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Development of an Android-Based Application for Technical Drawing to Enhance Learning Outcomes

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Abstract

This study is motivated by challenges in the teaching and learning process of technical drawing, including low student engagement, ineffective lesson hours, suboptimal learning media, and previous student achievement scores below 80%. The research aims to develop an Android-based learning media application, JAGAR, for teaching single-story house plan drawing, assess its feasibility, evaluate its practicality, and compare its effectiveness with other instructional methods in improving learning outcomes.

The study employs the ADDIE development model and is conducted at SMK Negeri 7 Semarang, specifically in the Grade XI Building Construction, Sanitation, and Maintenance Program. The sample consists of 70 students divided into two classes, each subjected to different instructional approaches.

The findings indicate that the JAGAR learning application is both feasible and practical based on evaluations by subject matter experts and teachers. Additionally, its implementation proves to be more effective than conventional methods. The study concludes that utilizing the JAGAR application significantly enhances student learning outcomes and motivation. The novelty of this research lies in the integration of instructional videos, quizzes, and job sheets within the learning media.

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INTRODUCTION

Education, when viewed as a process, consists of three key interrelated elements: learning objectives, learning experiences, and evaluation procedures. Learning itself is a communication process between students, teachers, and instructional materials. Communication cannot take place without the assistance of message delivery tools or media. The message to be communicated is the learning content found in the curriculum, which is conveyed by teachers, facilitators, or other sources into communication symbols, whether verbal, non-verbal, or visual.

With the advancement of technology in the mid-21st century, students are required to operate various applications that will later be needed in the workplace. In line with this, teachers must be able to explain how to operate drawing applications such as AutoCAD. Efforts to master science and technology are essential to achieving educational goals, which are realized through a well-designed curriculum. The technological advancements occurring today also impact the curriculum.

Traditional learning systems are characterized by face-to-face interactions between students and teachers. This approach has been in place for a long time to achieve the primary goals of teaching and learning. However, as student and teacher activities increase, this concept encounters challenges related to location and time constraints in its implementation.

A shift in the learning system paradigm is emerging, particularly in knowledge transfer. The learning process today tends to focus more on the teaching process, where content is fundamental, abstract, and targeted at specific groups. This approach is often passive in nature. With the development of Information and Communication Technology (ICT), learning has begun to shift towards case-based, contextual, and broader-reaching instruction that is not limited to specific groups. In such a learning process, students need to be more proactive in optimizing available learning resources.

The rapid technological advancements worldwide have significantly influenced the lifestyles of people, including those in the education sector. Numerous new technologies have been developed in education to enhance the quality of human resources, as education is regarded as highly important. The integration of technology into education has made knowledge and information more accessible, including in vocational schools (Sekolah Menengah Kejuruan - SMK).

Vocational High Schools (SMK) are secondary-level educational institutions designed to prepare students for direct entry into the workforce. Therefore, every SMK student is expected to master a specific field of study to remain competitive in securing employment. However, shaping students into experts in a particular discipline is not an easy task.

At SMK Negeri 7 Semarang, a semi-block system is implemented, where classes are divided into two groups (odd-index and even-index students). During odd-numbered weeks, students in the odd-index group study vocational subjects, while those in the even-index group study general subjects, and vice versa. Vocational subjects are taught in ten consecutive lesson hours per day, covering only one subject each day. Technical drawing is taught in Grade XI, where students learn the competency of drawing a single-story house plan.

In practice, the teacher employs a lecture and tutorial approach using a projector during classroom sessions, demonstrating the drawing process for students to follow. Ideally, students in Grade XI should be able to understand the components of a house structure and complete a single-story house plan. However, in reality, several challenges prevent the achievement of learning outcomes (Capaian Pembelajaran - CP). According to subject teachers, the block system at SMK Negeri 7 Semarang is less effective for learning AutoCAD, as the 10-hour continuous lesson period for a single subject causes students to lose concentration and become fatigued due to prolonged classroom-based instruction.

Additionally, if an academic day is lost due to national holidays or school activities, students miss an entire 10-hour lesson, leading to unmet learning objectives at the end of the semester. This system also creates gaps between students in the odd-index group and those in the even-index

group, as there is a discrepancy in instructional hours.

Initial observations indicate that students in Grade XI have not fully developed their understanding of practical technical drawing skills in the 2023/2024 academic year. Therefore, this study aims to develop an interactive learning media system at SMK Negeri 7 Semarang to support students in mastering the competency of drawing a single-story house plan. By integrating an interactive learning platform, students can receive additional support to enhance their technical drawing skills.

Learning media serve as tools or intermediaries that facilitate the teaching and learning process, making communication between teachers and students more effective. This greatly assists teachers in delivering lessons and enables students to grasp and comprehend the material more easily. This process requires teachers to align learning media with the Project-Based Learning (PBL) model.

Project-Based Learning emphasizes student-centered learning while delving into a particular topic. Constructively, students explore or deepen their learning through a research-based approach to answer meaningful, authentic, and relevant questions or issues (Grant, 2002). The use of learning media in teaching and learning processes can also stimulate students curiosity and motivation, while fostering psychological engagement. In addition to enhancing learning motivation, utilizing learning media can also improve students comprehension of the subject matter.

With 21st-century technological advancements, various tools can be utilized to develop learning media, including Android-based applications. Android devices are highly relevant to the daily lives of students. Beyond their function as communication tools, Android devices have the potential to become interactive learning media that benefit students.

Interactive learning media refers to digital visual media that can offer multiple functionalities based on user needs. The design and structure of these media can be adapted to suit specific learning requirements. The development of interactive learning media must be based on a thorough analysis of learning needs and conditions. It is essential to determine which learning materials should be incorporated, who the users will be, what resources are required and available, and other supporting factors for effective implementation. The learning media must then be designed accordingly, based on objective data and findings from the needs analysis.

To improve learning effectiveness and efficiency, modern learning media can provide a viable solution. The advancements in science and technology today serve as an enabling factor that can be leveraged to enhance educational processes. The increasing sophistication and accessibility of technology support progress across various fields, including education, economics, healthcare, and environmental sciences.

In education, the integration of modern technology is expected to aid learning processes, ultimately improving the comprehension of students and their learning outcomes. One of the most widely used technologies among students today is Android-based learning media.

Android is an operating system consisting of an operating platform, middleware, and applications. As an open-source software, Android allows developers to create applications that can be used on various mobile devices (Qumillaila et al., 2017). Currently, Android is one of the most popular operating systems, especially among young people. However, its use in education remains underutilized.

Research on smartphone usage reveals that most users fall within the age groups 13–15 years (44.1%) and 16–18 years (55.9%) (Waty and Fourianalistyawati, 2018). A significant portion of Android smartphone users are students, yet their devices have not been fully optimized for learning purposes. Given the widespread appeal of Android technology among students, it can be effectively integrated into technical drawing education, particularly for learning AutoCAD. Based on observations and identified challenges, this study seeks to develop an Android-based application as a teaching aid for instructors, packaged in an engaging format that can be accessed anytime and anywhere.

RESEARCH METHODOLOGY

Type of Research

This study utilizes Research and Development (R&D) as the research approach for developing interactive learning media. The development model adopted in this study is the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), which serves as a generic instructional design model and provides guidelines for constructing effective, dynamic, and performance-driven training programs and learning infrastructure.

Research Procedure

The research procedure refers to the steps used to collect data aimed at answering the research questions formulated in this study. In the context of the ADDIE development model, the steps undertaken in this research are as follows:

Analysis

The Analysis phase is a process of defining what will be learned by the research subjects, identifying problems or needs, and conducting a needs assessment. Problem analysis is carried out to determine and clarify whether the identified issues require solutions in the form of learning program implementation or improvements in learning media. Needs analysis is a crucial step in identifying the competencies that students need to acquire to enhance their performance, academic achievements, and skills. This phase ensures that the learning program is considered an appropriate solution to the educational challenges encountered.

Design

The Design phase requires a structured clarification of the learning program to ensure that it meets the intended learning objectives. There are four important steps in this phase, which include the development of the Android-based interactive media framework, the collection and selection of reference materials, the design of Android-based interactive learning media, and the development of instruments for gathering feedback on the learning media. The resulting design is then consulted with teachers from the Building Construction, Sanitation, and Maintenance Program. Once approved, the next step is the implementation of the agreed-upon Android-based interactive learning media design.

Development

The Development phase is the process of realizing the previously designed media, which involves the creation of Android-based interactive learning media. This phase aims to assess the feasibility of the developed media, which is then validated by media experts, subject matter experts, and users (teachers and students). The validators consist of three media experts and three subject matter experts. Additionally, teachers from the Building Construction, Sanitation, and Maintenance Program at SMK Negeri 7 Semarang and students taking the AutoCAD course provide feedback. After conducting feasibility and practicality tests, necessary revisions are made based on comments and recommendations from the validators.

Implementation

The Implementation phase involves applying the Android-based interactive learning media in the learning process. The research respondents are Grade XI students from the Building Construction, Sanitation, and Maintenance Program, divided into two groups. Grade XI KGSP 2 serves as the experimental class, where the Android-based interactive learning media is applied, while Grade XI KGSP 1 serves as the control class, where the learning process proceeds without the intervention. The steps taken in this phase include administering a pre-test to both groups, applying the Android-based interactive learning media in the experimental class while maintaining traditional learning in the control class, and conducting a post-test to measure the final learning outcomes and analyze respondents feedback.

Evaluation

The Evaluation phase is divided into two types: formative evaluation and summative evaluation. Formative evaluation involves feasibility and practicality tests of the Android-based interactive learning media, while summative evaluation focuses on assessing its effectiveness and practicality in improving

student learning outcomes. In this phase, data is analyzed to identify any deficiencies in the learning media. The evaluation results are compiled from assessment sheets and feedback forms.

Data Sources, Data Collection Methods, and Data Analysis

Data sources in research can include people, places, activities, or symbols (Widoyoko, 2012). The primary data sources in this study are respondents, who provide data in the form of verbal or written responses. Data collection is conducted through validity and reliability evaluations by media and subject matter experts, analysis of media practicality, and an effectiveness assessment based on the learning outcomes of students in the experimental group (Grade XI KGSP). Additionally, learning improvement is evaluated by comparing the control and experimental groups.

The instruments used in data collection consist of three methods. The first method involves questionnaires distributed to six media and subject matter experts to assess the feasibility of the JAGAR application and the relevance of test items to competency standards. The second method involves practicality surveys given to 35 students and 4 teachers to evaluate the practicality of the JAGAR application. The third method involves cognitive skill tests in the form of multiple-choice questions to measure students learning outcomes. A validity and reliability test is conducted on the test instruments to ensure that the collected data accurately measures the intended competencies.

Data analysis in this research follows a systematic approach consisting of several methods. The feasibility of the Android-based interactive learning media is analyzed using descriptive quantitative analysis. The practicality evaluation data, collected from feedback forms, is assessed using reliability analysis with KR-20. Since this study aims to develop and test a learning product, feasibility, practicality, and experimental tests are conducted using the quasi-experimental method.

The study adopts a Pre-Test – Post-Test Control Group Design, where two groups are assigned. The experimental group, consisting of students from Grade XI KGSP 2, receives treatment using Android-based interactive learning media, while the control group, consisting of students from Grade XI KGSP 1, follows the traditional learning approach. The research process begins with administering a pre-test to assess the initial knowledge level of both groups, followed by the implementation of the interactive learning media in the experimental group while maintaining traditional instruction in the control group. Afterward, a post-test is conducted using the same set of questions to evaluate learning improvements. The results are then compared and analyzed based on predefined evaluation criteria.

The collected data is analyzed using several statistical tests. The normality test is conducted to determine whether the data follows a normal distribution. The homogeneity test is performed to assess variance between groups and ensure comparability. The N-Gain calculation is used to measure the effectiveness of the interactive learning media. The independent t-test on N-Gain scores is employed to determine whether there is a significant difference between the experimental and control groups.

RESULT AND DISCUSSION

Result

Analysis

A problem analysis was conducted on students in the Building Construction, Sanitation, and Maintenance Program at SMK Negeri 7 Semarang. This analysis aimed to identify various shortcomings and weaknesses related to the learning media currently in use. The researcher carried out observations and interviews with teachers and students. Based on these observations, several findings were obtained: (1) According to the subject teachers, the block system applied at SMK Negeri 7 Semarang is ineffective for AutoCAD learning, as one subject is taught for eight consecutive hours. The prolonged duration leads to student fatigue and decreased engagement, as learning is confined to the classroom. At the end of the semester, learning outcomes (Capaian Pembelajaran – CP) are often not achieved due to ineffective learning days caused by national holidays or school events,

resulting in an immediate loss of eight hours of lessons. This system also creates gaps between odd-index and even-index groups, as one group inevitably lags behind the other within a semester; (2) Challenges related to the duration of learning and disparities in CP achievement from the previous year, as well as inconsistencies between odd-index and even-index classes, have been identified; (3) The use of teaching modules as learning media is ineffective because students generally have a low preference for reading. Alternative media such as instructional videos have not been implemented due to the unavailability of materials that align with the planned curriculum and are easily accessible to both students and teachers; (4) Teachers have not yet integrated innovative learning media such as animations or videos into classroom instruction. Instead, instructional references rely solely on one physical textbook.

Design

The development of the Android-based interactive media framework was guided by the instructional media development standards established by the Institute for Learning Development and Quality Assurance. The interactive media consists of three main components: the initial interface, content, and summary section. The initial interface includes the cover, credits, learning objectives, and expected competencies. The content section provides guidelines and instructional videos for technical drawing. The final section contains a summary and an overview of the course material.

Media Design

The design of the learning media involves structuring its initial framework, content, and conclusions. The layout of the JAGAR Android-based learning application was developed based on these elements.

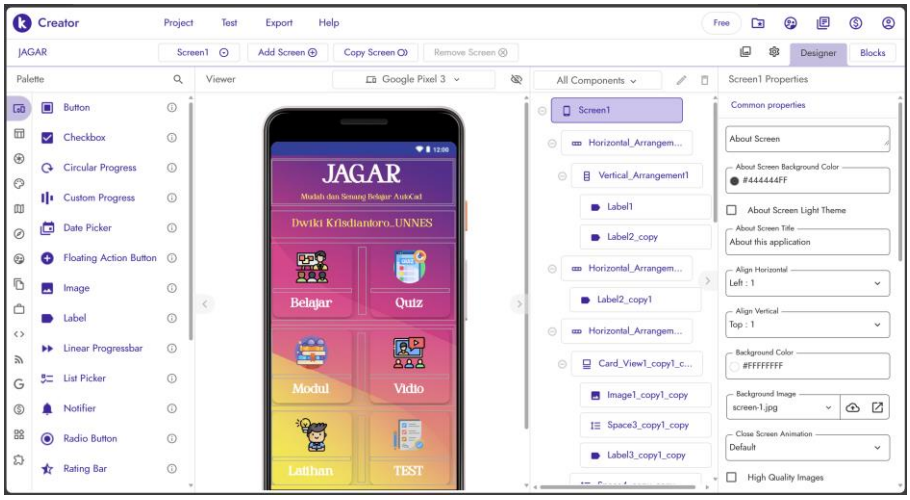

Figure 1. The Process of Developing the JAGAR Application

Development

This phase involves the implementation of the previously designed media. Several key stages were undertaken in the development of the JAGAR application. First, the content was created based on the curriculum and required learning competencies. Second, supporting media were selected and developed using the Kodular platform, ensuring compatibility with Android-based devices. Next, guidelines were prepared for vocational school teachers in the Building Construction, Sanitation, and Maintenance Program, allowing them to effectively utilize this learning media in their teaching process. Finally, formative revisions were made based on validation from subject matter experts and media specialists, ensuring the feasibility of the media before its use in classroom instruction.

Feasibility Analysis by Media and Subject Matter Experts

The feasibility analysis of the JAGAR Android application was conducted using an assessment rubric, with scores provided by three media experts and three subject matter experts. Based on the evaluations, the overall average rating from media and subject matter experts was

4.28, categorized as highly feasible. This confirms that the JAGAR Android application is valid and highly suitable for improving students' learning outcomes in technical drawing. The validation results indicate that only minor revisions were necessary, and no major restructuring was required, confirming its suitability as a learning medium for technical drawing courses.

Practicality Testing

The primary objective of analyzing student and teacher feedback through questionnaires was to assess the practicality of the JAGAR application. Based on the data analysis, the reproducibility coefficient (Kr) was 0.9, indicating that the developed JAGAR application is highly practical, meeting the practicality requirement of 0.9. This finding was further supported by the scalability test, which showed a scalability coefficient (Ks) of 0.73, exceeding the required minimum threshold of 0.60.

According to the feedback from teachers and students, 90% of users rated the application positively, as their average response scores fell within the 75% to 100% range, classifying the JAGAR application as highly practical. Based on these results, the JAGAR Android-based interactive learning media can be effectively used as a teaching tool for technical drawing courses.

Effectiveness Testing

N-Gain Test

Based on the results of the N-Gain score test, the average N-Gain score for the experimental class was 73.71 or 73%, with a minimum N-Gain score of 44% and a maximum N-Gain score of 91%. Meanwhile, for the control class, the average N-Gain score was 44.51 or 44%, with a minimum score of 20% and a maximum score of 74%.

Based on the interpretation of N-Gain effectiveness, the Gain score for the experimental class was 73%, leading to the conclusion that the implementation of the JAGAR Android application is quite effective in improving learning outcomes in Technical Drawing for Grade XI KGSP 2 students at SMK Negeri 7 Semarang in the 2024/2025 academic year.

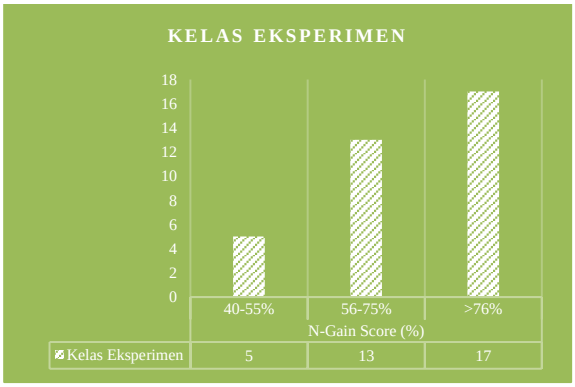

Figure 2. Bar Chart of N-Gain for the Experimental Class

Meanwhile, the use of the conventional method, based on the N-Gain effectiveness interpretation, resulted in a Gain score of 44%. This leads to the conclusion that the conventional method is less effective in improving learning outcomes in Technical Drawing for Grade XI KGSP 1 students at SMK Negeri 7 Semarang in the 2024/2025 academic year.

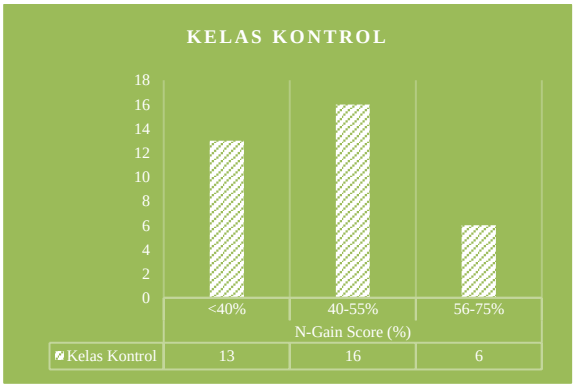

Figure 3. Bar Chart of N-Gain for the Control Class

T-Test Analysis

Table 1. T-Test Results for the Control and Experimental Classes

Data	Levene Statistic	T test	Significance Level
N-Gain_Percent	0.871	9.278	0.000

From the table, the significance value (Sig) in Levene's Test for Equality of Variances is 0.871, which is greater than 0.05. This indicates that the variance in N-Gain scores between the experimental and control groups is homogeneous.

Based on the analysis, the calculated t-value (9.278) is greater than the critical t-value (1.68957) at a significance level of 5% (df = 35). This suggests that before the JAGAR Android application was implemented, there was no significant difference between the experimental and control groups. However, after its application, the experimental class (Grade XI KGSP 2) demonstrated a statistically significant improvement in learning outcomes for single-story house plan drawing in technical drawing courses.

Evaluation

The final stage of this research and development study is the evaluation phase, where improvements are made to optimize the system further. This process involves analyzing the data collected from previous phases of the ADDIE model. The evaluation phase is conducted after the completion of the four preceding stages.

a. Formative Evaluation

The purpose of the formative evaluation is to assess the feasibility of the developed media and analyze its effectiveness in practical applications. Additionally, this evaluation aims to identify potential obstacles encountered during implementation. By understanding these challenges, early corrective measures can be taken to enhance the study's outcomes (Finlayson and Scriven, 1967). The formative evaluation focuses on reviewing the development of the JAGAR application and refining the assessment instruments used to evaluate its effectiveness. This process ensures that the learning objectives are met and that necessary improvements are made to the JAGAR application.

b. Summative Evaluation

The summative evaluation is designed to measure the overall effectiveness of the JAGAR application in improving student learning outcomes. This process determines how well the application contributes to student performance in single-story house plan drawing. The findings from the summative evaluation serve as a basis for deciding whether to continue, discontinue, or further develop the study for future research phases.

DISCUSSION

The final outcome of this development research is an interactive learning media in the form of the JAGAR Android application, which was developed gradually to produce an Android-based interactive learning media product. To ensure its feasibility, a series of validations were conducted by media experts, subject matter experts, users, and an effectiveness assessment. The validation process for media and subject matter experts was carried out directly in the field to obtain data for product revision through questionnaires adapted from the BNSP validated instrument.

One of the learning media variations that teachers can use to facilitate learning is Android-based learning media. JAGAR is an application that students can access online via smartphones. The JAGAR Android application can be used as learning material for students both individually and in groups. The JAGAR Android application is practical and can increase students enthusiasm and interest in learning technical drawing. By using Android-based learning applications, students will not feel that their learning media is unattractive or monotonous, which can diminish their interest in learning (Haryoko Purnama, 2013:59).

As technology continues to develop rapidly, the JAGAR Android application developed in this study will be very helpful in learning. The use of interactive multimedia-based learning media is one of the solutions to help students understand learning materials well. This is in line with the research conducted by Tasya Kurrahmah Fitria (2021) and Laili Nur Faizah (2021), which showed that there is a positive effect of using interactive learning media on student motivation and academic achievement at MAN 1 Cilacap. Sutopo and Kusumawardani (2024) state that (1) job sheets are feasible and practical for use in practical learning, (2) job sheets effectively improve cognitive, affective, and psychomotor aspects in basic culinary skills, and (3) job sheets contribute to the achievement of basic culinary competencies.

The feasibility study of the JAGAR Android application was based on assessment sheets completed by media experts with at least a bachelor's degree, as well as practicality tests

conducted among users, including Grade XI KGSP students and teachers at SMK Negeri 7 Semarang. The effectiveness of the JAGAR Android application was also evaluated. The aspects examined in this study included content validity, which refers to the alignment between presented concepts and relevant theories, as well as item validity, which assesses the accuracy of transforming theoretical concepts into operational forms (Drost, 2011). The validity of a developmental research product can be determined based on validation results (Azwar, 2014).

The development of the Android-based interactive media framework was guided by the Institute for Learning Development and Quality Assurance standards. The interactive media consists of three main components: the initial interface, content, and summary section. The initial interface includes the cover, credits, learning objectives, and expected competencies. The selection of materials was based on the curriculum and applicable ATP at SMK Negeri 7 Semarang, as well as existing modules and job sheets. The validation process concluded that the JAGAR Android application is a final product that is highly suitable for students to enhance learning outcomes in technical drawing.

The validation results of the JAGAR Android application, derived from assessments by three media experts and three subject matter experts, indicate that the appearance criteria received a score of 4.21 (highly feasible), while the programming criteria received a score of 4.28 (highly feasible). After averaging the scores, the overall validation score from media experts was 4.24, classified as highly feasible. Subject matter expert validation results for content criteria yielded a score of 4.11 (feasible), while the presentation criteria received a score of 4.50 (highly feasible). The overall average score for all aspects in the subject matter expert validation was 4.30, classified as highly feasible. Based on the development and validation process conducted by experts, the JAGAR application is deemed suitable for use as a learning medium in technical drawing courses.

The JAGAR application provides a learning experience that differs from conventional teaching methods, allowing students to learn anytime and anywhere. The material and exercises become more engaging with the inclusion of video tutorials and quizzes, which increase student engagement. The JAGAR application was also developed following BNSP's instructional media development standards.

According to Qudus et al. (2024), a questionnaire-based study found that 68% of students considered the video tutorial on Ticasbacc manufacturing highly feasible, while 32% rated it as feasible. The N-Gain test results showed that the experimental class experienced a 78% increase in learning outcomes, while the control class improved by 43%. This indicates that the Ticasbacc video tutorial was highly effective in improving student learning outcomes in the Fantasy Makeup course.

Akker et al. (1999) emphasize that one of the objectives of developmental research is to promote both theoretical and practical advancements in the final product. Learning media serve as tools or instructional components that stimulate student learning within their environment (Sudjana, 2005:205). Learning media can be understood as any planned resource that conveys or delivers messages from a source to create a conducive learning environment where learners engage in an efficient and effective learning process (Gagne and Briggs in Azhar Arsyad, 2014:4). Based on this explanation, the practicality test of the JAGAR Android application was conducted among teachers and students in Grade XI of the Building Construction, Sanitation, and Maintenance Program at SMK Negeri 7 Semarang.

Devi and Wijaya (2017) found that a feasibility analysis of job sheets indicated that the validation score from experts was 95.51%, classifying the job sheets as highly feasible. Empirical testing revealed that the job sheets improved student competency from 33.33% to 80.56%. Based on data analysis, it was concluded that performance-based job sheets are feasible for improving student competencies and are recommended as instructional tools to support practical activities.

Practicality refers to the ease of access and use of learning modules by teachers and students, ensuring that learning is meaningful, engaging, and beneficial to students lives while fostering

innovation (Alfiriani and Hutabri, 2017). The user validation phase involved teachers and students, during which the software engineering indicator received a score of 91% (highly practical), the visual communication indicator received a score of 90% (highly practical), and the instructional design indicator received a score of 90% (highly practical). The overall user validation score was 90%, classifying the application as highly practical.

The JAGAR application was developed with a strong emphasis on practicality, ensuring ease of use for both teachers and students. Through this application, students are not merely passive listeners in a classroom but can also watch demonstrations, read materials, engage in exercises, and interact with teachers and peers. In addition to enhancing motivation and interest, the JAGAR application helps students improve comprehension, present data in an engaging and reliable manner, facilitate data interpretation, and condense information. Teachers and students benefit from the flexibility provided by this application, as learning is no longer restricted to the classroom. Instead, students can study independently whenever and wherever needed, ensuring continuity even when in-person classes are disrupted due to unforeseen circumstances.

The primary objective of learning with the JAGAR Android application is to enhance learning outcomes in technical drawing, specifically in single-story house plan drafting. The effectiveness of the JAGAR Android application aligns with its development goal, which is to improve student competencies in technical drawing. The data analysis indicates that the JAGAR Android application is both effective and significant in technical drawing instruction. The success achieved by students provides satisfaction to teachers, affirming their role in delivering quality education.

The normality test aims to determine whether the data follows a normal distribution. The results of this test influence the type of statistical analysis used. The normality test can be calculated using the Shapiro-Wilk formula with the assistance of SPSS Statistics 26. The normality test results for the pre-test and post-test showed values greater than 0.05 for both knowledge and skills assessments, indicating that the data is normally distributed.

Meanwhile, the homogeneity test was conducted to determine whether the two groups had equal variance. The homogeneity test, also performed using SPSS 26, yielded values greater than 0.05 for both knowledge and skills assessments. This result indicates that the pre-test and post-test data were homogeneous, meaning both groups had similar variance before the intervention.

Below is a graph illustrating the differences in the average pre-test and post-test scores between the experimental and control classes.

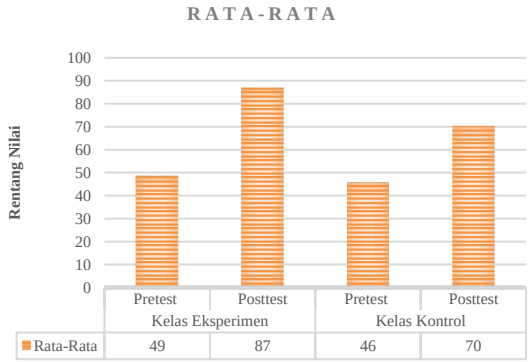

Figure 4. Graph of the Average Pre Test and Post Test Scores for the Experimental and Control Classes

The JAGAR interactive learning media can be used by Grade XI KGSP students at SMK Negeri 7 Semarang in the Technical Drawing course, classified as highly feasible, highly practical, sufficiently effective, and significantly beneficial for improving learning outcomes in technical drawing. The findings of this study align with the research conducted by Tiara Lestari (2021), Lisma Rinza (2021), Marwanti Armas (2021), Firda Fina Fitriya and Siti Faizah (2021), Salman Alfarizi and Aditya Prapanca (2020), Hendrik Purnama and Ahmad Roziqin (2020), Agus Ramdani, A Wahab Jufri and Jamaluddin (2020), Rizma Panca Patriani and Indrati Kusumaningrum (2020), which state that interactive learning media can significantly enhance students theoretical knowledge and practical skills.

The implications of this research encountered by the researcher during the field trial implementation were related to the

installation process of the application on students smartphones. Due to differences in individual smartphone settings, a significant amount of time was spent on troubleshooting. Therefore, the researcher recommends that before face to face sessions, students should be provided with the learning media in advance. For example, students should be required to install the application on their smartphones before the scheduled learning session begins.

CONCLUSION

Based on the findings and discussion presented in the previous chapters, the following conclusions can be drawn:

1. The JAGAR application was developed using Kodular as an assembly and programming tool for its integrated features. The JAGAR application consists of six features: Learning, Quiz, Module, Video, Practice, and Test, which provide instructional materials in the form of modules, instructional videos, job sheets, practice questions, drawing exercises, and tests. The development of these features utilized Bandicam, Google Forms, and AutoCAD software.
2. The feasibility test analysis of the JAGAR Android application was conducted using an assessment sheet, with evaluations provided by three media experts and three subject matter experts. The results showed an overall average rating of 4.28, which falls under the highly feasible category. Therefore, the JAGAR Android application is valid and highly suitable for enhancing learning outcomes in technical drawing. Based on these validation results, it can be concluded that JAGAR is valid with minor revisions and does not require significant restructuring, making it suitable as an instructional medium for technical drawing courses.
3. The practicality test was conducted by gathering user feedback during the development phase. The practicality test instrument was distributed to four vocational teachers in the Building Construction, Sanitation, and Maintenance Program and 35 students from Grade XI KGSP 2 at SMK Negeri 7 Semarang. The results showed an overall user response of 90%, with an average user rating between 75% and 100%, indicating that the JAGAR Android application is highly practical. This confirms that the JAGAR Android-based interactive learning media is a suitable instructional tool for technical drawing courses.
4. Based on the N-Gain analysis, the effectiveness assessment showed that the experimental class achieved a Gain score of 73%. This indicates that the JAGAR Android application is moderately effective in improving the learning outcomes of Grade XI KGSP 2 students in technical drawing at SMK Negeri 7 Semarang for the 2024/2025 academic year. In contrast, the conventional method resulted in a lower Gain score of only 44% in the control class, suggesting that traditional teaching approaches are less effective in enhancing students understanding of single-story house plan drawing in technical drawing courses, particularly for Grade XI KGSP 1 students at SMK Negeri 7 Semarang in the 2024/2025 academic year.

The results of the independent sample t-test showed that the calculated t-value (9.278) exceeded the critical t-value (1.68957) at a significance level of 5% (df = 35). Since the calculated t-value is greater than the critical t-value, it can be concluded that before the implementation of the JAGAR Android application, there was no significant difference between Grade XI KGSP 1 and Grade XI KGSP 2 at SMK Negeri 7 Semarang. However, after the JAGAR application was introduced to Grade XI KGSP 2 as the experimental class, it was proven to be moderately effective and statistically significant in improving learning outcomes in technical drawing competency.

REFERENCES

Alfiriani, A., & Hutabri, E. (2017). Practicality and Effectiviness of Bilingual Computer-Based Learning Module. Jurnal

Kependidikan: Penelitian Inovasi Pembelajaran, 1(1), 12-23.

Arsyad, A. (2014). *Media Pembelajaran*. Jakarta. PT Raja Grafindo Persada.

Azwar, S. 2014. Metode Penelitian. Yogyakarta: Pustaka Pelajar.

Devi, P. L., & Wijaya, M. B. R. Suwahyo.(2017). Pengembangan Perangkat Pembelajaran Jobsheet berbasis Performance Assessment untuk Meningkatkan Kompetensi Conventional Engine Tune Up.

Fina Fitriya, F., & Faizah, S. (2021). Pengembangan Media Pembelajaran Matematika Berbasis *Android* pada Materi Trigonometri. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *1*(2), 104–114.

Grant, M.M. 2002. Getting A Grip of Project Based Learning : Theory, Cases and Recomandation. North Carolina : Meredian A Middle School Computer Technologies. Journal Vol. 5

Mayasari, L. E. M. L. E., Qudus, N., Wahyuningsih, S. E., & Krisnawati, M. (2024). Pengembangan Video Tutorial Pembuatan Ticasbacc (Plastic Waste Based Accessories) sebagai Media Pembelajaran Mata Kuliah Rias Fantasi untuk Meningkatkan Hasil Belajar Mahasiswa. *Beauty and Beauty Health Education*, *13*(2), 57-68.

Purnama, H., & Roziqin, A. (2020). Pengembangan media pembelajaran interaktif berbasis aplikasi *android* untuk meningkatkan pemahaman peserta didik pada kompetensi dasar sistem pengapian elektronik. *Automotive Science and Education Journal*, *9*(2), 1–5.

Qumillaila, Q., Susanti, B. H., & Zulfiani, Z. (2017). Pengembangan Augmented Reality Versi *Android* Sebagai Media Pembelajaran Sistem Ekskresi Manusia. *Jurnal Cakrawala Pendidikan*, *36*(1), 57–69. https://doi.org/10.21831/cp.v36i1.9786

Satria, A. (2023). Pengembangan Media Pembelajaran Audio Visual Adobe Flash Pada Pembelajaran Cara Perawatan Anti-Lock Brake System. Jurnal Penelitian Pendidikan Indonesia, 8(1), 6-14.

Sudjana, N. (2005). *Dasar-Dasar Belajar Mengajar*. Bandung. Sinar Baru.

Sutopo, Y., & Kusumawardani, R. (2024). Development and Implementation of Jobsheets for Enhancing Basic Culinary Competence. *Journal of Vocational and Career Education*, *9*(1).

Waty, L. P., & Fourianalistyawati, E. (2018). Dinamika Kecanduan Telepon Pintar (Smartphone) Pada Remaja Dan Trait Mindfulness Sebagai Alternatif Solusi. *Seurune : Jurnal Psikologi Unsyiah*, *1*(2), 84–101. https://doi.org/10.24815/s-jpu.v1i2.11573

Widoyoko, E. P. (2012). *Teknik Penyusunan Instrumen Penelitian* (Vol. 15, Issue 1). Yogyakarta. Pustaka Pelajar.