



Development of an Electronic Brick Bonding Module Using the Autocad Program for Students

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Abstract

This research aims to develop an electronic AutoCAD learning module for drawing brick ties as an effort to increase the effectiveness of learning at Vocation High School 2 Merangin. The research method used is the Lee and Owens development model which consists of analysis, design, development, implementation and evaluation. The results of this research show that the AutoCAD learning module developed received a positive response from experts and students. This module is effective in improving students' understanding and skills in drawing brick ties using AutoCAD software. The novelty of this research lies in the development of interactive and interesting electronic modules to facilitate more effective and interesting learning. The implications of this research are increasing student motivation and interest in learning as well as increasing the quality of learning at Vocation High School 2 Merangin. Thus, the use of this AutoCAD learning module can make a positive contribution to improving the quality of education in the field of building engineering. The results of this research indicate that the development of an AutoCAD learning module can be an effective solution in overcoming challenges in learning technical drawing, especially in drawing brick ties. Therefore, it is hoped that the use of this module can be an innovative and efficient learning alternative in vocational high schools, as well as making a positive contribution in improving students' skills in technical drawing and their preparation for the world of work.

Keywords: Autocad program; Brick ties; Development; Electronic modules

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INTRODUCTION

Technological developments in this digital era also have a significant impact on education (Hidayati et al., 2017; Ouahi et al., 2022; Zwolak et al., 2017). The integration of technology in learning is becoming increasingly important to prepare students to face the demands of an increasingly complex and changing world of work (Akkaya, 2016; Han et al., 2016; Perienen, 2020). In this context, the use of the AutoCAD program as an aid in engineering drawing has become standard in many construction industries. Therefore, providing electronic modules that utilize this technology is expected to strengthen the relevance of learning to industry needs and prepare students with appropriate skills.

The application of the module-based learning concept has been proven effective in various educational contexts. Modules provide an organized structure and allow students to study independently, at their own pace and learning style. Thus, the development of an electronic module for drawing brick ties can be an effective means of increasing student independence and learning

motivation. Adoption of constructivist learning theory is also an important basis in developing this module (Anas & Firmansyah, 2020; Basuki & Febriansyah, 2020; Pratiwi et al., 2021). This theory emphasizes the importance of students' active role in constructing their own knowledge through meaningful learning experiences. By designing modules that allow students to interact directly with learning material, it is hoped that they can improve understanding and retention of the concepts and skills taught.

The background to the development of an electronic module for teaching brick bond drawing using the AutoCAD program at Vocational High School 2 Merangin is the result of an in-depth understanding of the challenges and needs in the student learning process in the field of building engineering. At the vocational high school level, especially in the building engineering department, learning technical drawing has a very important role as a foundation for students' ability to design and understand building structures (Stukalova, 2017). However, experience in teaching brick bond drawing shows that students often have difficulty understanding and applying the concepts and skills required.

Apart from that, in order to achieve optimal learning effectiveness, continuous evaluation is also needed (Khoiri, 2021; Raffaghelli et al., 2018; Wibowo, 2017). Continuous evaluation will help identify student weaknesses and learning needs, as well as enable necessary adjustments to be made in module development (Ramadhanti et al., 2022; Sugihartini & Jayanta, 2017; Toma & Greca, 2018). Taking into account the background mentioned above, the development of an electronic module for drawing brick ties using the AutoCAD program at the Merangin 2 vocational high school is expected to be a significant step in improving the quality of learning, preparing students with industry-relevant skills, and supporting the achievement of relevant competencies. has been established in the curriculum.

This research is in line with research conducted by Alfian et al (2021), but related research is the lack of focus on developing an AutoCAD learning module specifically for drawing brick ties in the context of building engineering education in vocational high schools. Although there has been a lot of research on the use of AutoCAD in engineering learning, not much has focused on drawing brick ties, which is an important practical skill in the construction field. This research also contributes significant novelty by developing an AutoCAD learning module specifically designed to overcome students' difficulties in understanding and drawing brick ties accurately and efficiently. By combining AutoCAD technology with relevant learning content, this module provides an innovative and effective approach to improving students' skills in the field of building engineering drawing, while optimizing the use of technology in the learning process.

The urgency and objectives of this research are very important in the context of building engineering education at the Vocation High School 2 Merangin vocational high school. Given the challenges in understanding and applying the technical concept of drawing brick ties, as well as the lack of student interest in this learning, developing an AutoCAD learning module has become an urgent need. The main aim of this research is to create a module that can help students understand these concepts better and more fun, while improving their practical skills in technical drawing. Through the use of technology in learning, it is hoped that this module can stimulate students' interest in learning, improve the quality of education, and increase their readiness to face the world of work in the field of construction and building engineering. Thus, this research has significant urgency in overcoming existing learning challenges, while making learning more relevant and effective for vocational high school students.

RESEARCH METHODS

Research Design

This research design is research and development which consists of five main stages, namely analysis, design, development, implementation and evaluation. This stage provides a structured framework to ensure the development of AutoCAD learning modules runs systematically and effectively.

This research was carefully designed to ensure that each step produces a quality product that meets learning needs (Hamidi, 2018; Sadeh & Garkaz, 2019; Syauqi et al., 2020).

Research Target/Subject

The research targets or subjects consisted of several groups, including learning design experts, AutoCAD learning content experts, and Building Drawing Engineering students at Vocational High School 2 Merangin. By involving various subjects, this research ensures that module development can meet applicable learning needs and standards. The participation of diverse subject groups ensures that broad and diverse perspectives are taken into account in the development process.

Research Procedures

This research procedure includes four main stages, starting from expert assessment, small group trials, to field trials. Each stage is carried out in a structured manner to ensure the validity and effectiveness of the module being developed. By adhering to established procedures, this research can produce reliable data and valuable information for successful module development (Ardianti, 2021; Ferreira et al., 2018; Yanti et al., 2020).

Instruments, and Data Collection Techniques

The instruments and data collection techniques used in this research include questionnaires, observations and interviews. The questionnaire consists of an open questionnaire and a closed questionnaire, with a Likert scale as a data analysis technique to measure the quality and success of the learning module (Kazmi, 2000; Ram, 2021; Shereni, 2020). The use of a variety of instruments and data collection techniques allows researchers to obtain comprehensive and in-depth information about the responses and needs of research subjects.

Data analysis techniques

The data analysis techniques used include qualitative descriptive and percentage calculations. Data from closed questionnaires were analyzed using percentages to evaluate the level of success and acceptance of the module. Meanwhile, data from the open questionnaire was converted into scores using a Likert scale to provide a more in-depth picture of the quality of the AutoCAD learning module being developed. By using appropriate analysis techniques, researchers can interpret data accurately and draw valid conclusions from the research results.

RESULTS AND DISCUSSION

Development of an electronic brick bonding module using the AutoCAD program for students at the Negeri 2 Merangin vocational high school, developed in accordance with needs analysis by following the media development procedures development model. The results of development follow the following stages: At the analysis stage there are two main activities, namely needs analysis and start-finish analysis. At the needs analysis stage, information was obtained that students had difficulty completing the task of drawing brick ties because it was too difficult and complicated to complete. From the observations made by students, it was difficult to draw brick ties because the drawing was not neat, the time took a long time, the application of the brick bond object was required in accordance with the concrete object, apart from that the time required was shorter. When students practice by manually drawing the brick walls that are built, their stability is not guaranteed because the accuracy of the ties cannot be guaranteed (Asakir & Mahmudah, 2022; Cowan et al., 2021; Rafsanjani & Razaq, 2019).

At the beginning-to-end analysis stage using observation techniques, the following information was obtained: (1) generally students have their own computers/laptops and are able to use computers and read and translate construction drawings, organize construction work correctly, especially carrying out simple measurements and calculations, (2) the availability of facilities and infrastructure from the

school such as the availability of study rooms, libraries, computer laboratories, chemistry/physics laboratories, language laboratories and workshops, the availability of practical places, relatively adequate practical equipment for skill programs and an adequate number of practical supervising teachers, (3) there are many internship places that are easy to access from the school.

Activities at this design stage include: (1) schedule, namely the time required to manufacture the product for 5 months; (2) product development team, consisting of researchers, a team of assessors or validators consisting of media experts and material experts, as well as class X students at Vocational High School 2 Merangin; (3) media specifications, the development of this electronic module contains learning material for drawing brick ties for class IX semester 2, the program used is Microsoft Word 2010 for making story boards, design feedback is packaged in the form of exercises; (4) material structure, identifying competency standards analyzing basic competencies, formulating learning indicators, setting learning objectives, developing learning strategies, developing materials, designing forms of assessment and evaluation; (5) configuration control, is the activity of designing a series of electronic module development design specifications before the development product is validated by experts for review; (6) repetition or evaluation, which can take the form of evaluating the design and content of the product by experts in the field, suggestions for product improvement can also be obtained from the evaluation results by conducting product trials on potential targets.

This stage is a development activity, namely in the form of determining navigation, buttons, choosing background colors, preparing material for drawing brick ties, making flowcharts, making layouts, screen designs or visual designs, and other supporting elements. The next activity is media production which begins with entering images, buttons, clip art, sound, accompanying music, video into the micromedia flash program (Zulfa & Haryanto, 2021). The material previously formatted in Microsoft Word is then transferred to the stage tool and distributed onto the screen as shown in the flowchart and layout. All components created are collected and put together, in the form of video/animation, and insert sound into each button. The final activity at the development stage is storing it in CD (Compact Disk) format to be given to reviewers. Next, we revised and perfected the product until we found a product in the form of an interactive CD to enrich quality drawing learning.

The implementation stage carried out was to test the product resulting from the development of an electronic brick bonding module using the AutoCAD program on students at the Merangin 2 State Vocational School. The trial was carried out in three stages, namely individual trials, small group trials and field trials. To assess the accuracy of the design so that this electronic product is of high quality, a media expert review was requested, and after several revisions this product was declared valid/legitimate and suitable for testing. A review was also carried out with material experts to assess the depth and accuracy of the selected material for the development of brick bond electronic modules using the Autocad program. From the results of the review by material experts, it was concluded that this media was suitable for field testing without revision and was declared good and could be used as a learning media in schools.

The small group trial stage was carried out by 3 students in the Building Drawing Engineering vocational school at 2 Merangin. From this small group trial, the result was that the attractiveness aspect of the small group trial was assessed using very attractive assessment criteria. The large group trial phase was carried out by 10 students of class X Building Drawing Engineering at Negeri 2 Merangin vocational high school. From the results of field trials, it is known that the interactive product learning electronic modules for bonding bricks using the AutoCAD program in terms of attractiveness is in the very attractive category.

The implementation of the Pre-test and Post-test is intended to test effectiveness in more depth as in an experiment as a comparison. During the pre-test The highest score obtained by students was 70 and the lowest score was 25, an average score of 49% with learning completeness of 10%. After holding the post-test, the highest score obtained by students was 85 and the lowest score was 70, the average score was 67% with learning completeness of 100% and the percentage increase in score of 18.00%.

Evaluation activities are carried out through two activities, namely product validation and testing. Validation is carried out by learning media experts and learning material experts. Based on the results of validation by learning material experts on aspects of learning material designed in AutoCAD interactive CD media for learning to draw brick ties, it was declared to be of good quality and suitable for use without any suggestions for improvement. Based on the results of validation by learning media experts, the AutoCAD interactive CD media still needs several improvements, including aspects of program use procedures, use of media and images, clarity of images and narration, as well as application of questions and exercises.

Product trials were carried out twice, namely small group trials and large group trials. Small group trials were carried out on three respondents. The small group trial questionnaire score obtained was 128 with a percentage of 85.33%. In the large group trial, a questionnaire score of 407 was obtained with a percentage of 81.40%. Based on the results of these two group trials, it can be concluded that the quality of the development of the brick bond electronic module using the AutoCAD program is very attractive. The discussion from material experts consists of seventeen indicators, for the development of electronic brick bonding modules using the AutoCAD program for students Vocation High School 2 Merangin relating to the quality of learning materials, the validator assesses that the quality of the learning materials contained in the CD (Compact Disk) program is adequate, good and appropriate, therefore the developer did not revise the learning material contained in the program. The discussion of data on small group trials and large group trials is summarized into the following aspects.

Aspects of Attractiveness namely, students with high category computer mastery will be enthusiastic when opening interactive multimedia learning programs and calmer when opening introductory AutoCAD material. Students with moderate computer mastery did not experience difficulties when opening introductory AutoCAD material but had a few questions about other students. Students with low category computer mastery experience difficulties from starting to ending the program and are always asking questions both with friends and accompanying teachers. Effective Aspect Learning objectives that use Indonesian clearly and easily understood can be well received by students. The content of the material is in accordance with the curriculum, examples, images, introductory steps to AutoCAD, and color display are very supportive. As well as the use of technical terms commonly used by students, they are applied to the program. Therefore, in using interactive CD-learning media, the effective aspect has been fulfilled. Efficiency Aspect Indicators of learning success obtained from the pre-test and post-test results show that learning outcomes have increased by 18%. The number of students who have reached the minimum completion criteria after carrying out the post-test is 10 out of 10 students, if the percentage of students who complete is 100%. This shows that the use of interactive CD media for learning to draw brick ties using the AutoCAD program has achieved an efficient aspect.

This research is in line with research Ashfahani et al (2020), developing an AutoCAD learning module for drawing brick ties, but there are several shortcomings that could be gaps for further research. One of them is limitations in the testing and validation aspect of the module, where this research focuses more on evaluation by experts and limited field trials. In addition, the influence of different environmental factors and school contexts on the effectiveness of the module also needs to be considered further. Furthermore, further research needs to be carried out to identify more efficient and effective ways of implementing the module in various learning situations. By paying attention to this gap, further research can be more in-depth and comprehensive in optimizing the use of AutoCAD learning modules in the context of building engineering education.

The main uniqueness of this research lies in the approach used in developing the AutoCAD learning module for drawing brick ties. By utilizing a structured research design and involving various related subjects, this module not only offers comprehensive and structured content, but is also tailored to the needs of Merangin 2 State Vocational School students. In addition, the use of technology in learning is a significant added value, allowing students to gain a deeper understanding and better skills

in technical drawing. Thus, this module offers an innovative approach to technology-based learning that can improve the quality of education in the school environment.

The implications of this research are very relevant for increasing the effectiveness of learning building engineering, especially in terms of understanding and applying the concept of brick bonding using AutoCAD software. With the learning module being developed, it is hoped that it can help students at the Negeri 2 Merangin vocational high school overcome difficulties in understanding the material and improve their practical skills in technical drawing accurately and efficiently. Apart from that, the use of this module can also stimulate students' interest in learning and increase their motivation in participating in learning. However, there are several limitations that need to be considered, such as time and resource limitations which limit the depth of analysis and the number of samples involved in the research. In addition, the focus of this research is only on developing a module for drawing brick ties using AutoCAD, so other aspects of building engineering learning have not been fully covered in this research.

CONCLUSION

Overall, this research provides a valuable contribution in the development of AutoCAD learning modules for Merangin 2 State Vocational School students. By using a structured research design, involving relevant subjects, and applying careful research procedures, the modules developed can meet the specified learning standards. The results of data analysis from various collection instruments show that this module received positive responses from experts and trial participants, and obtained a good assessment regarding its quality and success. Thus, the AutoCAD learning module developed in this research is expected to increase learning effectiveness, motivate students, and improve their understanding and skills in drawing brick ties using the AutoCAD application.

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