching and learning sessions as well as exams that will be conducted. Therefore, the researcher will develop a web-based self-learning module in Malay to optimize understanding among students. Not only that, with the use of the learning module, students can use it according to their convenience without being tied to time and place because it is systematically designed based on the curriculum and displayed using electronic mediums such as computers or smartphones and so on.

Furthermore, based on the interview that was conducted with the lecturer with a bachelor's degree in vocational education (Refrigeration and Air Conditioning) at UTHM, he expressed some problems that strengthened the researcher's plan to develop a web-based self-learning module. Among those mentioned, the lecturer said that there is no special module for this course given to students so, if the student does not attend the class where the time allocated for the practical course is long period, of course, the student will be left behind. So, with this self-learning module, students can undergo learning sessions on their own and will refer to the lecturer if they need additional information. This is also supported by Sazilah & Faizal (2017) who is most of the modules in the market are in the form of teaching modules used by instructors for teaching purposes compared to self-learning modules.

There are several research objectives to be achieved in this study, among them are:

i. Designing a web-based self-learning module for the Topic Split Unit Air Conditioning System.

ii. Develop a web-based self-learning module for the Topic Split Unit Air Conditioning System.

iii. Evaluating the functionality of a web-based self-learning module on the Topic Split Unit Air Conditioning Systems among experts.

iv. Evaluating the usability of a web-based self-learning module for the Topic Split Unit Air Conditioning System among students.

The scope of study for the development of a web-based self-learning module for the Topic Split Unit Air Conditioning System is produced based on the learning content for the bachelor's degree Vocational Education program (Refrigeration & Air Conditioning), Universiti Tun Hussein Onn Malaysia. Therefore, to ensure that the objective of this study can be achieved, the scope of the study needs to be paid attention to by conducting studies in institutions that offer study programs in the field of Refrigeration and Air Conditioning. Furthermore, the focus of this research is to develop a web-based self-learning module for the topic of Split Unit Type Air Conditioning Systems that will help in students' understanding as well as make revised material for that topic.

2. Methodology

The research methodology is used to collect information to achieve the goals of this research. A detailed research methodology can facilitate and complete the data collection process more systematically. It also explains how data is obtained and analyzed to ensure that the research is carried out smoothly and effectively. It consists of the Research Design, Research Procedure, and Research Instrument or other important information related to the methodology for this research which is the development of a web-based self-learning module for the Topic Split Unit Air Conditioning System

2.1 Research Design

The research carried out is the development of a web-based self-learning module for the Topic Split Unit Air Conditioning Systems. The product is being tested for its functionality among experts in the field as well as its usability among users which are students. The type of data used in this study is quantitative. The researcher used an expert validation checklist form to obtain data on functionality among the selected experts. In addition, the researcher used a questionnaire to obtain data on the usability of the product among users which is students.

2.2 ADDIE Instructional Design Model

The researcher has chosen the ADDIE Model as a reference for product development. This is because the ADDIE Model is the main model in development studies that is a catalyst for the development of other development modules and it is also widely used by researchers, Adenan Ayob (2017). This shows that it is proven to be effective in addition to having a regular process layout with a systematic sequence of activities. Thus, to ensure that the product produced is effective and efficient, the researcher explains in detail the research process concerning the steps and phases in the ADDIE Model. The first phase begins with the analysis phase where the researcher analyzes problems related to the product and solutions to the problems that arise. Next, the second phase is to design the instructional method used for the product of this study. Followed by the third phase is the development phase which gives details about the development of the research product. Next, the fourth phase is the implementation phase of the development and design of the research product according to the specifications set by the researcher. Finally, the evaluation phase is to measure and get feedback from experts and users about the research product that has been developed. Table 1 shows the approach used based on ADDIE Model.

Table 1: Approach of ADDIE Model

ADDIE Model	Approach
Phase 1: Analysis	-Identify objectives -Analysis of learning content based on syllabus -Analysis of the user's learning style
Phase 2: Design	-Content design based on Gagne Nine Events of Instruction -Interface design using storyboard -Interaction design to put in the module
Phase 3: Development	-Content development -Interface development -Interaction development
Phase 4: Implementation	-Users need to get links to go to the website. *(https://sites.google.com/view/mpk-spujup)* -User can choose to go sequentially from each learning unit or directly to the desired learning unit
Phase 5: Evaluation	-Expert Evaluation (technical design & content) -User Evaluation (students)

2.3 Research Instrument

In conducting this research, the researcher prepared two sets of product functionality checklist forms for technical design experts and content experts. Not only that, but the researcher also prepared a set of product usability questionnaires for the end users which are students. The language used in the checklist form and the questionnaire form is in the form of Bahasa Melayu which this language is easy to understand and will be distributed privately. In addition, for the technical design expert checklist form instrument, there are two parts, namely Part A (technical functionality of the product) and part B (expert comments and suggestions). As for the content expert checklist form instrument, there are two parts, namely Part A (product content functionality) and Part B (expert comments and recommendations). Next, for the student questionnaire instrument, are five parts namely Part A (respondent demographics), Part B (Presentation design), Part C (content), and finally Part D (user-friendliness).

3. Results and Discussion

This research involved 5 experts from the Faculty of Technical and Vocational Education (FPTV), UTHM which is three of them represented technical design experts while the other two represented content experts.

Table 2: Product Validation Expert Panel List

Name	Expertise
Expert 1 (Content Product)	- Refrigeration and Air Conditioning Technology
Expert 2 (Content Product)	- Refrigeration and Air Conditioning Technology
Expert 3 (Technical Design Product)	- Computer-Based Teaching and Learning
Expert 4 (Technical Design Product)	- Instructional Design and Technology
Expert 5 (Technical Design Product)	- Computer-Based Teaching and Learning - Instructional Design and Technology

Moreover, those experts are selected based on several characteristics. All of them are experts who are working as teaching staff at FPTV who have 6 years of teaching experience and above where they can understand the nature of the students in the faculty. In addition, that expert also has the highest academic

qualification, which is a Ph.D. in the field of Technical and Vocational Education (TVET) and has been involved in the development of books or modules, whether physical or digital mode. Table 2 shows the list of expert panels that are involved in the product functionality evaluation.

3.1 Evaluation of Functionality Among Experts

The expert evaluation of the product functionality of this study involved a total of three lecturers in the field of Instructional Design and Technology for design evaluation and two lecturers in the field of Refrigeration and Air Conditioning Technology for content evaluation from the Faculty of Technical and Vocational Education of UTHM. All the lecturers were provided with a link to the learning module that had been developed and given time to explore it in addition to an explanation by the researcher about the development process and how to use it. After exploring the learning module, the researcher gives a checklist form according to a specific assessment, whether it is a design expert assessment or a content expert assessment. In addition, the results are evaluated based on percentages.

Based on the overall analysis of the product functionality evaluation carried out, it shows that as many as (94.44 percent) of product technical design experts and (100 percent) of product content experts agree that the learning module developed has a high level of functionality from the technical design aspect of the product and the aspect of product content. Overall, the level of functionality of the Web-Based Self-Learning Module for the Topic of Split Unit Type Air Conditioning System is high which is as much as (97.22 percent).

3.2 Evaluation of Usability Among Students

Student evaluation of the usability of this research product involved a total of 27 students from the bachelor's degree Vocational Education program (Refrigeration and Air Conditioning) by the Faculty of Technical and Vocational Education, UTHM. All these students are students who are enrolled in the Refrigeration and Domestic Air Conditioning Engineering Technology Skills Course (BBA40204) in semester 2 (2022/2023). All the students were provided with a link to the learning module that had been developed and given time to explore it alongside an explanation by the researcher about the development process and how to use it. After completing the learning module, the researcher provided a questionnaire to evaluate the usability of the study product for them to answer. Next, the data obtained was analyzed by the researcher using the IBM Statistical Package for Social Science software version 27 to achieve the fourth objective of the study. The mean score obtained will be interpreted based on a four-point Likert scale adapted from Riduwan (2012).

Based on the overall analysis of the product usability evaluation that was carried out, it shows that the usability evaluation of the study product from the presentation design aspect is high (mean=3.66, standard deviation=0.388), from the content aspect is also high (mean=3.62, standard deviation=0.485) and finally from the user-friendliness aspect is also high (mean=3.63, standard deviation=0.469). Overall, the level of usability of the Web-Based Self-Learning Module for the Topic of Split Unit Air Conditioning System is high which is the overall mean is 3.64 which gives the mean interpretation as high, and the standard deviation value is 0.447. The standard deviation also shows that the item is not scattered far from the mean value because the total standard deviation shows a value less than 1. Table 4 shows the overall analysis of the product usability evaluation.

Table 4: Overall Analysis of The Product Usability Evaluation

Aspects	Mean	Standard Deviation	Mean Interpretation
Presentation Design	3.66	0.388	High
Contents	3.62	0.485	High
User Friendliness	3.63	0.469	High
Total	3.64	0.447	High

4. Conclusion

The development of good and effective learning modules is important to help students understand as well as to be revision material for specific learning topics. The findings of this study, which is the development of a web-based self-learning module for the Topic of Split Unit Air Conditioning Systems, show positive feedback from product technical design experts, product content experts, and users which is students. In conclusion, this learning module was developed to increase students' understanding and be a revision material for the topic of Split Unit Air Conditioning Systems among students of the bachelor's degree Vocational Education Program (Refrigeration and Air Conditioning), Universiti Tun Hussein Onn Malaysia in particular. It is expected that the product development of this study will go through the development process using the ADDIE Model and the content design process using Gagne's 9 Events of Instruction Model and have gone through the functionality evaluation of product technical design experts and product content experts, followed by user usability evaluation that is students can be accepted by all parties.

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