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Developing an ESQ-based e-learning model to improve learning outcomes and student character

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Abstract

This research aims to improve the learning outcomes of class X students in manufacturing engineering drawing at SMK Dhuafa Padang by implementing ESQ-based e-learning model. The method used is Research and Development (R&D), which includes planning, development, trial, and product revision stages. The research results indicate that ESQ-based e-learning model effectively improve student learning outcomes. In the trial phase, 86.67% of students scored ≥ 70, showing a significant increase compared to before the implementation of this device. In addition, ESQ-based e-learning model was validated by experts and positively influenced student character, with a positive regression coefficient of 0.720. This research concludes that ESQ-based e-learning model improves student learning outcomes and character and can be used as a valid, practical, and efficient learning medium in manufacturing engineering drawing.

Keywords

ESQ, learning outcomes, student character.

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Introduction

Education is a basic need for everyone and is crucial today. Education helps individuals to create, develop, grow, mature, and contribute to cultural organization and order. Education plays a vital role in human development so that they can carry out their functions. Therefore, education must be a right for all humans. According to Law of the Republic of Indonesia No. 20 of 2003 concerning the National Education System, education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals, and skills needed for themselves, society, nation, and state (Nurdin, 2015). To meet the desired educational standards in Indonesia, clear education standards are needed, one of which is the process standard. Based on Permendikbud Number 34 of 2019, especially in Appendix III, there are changes in the learning process standards in SMK/MAK, where the learning process is divided into four types, namely classroom learning, practical learning, block system learning, and learning in a dual system (Rohaeni et al., 2021).

Education quality must be improved through a successful teaching and learning process in schools. According to Rahim et al. (2019), the learning process is influenced by learning media at school and at home. Schools as formal educational institutions should provide regular, systematic, and graded educational services according to precise requirements. Education in Indonesia is divided into three levels: basic education, secondary education, and higher education. One form of secondary education is vocational high school (SMK).

Kurniawan et al. (2022) stated that vocational high schools are educational institutions that aim to prepare students to master specific skills. Vocational high school (SMK) is one of the educational institutions that aims to prepare quality human resources to face the world of work challenges. Vocational high school (SMK) prioritizes the development of students' abilities to perform types of work that suit their interests and work standards (Rahmadhani & Suryati, 2022). Vocational high school (SMK) prepares students by equipping them with the necessary abilities and skills they will need in the workforce after graduation.

Indonesia has many vocational high schools, both state and private, in the province of West Sumatra. The number of vocational high schools (SMK) in West Sumatra reaches 213 schools (https://data.sekolah-kita.net). In this research, researchers selected two sample schools, namely state and private vocational high schools, for pre-research through observation.

The first observation was conducted at SMKN 1 West Sumatra on November 23, 2021. From this observation, information was obtained that the learning devices had been updated based on the academic year but were not yet ESQ-based. Teachers' selection of learning methods was neither engaging nor diverse. The school already has an e-learning system called KBM Online, but it has not been utilized properly. Students are less motivated and less interested in manufacturing engineering drawing subjects but prefer practical workshop learning. Students also lacked optimal development in politeness and responsibility.

The second observation was conducted at SMK Dhuafa Padang on December 15, 2022. The results indicated that the learning devices were still not ESQ-based, the teacher's learning methods were less interesting and varied, and the school did not yet have e-learning. Students

are less motivated and less interested in the manufacturing engineering drawing subject but prefer practical learning in workshops. The polite and responsible character of students is also not optimal.

Methodology

This type of research is research and development (R&D), coupled with regression analysis. According to Lee et al. (2017), R&D is a research method used to create specific products and test their effectiveness. This description is in line with Hastuti (2023), who explained that in the education sector, the essence of development research is not to design or carry out theoretical studies, but to develop effective products for educational institutions. Borg and Gall describe the development in Sugiyono (2014). The research stages are: *Potential problems*, researchers identify potential in the students, technological advancements, and issues like low motivation and less engaging learning approaches. *Information gathering*, the researchers obtain the information by observing, conducting interviews, and determining the learning media requirements that align with the characteristics of the lesson and the student. *Product design*, planning and designing learning devices for the curriculum encompasses preparing materials, designing, equipment setup, and media creation. *Design validation*, experts in media and material perform validation by creating validation instruments and analyzing the results at various stages. *Design improvement*, design improvements based on input from validators. *Limited trial*, testing the practicality of learning devices on small groups of students and teachers for two days. *Product revision*, product revision based on the results of limited trials. *Usage trial*, a trial was conducted on a large group for seven days to measure the effectiveness of the media, including a pre-test and a post-test. *Product revision*, the researchers revised the product based on the outcomes of the limited trial. *Final product,* the final product is declared valid, practical, and effective for use in learning.

This research was also supplemented by using regression analysis techniques. This research aims to determine the potential causal influences based on how existing consequences are treated after developing the development product. The ESQ-based e-learning model was re-examined to see their effect on student character through regression analysis.
The steps taken in simple regression analysis (Sugiyono, 2014) are as follows:

- Creating a simple linear equation
- Calculating the simple correlation coefficient between X and Y

$$r_{xy} = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{(n\sum x^2 - (\sum x)^2)(n\sum y^2 - (\sum x)^2)}}$$

Description:
r_{xy} = Correlation coefficient between x and y
$\sum xy$ = Sum of products between x and y
$\sum x^2$ = Sum of squares of predictor scores x
$\sum y^2$ = Sum of squares of criterion y
n = Number of samples

- Calculating the coefficient of determination (r2) between predictors X and Y. The magnitude of the coefficient of determination is the square of the correlation coefficient (r2).
- Testing significance with the t-test

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Description:

t = t-count value
r = correlation coefficient between variables x and y
n = number of respondents
r^2 = square of the correlation coefficient between variables x and y

The criteria for accepting and rejecting a hypothesis for simple regression analysis are:

- T-count > t-table, or significant ≤ 0.05, so the null hypothesis (H0) is rejected, and the alternative hypothesis (Ha) is accepted.
- T-count ≤ t-table, or significant > 0.05, so the null hypothesis (H0) is accepted, and the alternative hypothesis (Ha) is rejected.

The effectiveness test with objective questions was carried out twice with the same questions, namely before the experiment (pre-test) and after the experiment (post-test), with one group of subjects. This treatment involved three stages applied to a group of students taking the manufacturing engineering drawing subject in the July-December 2023 semester. The product trial design is presented in the table below.

Table 1. *Product trial design*

Pre-test	Treatment	Post-test
O_1	X	O_2

Source: Sugiyono (2014)

Research design, site, and participants

This research used the research and development (R&D) method. The learning media experts were two lecturers from Universitas Negeri Padang. The respondents of this research were teachers at SMK Dhuafa Padang and students taking the manufacturing engineering drawing subject in the July-December 2023 semester. The research on ESQ-based e-learning model for the manufacturing engineering drawing subject, employs an R&D model that follows the Borg and Gall development framework.

This research used two data collection techniques, namely observation and questionnaires. Researchers employed observation techniques to assess students' lack of motivation and interest in manufacturing engineering drawing. Furthermore, after conducting observations, researchers found problems related to students' lack of motivation and interest in manufacturing engineering drawing, but they preferred practical learning in workshops. However, the learning methods selected by teachers remained uninteresting and lacked variety.

Therefore, a solution was sought, developing ESQ-based e-learning model in manufacturing engineering drawing to improve students' learning outcomes and character.

The product produced in this research was an ESQ-based e-learning model in the manufacturing engineering drawing subject, which could improve the learning outcomes and character of vocational high school students. This research used a product validity assessment for the application being developed. The validity of the application in this research was established by the necessary experts, namely, media experts and material experts. The product questionnaire assessment used a Likert scale. In the validation test, the validator provided suggestions for aspects measured using media assessment indicators with a value range of 1-5.

Findings

This research aims to develop a valid, practical, and effective ESQ-based e-learning model in manufacturing engineering drawing. It also studies its impact on the character development of vocational high school students. The process of making an ESQ-based e-learning model has the following stages:

Potential problems

This research identifies the potential problems faced by students at SMK Dhuafa Padang. The potential for achieving maximum results lies in the students, who can excel if their skills and abilities are continuously developed. In addition, rapid technological developments also support classroom learning. However, the problem was the lack of interest in manufacturing engineering drawings because they preferred practical lessons in the workshop. In addition, teachers have not provided ESQ-based e-learning model, and the internet, which is filled with harmful content, requires supervision in its use. The environment of vocational high school students, often associated with brawls, also requires emotional learning and a spiritual approach to prevent these problems.

Information gathering

From the information obtained, the researcher found that appropriate learning tools are needed to realize a successful education process. Learning tools must continue to be developed to adapt to current conditions. Therefore, the researcher conducted a study on developing ESQ-based e-learning model for manufacturing engineering drawing, which can be utilized well at SMK Dhuafa Padang to improve students' abilities and characters.

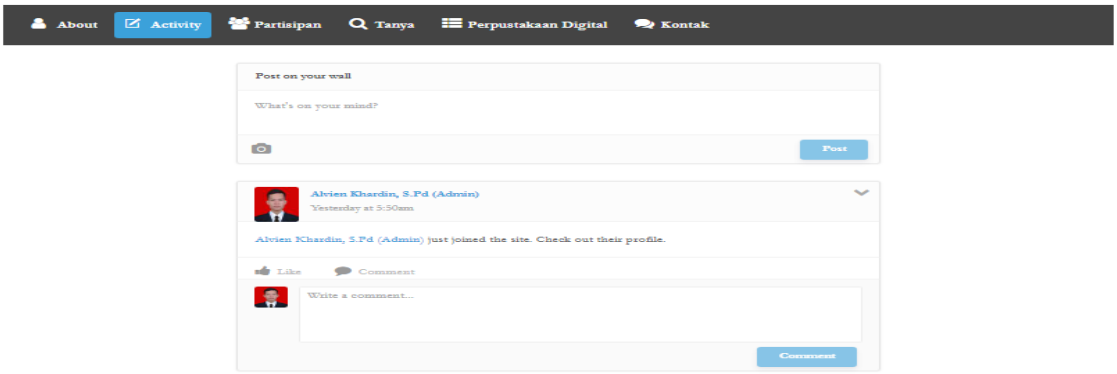
Product design

Home page of ESQ-based e-learning model, to access the login page from e-learning, you can open it via a browser with the address https://baraja-gambar.studi-vokasi.com/.

Figure 1. *E-learning home screen view*

- Activity Page

Figure 2. *Activity page view*



This page facilitates activities for both students or teachers' activities where they can post additional learning from both teachers and students. Posts can directly discuss or respond to other posts.

Design validation

Validation of instrument validity, the analysis of the validation test for the instrument's validity shows that the average assessment by two instrument experts on the product validity instrument is 0.90909 and is categorized as "valid." This means that the product validation instrument created by the researcher is suitable for use in this research.

Table 2. *Validator assessment of product validation instruments*

Items	Assessment						Description
	1	2	S1	S2	∑S	V	
1-11	50	52	39	41	80	0.90909	Valid

Product validation, the media expert validation analysis results indicate that the average assessment of the product by two learning media experts is 0.875, which categorizes it as "valid." This indicates that the ESQ-based e-learning model developed by researchers for e-learning are appropriate for use in this research context.

Table 3. *Learning media experts' assessment of products*

Items	Assessment		S1	S2	∑S	V	Description
	1	2					
1-15	68	67	53	52	105	0.875	Valid

Then, based on the results of the expert validation analysis, it is known that the average assessment by two material experts on manufacturing engineering drawings for the product is 0.85 and is categorized as "valid." This means that in terms of manufacturing engineering drawing material, the ESQ-based e-learning model created by the researcher is suitable for use in this research.

Table 4. *Material expert assessment of the product*

Items	Assessment		S1	—	S2	∑S	V	Description
	1	2						
1-23	66	66	51		51	102	0.85	Valid

Design improvement, the validator's assessment of the ESQ-based e-learning model resulted in several revisions. The revisions recommended by the validator resulted in the following changes to the ESQ-based e-learning model.

Table 5. *Suggestions and revisions to the product practicability instrument*

Suggestion	Before revision	After revision
Add an example of filling out the instrument	There are no examples of instrument filling yet	An example of completing the instrument has now been provided
More precise instructions are needed to fill out the device	Instructions for filling out the instrument are not yet complete	There are complete and clear instructions for filling out the instrument
Create a rubric of answer choices	There is no answer choice rubric yet	There is already a section for answer choices

From the results of the validation test analysis of the practicality instrument, it is known that the overall average assessment by two instrument experts on the product practicality

instrument was 0.81818 and received the "Valid" category. This means that the product's practicality instrument created by the researcher is suitable for this research.

Table 6. *Validator assessment of the product practicability instrument*

	Appraiser						
Item	1	2	S1	S2	∑S	V	Description
1-11	47	47	36	36	72	0.81818	Valid

The practicality results according to the product practicality questionnaire developed can be seen in the following table.

Table 7. *Product practicality from students in limited trials*

Statement Items	Score given				
	Student 1	Student 2	Student 3	Student 4	Student 5
1	4	4	4	4	5
2	4	5	4	4	4
3	4	5	5	4	5
4	4	4	4	5	4
5	5	5	4	4	5
6	4	4	5	4	4
7	4	5	5	4	5
8	4	4	2	4	5
Total score	33	36	33	33	37
Maximum score	40	40	40	40	40
Mark (%)	82.5	90	82.5	82.5	92.5
Average (%)	86				
Information	Practical				

From the results of product practicality analysis by students as users in limited trials, it is known that ESQ-based e-learning model, which the researchers developed, received an average score of 86% and received the "Practical" category. Practical results filled in by two teachers. The theory developed can be seen in the following, as shown by the product practicality questionnaire developed in the table.

Table 8. *Product practicality from teachers in limited trials*

Statement Items	Score Given	
	Teacher 1	Teacher 2
1	4	4
2	5	5
3	4	5
4	5	5
5	5	4
6	5	4
7	4	4
8	4	4
Total Score	36	35
Maximum Score	40	40
Mark (%)	90	87.5
Average (%)	88.75	
Information	Practical	

From the results of product practicality analysis by teachers as users in limited trials, it is known that the ESQ-based e-learning model that researchers developed received an average score of 88.75% and received the "Practical" category.

Limited trial

Testing the practicality of learning devices on small groups of students and teachers for two days.

Product revision, the practical results obtained from student and teacher assessments when using ESQ-based e-learning model in limited trials have undergone several revisions. In general, the changes based on the recommended revisions are as follows:

Table 9. *Suggestions and product revisions after limited trials*

Suggestion	Before revision	After revision
The syllabus was moved to its position at the beginning of e-learning.	The syllabus is displayed on the digital library page.	The syllabus is located on the e-learning home page.
The attendance section adds the day, date, and time of attendance.	In the attendance section, there is only one name.	The attendance section includes the name, day, date, and time of attendance.

Usage trials were conducted using a quasi-experimental design for seven consecutive days on 15 students taking the manufacturing engineering drawing subject in the January–July 2024 semester, apart from five people in the limited trial. Here is the explanation:

Practicality product, researchers distributed practicality instruments to 15 students involved in the trial usage process. From the results of the product practicality analysis by students as users in trial use, it is known that the ESQ-based e-learning model, through e-learning that the researchers developed, received an average score of 92.00% and received the "Practical" category. According to student suggestions, this practicality was followed by several improvements that researchers made to ESQ-based e-learning model. These improvements will be in the next stage.

Effective product, in this case, there are three stages: making the instrument effective, validating the instrument, and conducting tests to assess the product's effectiveness (based on results of the students' study). The results of the validation test analysis of objective test instruments indicate that the overall average assessment by two instrument experts on the product validity instrument is 0.84091, and the instrument received the "Valid" category. This means that the product validation instrument created by the researcher is suitable for use in this research.

Table 10. *Validator assessment of objective test instruments*

	Appraiser						
Item	1	2	S1	S2	∑S	V	Description
1-11	48	48	37	37	74	0.84091	Valid

Moreover, the following is a description of the analysis of the effectiveness of ESQ-based e-learning model.

Effectiveness-based on classical completeness, after carrying out an effectiveness analysis based on classical completion of 15 students who took part in the use trial, starting from the pre-test and post-test, the results were as follows:

Table 11. *Product Effectiveness (Classical Completeness)*

Description (number of students)	Pre-test	Post-test
What Follows	15	15
The Complete One	7	13
The Incomplete	8	2
Completion Percentage (%)	47	86.67
Category	Ineffective	Effective

From the analysis results of 15 students in the pre-test, only seven students passed, with a percentage of 47% in the ineffective category. After using the ESQ device through e-learning in the post-test, 13 students passed with a percentage of 86.67% in the effective category. Therefore, based on classical completeness, using the ESQ device through e-learning is as effective as a manufacturing engineering drawing media because of the increase in student learning outcomes after the treatment of using the device.

Effectiveness-based gain score, after carrying out an effectiveness analysis based on the gain score of 15 students who took part in the usage trial, starting from the pre-test and post-test, the results were as follows:

Table 12. *Effectiveness test analysis results based on the gain score*

(Average) post-test – pre-test	(Average) ideal score–pre-test score	N-gain score (%)
62.40	78.93	33.08
	Category	Currently

The researcher attaches them to this thesis for further details of the analysis results. Based on the results of this analysis, it is known that student learning outcomes have an average N-Gain score of 33.08%, namely in the medium category. It is concluded that the ESQ-based e-learning model is effectively used as a learning medium for manufacturing engineering drawing. Effectiveness-based on comparison of class learning results: control and experiment. Test the hypothesis for increasing learning outcomes.

Table 13. *Paired sample t-test results*

Paired Samples Test

	Paired Differences							
				95% Confidence interval of the difference				
	Mean	Std. Deviation	Std. Error mean	Lower	Upper	Q	df	Sig. (2-tailed)
Pre-test Post-test	-16.53333	20.70496	5.34600	-27.99936	-5.06731	-3.093	14	.008

Based on Table 48, you can see the significance of the data value, namely the sig value. 0.008 < 0.05 means H0 is rejected and H1 is accepted. Therefore, there is an increase in learning outcomes after students use ESQ-based e-learning model.

Regression hypothesis testing

Table 14. *Simple regression test results*

Coefficients [a]

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	22.523	3.590		6.274	.000
	Learning tools	.720	.045	.975	15.859	.000

a. Dependent variable: Student character

The table above presents a simple linear regression analysis conducted to examine the effect of learning tools on student character. The analysis reveals that the learning tools variable significantly and positively impacts student character, as indicated by the unstandardized coefficient (B) value of 0.720. This means that for every one-unit increase in the use of learning

tools, student character increases by 0.720 units. The standardized coefficient (beta) is 0.975, reflecting a strong positive relationship between the two variables. The corresponding t-value is 15.859 with a significance level (sig.) of 0.000, indicating that the effect is statistically significant at the 0.001 level. Additionally, the constant value is 22.523, showing the predicted value of student character when the learning tools variable is zero. The constant is also statistically significant, with a t-value of 6.274 and a significance level of 0.0000.

Product revision

The practical results obtained from the usage trials have undergone several revisions due to the constraints, suggestions, and input from students as users of ESQ-based e-learning model when using them.

Table 13. *Suggestions and product revisions after trial use*

Suggestion	Before revision	After revision
Information is given after completing the assignment/evaluation. The system has recorded the submitted assignment.	No assignment information has been recorded by the system when *submitting* the assignment.	The system already records assignment information recorded when *submitting* the assignment.

Final product

After going through validation by learning media experts and manufacturing engineering drawing material experts, the ESQ-based e-learning model was declared valid and revised according to the validator's suggestions. Limited testing on small groups of students and teachers showed that the tool was practical to use, followed by revisions based on feedback. Furthermore, trial use on a large group of students proved that this device was practical and effective, so that after refinement, this device was declared final.

Discussion

This development research aims to produce valid and accountable learning media. This product has been validated by experts, aligning with Sugiyono (2014), regarding the importance of involving experts in assessing new products. The resulting product has undergone various assessments, testing, and refinement stages. It is expected to be able to provide innovations and solutions to problems in the world of education.

The results of validation by four validators, consisting of two media experts and two material experts, stated that ESQ-based e-learning model are valid as learning media. The validator assesses the e-learning developed by the content, objectives, and instructional and technical aspects of the manufacturing engineering drawing subject. This assessment aligns with Al-Alwani (2014), who stated three main criteria for assessing learning media: quality of content and objectives, instructional quality, and technical quality.

Using ESQ-based e-learning models makes students more active, independent, and motivated in learning. The validation results by two media experts showed an average rating

of 0.875 in the "Valid" category. Meanwhile, two manufacturing engineering drawing material experts gave an average rating of 0.85, also in the "Valid" category. Overall, this device is declared suitable for use as a learning medium for manufacturing engineering drawing. For practicality, the results of limited trials show that ESQ-based e-learning models are rated as practical by students with a score of 86% and by teachers with a score of 88.75%. In the trial use, this device was again assessed as practical by students with a score of 92%.

Based on the results of limited trials and use, the ESQ-based e-learning model has proven to be easy to use and appropriate for the time available in the manufacturing engineering drawing subject. Teachers responded that this device was simple and practical to use, which aligns with Novelita et al. (2023), who stated that practicality includes ease of preparation, processing, interpretation, and administration. Djou et al. (2022) also stated that practicality can be measured from teachers' and students' considerations regarding the ease and usefulness of the device.

For effectiveness, trials show that most students succeed in mastering the material. In the trial use, 86.67% of students obtained a score ≥ 70, and analysis of classical completion and an average gain score of 33.08% showed that the ESQ-based e-learning model was practical. This is the opinion of Badriyah (2015), who stated that effectiveness is demonstrated by achieving results that are set goals. Thus, this device is effectively used in learning because it achieves the expected goals.

After going through validation, testing, and revision stages, the ESQ-based e-learning model were declared valid, practical, and effective. Therefore, this learning tool is suitable for use as a learning medium for manufacturing engineering drawing, according to Semadiartha (2012). The analysis shows the device's positive significant influence on improving student character based on regression results with a coefficient of 0.720 and a significance of 0.000. The regression equation Y = 22.523 + 0.720X shows the positive influence of the device variable (X) on student character (Y).

Conclusion

The ESQ-based e-learning model was declared valid based on the assessment of four expert validators. Validation was carried out to assess the feasibility of the ESQ-based e-learning model according to the criteria. Limited trials showed a level of practicality of the ESQ-based e-learning model were more than 85%, based on student and teacher assessments. The trial of use on students also produced an average practicality score above 90%. Pre-test-post-test analysis revealed increased student learning outcomes after using the ESQ-based e-learning model. Regression analysis and t-tests confirmed the significant influence of ESQ-based e-learning on improving student character. Based on classical completeness and gain score, the ESQ-based e-learning was effective. By fulfilling the aspects of validity, practicality, and effectiveness, it is concluded that the ESQ-based e-learning model can be implemented as a learning medium for manufacturing engineering drawings according to the research objectives. ESQ-based e-learning models can be used as a beneficial learning solution.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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