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Development of *MOSHEE (E-Modul & E-Jobsheet)* to Enhance Students' Learning Independence in the Network Measuring Instruments Subject

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ABSTRACT

Learning success is influenced by several factors, one of them is learning media. The shift from teacher-centered learning to student-centered learning requires teachers to act as facilitators in developing media that support learner independence. This study aims to develop MOSHEE (E-module and E-jobsheet) based on Book Creator and to examine its feasibility and effectiveness in improving students' learning independence in the Network Measurement Tools subject for Grade X TKJ students at SMKN Prigen, Pasuruan. This research employed the Research and Development (R&D) method using the ADDIE model, which consists of the stages of Analysis, Design, Development, Implementation, and Evaluation. The trial was conducted through a quasi-experimental design involving two groups, namely the experimental class and the control class. The results showed that the media validity level reached 93.75%, categorized as highly valid, while the material validity reached 95.07%, categorized as highly feasible. Students' learning independence reached 90%, indicating that MOSHEE was able to improve students' learning independence. In addition, a reliability test of the learning independence questionnaire instrument was conducted, resulting in a reliability value of 0.801, which is included in the high category. Based on these findings, MOSHEE is considered feasible as a learning medium and effective in improving students' learning independence.

Keywords: *MOSHEE, E-Modul, E-Jobsheet, Learning Media, Learning Independence.*

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INTRODUCTION

The educational paradigm in the 21st century has shifted from teacher-centered to student-centered learning. This transformation fundamentally changes the teacher's role from primary knowledge transmitter (teacher-centered learning) to learning facilitator (student-centered learning). This transformation fundamentally alters the role of the teacher in the classroom, shifting from the primary source of information to a learning facilitator. As facilitators, teachers must demonstrate high creativity in designing engaging, interactive media that address students' needs. Rapid advances in digital technology provide educators with ample opportunities to create innovative instructional tools that stimulate active student engagement.

In state vocational high schools (SMKN), instruction emphasizes not only knowledge

acquisition but also the development of hard and soft skills aligned with workplace demands. As stated in the explanation of Article 15 of the National Education System Law, SMKs prepare students primarily for employment in specific fields. According to Evans (as cited in Djojonegoro, 1998), vocational education aims to (1) meet societal needs for skilled labor, (2) expand educational choices for individuals, and (3) foster lifelong learning motivation.

In vocational high schools, within the Computer Network and Telecommunication Engineering subjects, students learn about Network Measurement Tools. The Network Measurement Tools subject requires students to identify tools, explain their functions, and use them effectively. Students need both conceptual understanding and practical experience. To meet these learning objectives, students are required to understand the concepts of network measurement tools and gain practical experience in using them. However, regarding the "Network Measurement Tools" learning unit, there is currently no material available to students that presents this topic in an interactive and engaging manner. However, our classroom observations revealed that current instruction for this topic relies primarily on conventional lectures, PowerPoint presentations, and demonstration videos. In conducting practical activities at the SMKN Prigen, teachers of specialized vocational subjects at SMKN Prigen typically prepare printed Student Worksheets or jobsheets that outline the procedures for the activities. The use of printed jobsheets requiring handwritten responses results in a lack of enthusiasm among students and fails to foster independent learning, as students tend to wait for teacher explanations rather than work independently.

At SMKN Prigen, several specific challenges were identified in Phase E instruction on Network Measurement Tools: (1) teachers use fragmented conventional media (separate videos, materials, and printed worksheets); (2) students remain dependent on teacher guidance during practical activities; (3) learning independence is low among Grade X TKJ students; (4) students struggle particularly with cable testing (e.g., cross cables); and (5) e-modules are underutilized, with most materials still in printed or isolated video formats.

To address these issues, we developed an interactive multimedia e-module that integrates text, images, videos, and assessments within a single platform. The use of the e-module enables the integration of text, images, video, and interactive assessments within a single learning platform. Prior research indicates that e-modules and instructional videos can improve learning outcomes, yet few studies have integrated theory, practical jobsheets, and demonstration videos for this specific topic, particularly while simultaneously examining both cognitive achievement and technical skills alongside learning independence.

In today’s digital era, students must develop self-regulated learning skills to build critical thinking, intrinsic motivation, and personal responsibility. Self-reliance is defined as confidence in one’s own abilities and judgments (Puri, 2017). Research by Quesada-Pallares (2019, p.7) found that vocational students using digital media exhibited higher levels of self-regulated learning than those in

conventional settings. Based on that statement, students in Vocational High Schools are expected to be able to learn independently and possess problem-solving skills in order to develop a resilient, initiative-driven, and highly competitive character to face the demands of the workplace.

To foster independent learning among students, there are many applications that teachers can use to create engaging and interactive lessons. Book Creator is a versatile digital platform that enables teachers to create creative, interactive, and engaging e-modules. Previous studies have shown its effectiveness in blended learning environments. Its features support diverse learning styles through images, videos, animations, and simple interactive quizzes tailored to students' cognitive levels (Oktavia, 2022).

The development of MOSHEE serves as a solution to provide an interactive and engaging learning experience for students, thereby enhancing their learning independence. We developed MOSHEE (E-Module & E-Jobsheet) using Book Creator to provide an integrated, interactive, student-centered experience combining theory, practical procedures, and tutorial videos. Accessible anytime, MOSHEE is designed to increase learning independence in the Network Measurement Tools subject for Grade X TKJ students at SMKN Prigen. The media meets criteria for reliable digital learning resources in laboratory settings. The following conceptual framework illustrates the development process (see Figure 1).

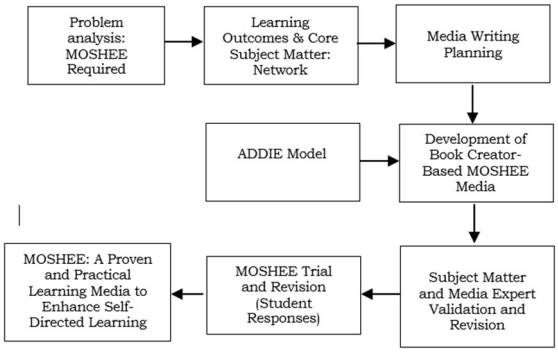


Figure 1. Conceptual Framework

Numerous studies have developed Book Creator-based e-modules as digital learning media. However, most of these studies have primarily focused on developing e-modules as standalone instructional materials and have not integrated e-jobsheets as practical learning guides, particularly for vocational subjects that require the development of technical skills.

Sanjaya et al. (2023, p.417) developed a Book Creator-based e-module to support differentiated instruction in Social Studies. The findings indicated that the e-module demonstrated a very high level of validity and was considered practical, engaging, and suitable for classroom implementation. Nevertheless, the study focused solely on the development of an e-module as a digital instructional resource without integrating practical activities or technical skill assessment.

Gani et al. (2024, p.227) developed a Book Creator-based e-module and found that the developed learning media was valid and showed the potential to enhance students' academic achievement. However, the study was limited to evaluating product feasibility and cognitive learning outcomes, without examining its impact on students' technical skills and self-regulated learning.

Iskandar and Sudrajat (2024, p.10) developed a Book Creator-based e-module as a learning resource for Social Studies. The validation results showed that the product was highly feasible for use as an independent learning resource. However, the developed media did not integrate practical learning activities or digital jobsheets, making it function primarily as a learning resource rather than as a practice-oriented instructional medium.

Through a systematic literature review, Ismi et al. (2024, p.70) concluded that Book Creator-based e-modules have considerable potential to improve students' conceptual understanding. Nevertheless, the review also highlighted that existing research on Book Creator has predominantly focused on the development of e-modules, while studies integrating e-modules with practical learning media and technical skill assessment remain limited.

Based on previous studies, several research gaps can be identified. First, most previous studies have focused solely on developing Book Creator-based e-modules, whereas the development of integrated digital e-jobsheets has received limited attention. Second, previous research has predominantly been conducted at the elementary and junior secondary school levels and has mainly addressed general education subjects. In contrast, studies conducted in Vocational High Schools (SMK), particularly within the Computer and Network Engineering program on the Network Measurement Instruments course, remain very limited. Third, earlier studies generally evaluated only the feasibility of the learning media or students' cognitive learning outcomes. The effects of digital learning media on self-regulated learning, technical skills, and academic achievement simultaneously have rarely been investigated. Finally, no previous study has developed an integrated learning medium that combines theoretical content, practical jobsheets, instructional videos, assessments, and documentation of practical activities within a single Book Creator platform for the Network Measurement Instruments course.

The novelty of this study lies in the development of MOJEBS (Book Creator-Based E-Module and E-Jobsheet), which integrates several instructional components into a single digital learning platform. These components include: an e-module as a theoretical learning resource, an e-jobsheet providing step-by-step practical guidance, practical demonstration videos that can be accessed directly through Book Creator, assessment and practice links; and documentation of students' practical work to support learning reflection.

Furthermore, this study is implemented in the Network Measurement Instruments course for Grade X students of the Computer and Network Engineering (TKJ) program. Unlike previous studies, this research not only evaluates the feasibility of the developed learning media but also investigates its effects on students' self-regulated learning, technical skills, and academic achievement using a Quasi-Experimental Nonequivalent Control Group Design.

This study is expected to make the following contributions. (1) Theoretical

Contribution : This study enriches the body of knowledge on the development of Book Creator-based digital learning media in vocational education by providing empirical evidence regarding the relationship between the use of digital learning media and students' self-regulated learning, technical skills, and academic achievement. (2) Practical Contribution : this study produces MOSHEE, an integrated digital learning medium that can be utilized by vocational teachers to combine theoretical instruction and practical learning within a single platform, thereby supporting the implementation of competency-based learning in Vocational High Schools (SMK). (3) Methodological Contribution : This study provides an example of applying a Quasi-Experimental Design to evaluate the effectiveness of digital learning media in vocational education by simultaneously measuring students' cognitive, affective, and psychomotor learning outcomes.

RESEARCH METHODS

We used a systematic Research and Development (R&D) approach to create and validate an innovative educational product. In this context, product development aims to refine existing learning tools to better align with the needs of the workforce, ensuring that the resulting product is not only technologically innovative but also possesses validity that is defensible from both academic and practical perspectives. This development research on MOSHEE (e-module and e-jobsheet) employs the ADDIE model, which consists of five stages.

The ADDIE model guided the process: Analysis, Design, Development, Implementation, and Evaluation. In the Analysis phase, we identified required competencies and learning objectives focused on fostering independence. The most important step is to determine the learning experiences students need to have during the learning process. The Design phase involved clarifying learning programs, formulating basic competencies, mapping content, developing the e-jobsheet framework, and preparing assessment instruments and practical rubrics. During Development, we created the MOSHEE prototype, including pretest/posttest items, which were validated by material and media experts. Implementation took place in productive classes for Grade X TKJ students studying Network Measurement Tools. Finally, the Evaluation phase gathered user feedback for refinement.

The study population comprised all 10th Grade Computer Network Engineering (CNE) students at SMKN Prigen enrolled in the Network Measurement Tools element of Phase E. Through cluster random sampling, two classes of comparable ability levels were selected to evaluate the effectiveness of MOSHEE (E-Module & E-Jobsheet). The study was conducted at SMK Negeri Prigen, Prigen District, Pasuruan Regency, East Java Province. The independent variable in this study is the implementation of MOSHEE as an innovative instructional medium for the Network Measurement Tools unit. This product was designed as a stimulus that integrates text, visuals, practical demonstration videos, and digital worksheets within a unified learning

ecosystem. By leveraging the Book Creator platform, this variable manipulates the way students access content that was previously conventional and fragmented, with the goal of shifting the instructional paradigm toward a more interactive, student-centered model. MOSHEE is thus expected to serve as a comprehensive digital solution for educational needs in the SMK environment.

Research activities fundamentally constitute a measurement process, which necessitates representative measurement instruments, commonly referred to as research instruments. Consistent with Sugiyono (2019, p. 156), research instruments function as tools for measuring various phenomena, both natural and social, that constitute the object of observation. In this study, we employed questionnaires as the primary data collection technique. As defined by Sugiyono (2019, p. 199), a questionnaire is a data collection method that presents a series of written questions or statements for respondents to answer.

The instrument type used was a closed-ended questionnaire, a format that, as described by Winarno (2013, p. 99), provides pre-specified answer choices from which respondents select the most appropriate option. The questionnaire items were constructed to capture factual data reflecting respondents' actual experiences. Specifically, the instrument was administered to Class X TKJ students to collect comprehensive data on the variable of learning independence as an outcome of the treatment, that is, the use of the interactive e-module.

Data collection relied primarily on questionnaires. We used closed-ended Likert-scale items (Sugiyono, 2019) with the following scoring:

Table 1. Likert Scale

Number	Response Options	Score
1	Strongly Agree (SA)	4
2	Agree (A)	3
3	Disagree (D)	2
4	Strongly Disagree (SD)	1

Through this Likert scale, we sought to measure improvements in student learning independence resulting from the use of MOSHEE (E-Module and E-Jobsheet). In accordance with the research objectives, we developed the following questionnaire instruments:

a. material expert validation questionnaire,
b. media expert validation questionnaire, and
c. student learning independence questionnaire.

The questionnaire submitted to subject-matter experts covers an in-depth evaluation of content quality, language use, and content appropriateness within the MOSHEE (E-Module & E-Jobsheet) for Grade 10th CNE students. This instrument was designed to ensure that the Network Measurement Tools content meets Phase E curriculum standards and industry competency requirements. Findings from the subject-matter expert validation serve as the primary basis for revising and refining the substantive quality of the product prior to field trials. With expert input, the content dimension of MOSHEE is expected to effectively stimulate both students' technical skills and learning independence.

To determine the effectiveness of using MOSHEE in the Network Measurement Tools course, hypothesis testing was conducted using

the Normalized Gain (N-Gain) analysis. The following categories are used to determine the level of N-Gain as proposed by Negara (2017):

Table 2. N-Gain Score Criteria

N-Gain Value	Category
N-Gain > 0,7	High
0,3 < N-Gain ≤ 0,7	Moderate
N-Gain ≤ 0,3	Low

Furthermore, to interpret the effectiveness of the N-Gain score, the criteria proposed by Ariani (2014) were applied, as presented in Table 3.

Table 3. Interpretation of N-Gain Effectiveness

Percentage (%)	Interpretation
<40	Ineffective
40 - 55	Less Effective
56 - 75	Moderately Effective
>76	Effective

The N-Gain analysis was used to measure the effectiveness of MOSHEE in the Network Measurement Tools course. This analysis was conducted by comparing the difference between the pre-test and post-test scores relative to the maximum possible improvement that students could achieve, using the following calculation formula:

$$N - Gain = \frac{\text{Skor PostTest} - \text{Skor PreTest}}{\text{Skor Ideal Maksimal} - \text{Skor Pretest}}$$

RESULTS AND DISCUSSION

An e-module is a systematically organized digital learning resource designed to support independent study (Prastowo, 2018). It integrates text, images, audio, video, and animation. An e-jobsheet is a technology-based tool that facilitates the collection, summarization, assessment, and testing of learning activities (Kurniawan & Hidayatullah, 2023). MOSHEE represents an innovative solution that combines these elements to promote greater learning independence.

In the Analysis phase, we identified key problems through observation and interviews: student dependence on teacher explanations, low learning independence, difficulties with practical testing (especially cross-cable measurement), and limited use of integrated digital media.

During the Design phase, we mapped content, defined learning outcomes and objectives (see Figure 2: MOSHEE Home Page).

Figure 2. MOSHEE Home Page

In the Development phase, we built MOSHEE in Book Creator, incorporating pretests, core materials, student worksheets, posttests, and enrichment activities (see Figure 3: Network Measurement Tools on MOSHEE).

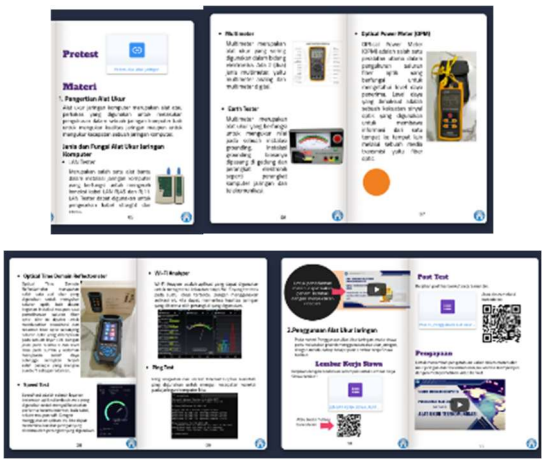


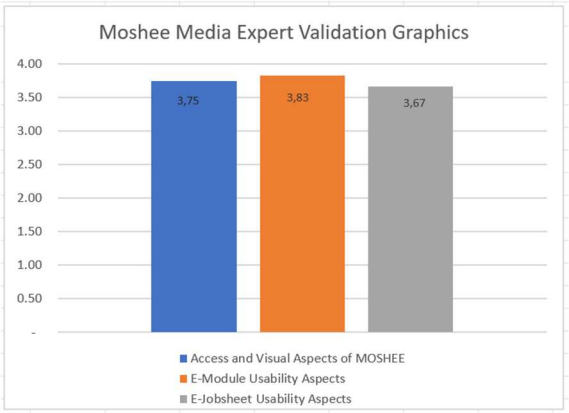
Figure 3. Network Measurement Tools on MOSHEE

The Implementation phase involved two class sessions with Grade X TKJ students. As

facilitator, the researcher observed student activities.

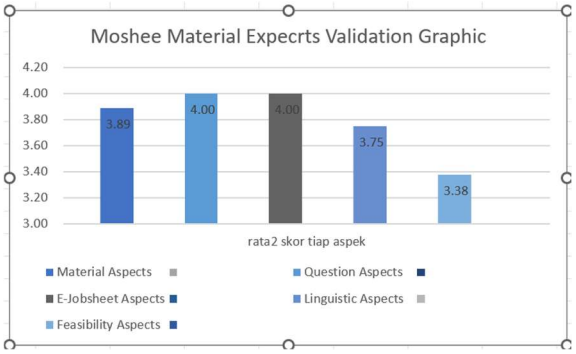
1. Media Expert Validation

Media experts rated accessibility and display at 3.75, e-module use at 3.83, and e-jobsheet use at 3.67 (average 3.75, or 93.75%, highly feasible). Based on these results, the average validity score from the media expert was determined to be 3.75, which translates to 93.75%. Consequently, MOSHEE is deemed highly suitable as an interactive learning medium capable of enhancing students' learning independence.



Graph 1. Media Expert Validation

2. Material Expert Validation

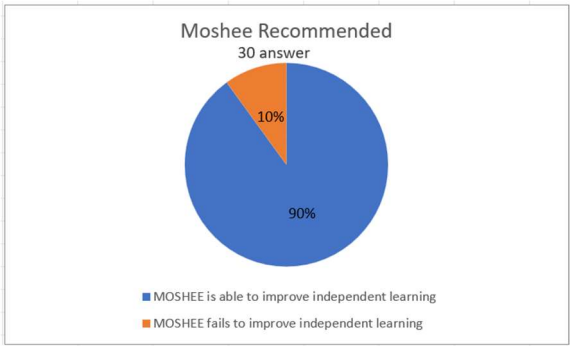


Graph 2. Material Expert Validation

Material experts rated content at 3.89, questions at 4.00, e-jobsheet at 4.00, language at 3.75, and practicality at 3.38 (average 3.80, or 95.07%, highly feasible).

3. Student Learning Independence Questionnaire

Students were administered a learning independence questionnaire alongside a MOSHEE feasibility instrument. Results showed that 90% of students reported that MOSHEE improved their learning independence, while 10% indicated that it did not. The instrument showed normal distribution (Kolmogorov-Smirnov $p = 0.214 > 0.05$), valid items (corrected item-total correlation > 0.30), and high reliability (Cronbach's $\alpha = 0.801$).



Graph 3. MOSHEE Recommendation

The learning independence questionnaire data were further subjected to normality, validity, and reliability testing using SPSS 27. The results of the statistical and descriptive analyses are presented in the following tables.

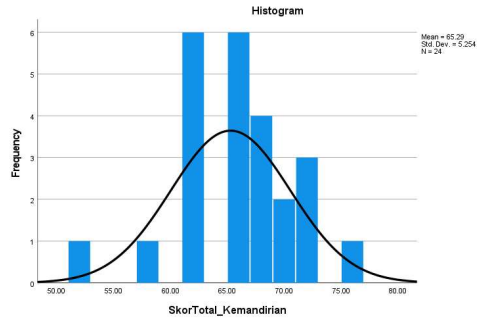
One-Sample Kolmogorov-Smirnov Test

Table 4. Normality Test Using the Kolmogorov–Smirnov Method

		TotalScore_Independence
N		24
Normal Parameters[a,b]	Mean	65.2917
	Std. Deviation	5.25423
Monte Carlo Sig. (2-tailed)[e]	Sig.	.214

With a sample size of 24, a mean of 65.29, a standard deviation of 5.25, and a significance value of 0.214, the data are determined to follow a normal distribution, as the significance value of 0.214 exceeds the 0.05 threshold. A standard

deviation of 5.25 indicates a moderate degree of data dispersion. The normal distribution is further confirmed by the histogram below, which shows a score distribution with no pronounced skew, data concentrated around the mean, and no extreme deviations.



Graph 4. Normality Test Histogram

Validity testing yielded valid results, with corrected item-total correlation values exceeding 0.30. Reliability testing using Cronbach's Alpha produced a coefficient of 0.801, indicating that the instrument is reliable with a high level of internal consistency and is therefore suitable for use as a research data collection tool. This value confirms that the statements and indicators in the instrument are interrelated and measure the same underlying construct. The reliability statistics are presented in Table 3 below.

Reliability Statistics

Table 5. Learning Independence Instrument Reliability

Cronbach's Alpha	N of Items
.801	24

Stage 5, Evaluation. The Evaluation stage involved a final revision of MOSHEE based on feedback and recommendations from the validators, which were then used to refine the developed medium. Upon completion of the revisions, the medium was cleared for use in the final field trial.

The media expert validation yielded an overall average of 93.75% across all indicators, leading to the conclusion that MOSHEE is highly feasible for instructional use in the SMK setting, specifically for the Network Measurement Tools unit in Class X TKJ, given its engaging and interactive design. Nevertheless, one recommendation from the validator identified the need for revision in the e-module: the addition of video documentation produced from students' own practical sessions on the Network Measurement Tools unit.

The subject-matter (SM) expert validation yielded an overall average of 95.07% across all indicators, confirming that MOSHEE is highly feasible for instructional use at the SMK level, with content that is well-aligned with the learning objectives of the Network Measurement Tools unit. Revision was recommended, however, in terms of deepening the content and incorporating additional examples drawn from everyday learning experiences, so as to make the material more relatable and to sustain student engagement.

In the small-group user trial, MOSHEE received a feasibility rating of 90%, indicating that it is effective as an instructional medium for the Network Measurement Tools unit and capable of improving student learning independence. The remaining 10% of users indicated that MOSHEE did not improve their learning independence, a finding that warrants further examination of the medium and targeted revisions to ensure that learning independence gains extend to all users. Reliability testing of the independence instrument using Cronbach's Alpha yielded a coefficient of 0.801, confirming

a high level of internal consistency and suitability for use as a research data collection tool. The validation outcomes from media experts, subject-matter experts, and the student learning independence questionnaire are summarized in Table 4 below.

Table 6. Summary of Media, Content, and Learning Independence Validation Results

Validation	Percentage	Category
Media Expert	93,75%	Highly Feasible
SM Expert	95,07%	Highly Feasible
Student Independence Questionnaire	90%	*MOSHEE improves learning independence*

4. N-Gain effectiveness test

To measure the effectiveness level of MOSHEE, the N-Gain score test was calculated using the learning outcomes of the experimental and control classes from the pre-test and post-test, which are presented in Table 4 below:

Class	Mean		Average N-Gain <g>	Category	Presentase
	Pre-test	Post-Test			
Experimental	54,00	92,67	0,82	High	82,75%
Control	53,67	85,33	0,67	Moderate	67,72%

Based on the N-Gain Score analysis, the experimental group obtained an average N-Gain score of 0.82, with an effectiveness percentage of 82.75%, which falls into the high category and is classified as effective. Meanwhile, the control group achieved an average N-Gain score of 0.67, with an effectiveness percentage of 67.72%, which is categorized as moderate and interpreted as moderately effective.

These findings demonstrate that MOSHEE (E-Module and E-Jobsheet) effectively improves students' learning independence. Furthermore, the results of the Independent Samples t-Test conducted on the N-Gain data showed a Levene's Test significance value of 0.228 ($p > 0.05$), indicating that the data variances were homogeneous.

Based on the Equal Variances Assumed row of the t-test results, the Sig. (2-tailed) value was 0.012. Since the significance value of 0.012 < 0.05, it can be concluded that there is a statistically significant difference in the mean N-Gain scores between the Experimental Group (0.8275) and the Control Group (0.6772).

These results indicate that the experimental group achieved a more effective improvement in learning outcomes, with a moderate effect size according to Cohen's d (0.670).

In this study, MOSHEE functions not only as a medium for delivering instructional content but also as a learning tool that facilitates each phase of self-regulated learning. Through the e-module, students are able to learn theoretical concepts independently at their own pace. The e-jobsheet provides systematic step-by-step practical guidance, enabling students to plan and carry out practical activities more effectively. Furthermore, the integrated demonstration videos allow students to observe correct work procedures, while the built-in practice exercises and assessments enable them to monitor their learning progress and reflect on their learning outcomes.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This development study produced MOSHEE (E-Module and E-Jobsheet) for the Network Measurement Tools unit, designed for Class X Computer and Network Engineering (TKJ). MOSHEE integrates an e-module and an e-jobsheet within a single instructional medium to enhance student learning independence. It encompasses a complete learning sequence, including instructional content, a pretest, a posttest, a jobsheet, enrichment activities, and reflection, aligned with the learning objectives of the Network Measurement Tools unit. The fulfillment of media and content feasibility criteria through the validation process directly shaped the quality of the resulting product, which was subsequently implemented with students. The feasibility of MOSHEE as both a learning resource and an instructional medium is evidenced by the student learning independence questionnaire results: following feasibility assessment, students demonstrated the ability to learn independently using MOSHEE, with the teacher serving as a facilitator. the novelty of this study lies in the development of MOSHEE, an integrated digital learning medium that combines theoretical content, practical guidance, demonstration videos, practice exercises, and assessments within a single Book Creator-based platform. In addition, this study establishes empirical evidence of the effectiveness of MOSHEE in enhancing vocational high school students' self-regulated learning through the implementation of a Quasi-Experimental Nonequivalent Control Group Design. Therefore, MOSHEE has the potential to serve as an alternative digital learning medium that supports the implementation of competency-based learning in Vocational High Schools (SMK).

Recommendations

Future iterations should incorporate student practical videos, deepen certain content areas, and add more everyday examples to increase engagement. Feedback from validators and senior teachers will guide further improvements.

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