E-ISSN: 2775-7854
Jurnal Inovasi, Evaluasi, dan Pengembangan Pembelajaran (JIEPP)
Volume 6, Issue 1, April 2026, pp 28-37
https://doi.org/10.54371/jiepp.v6i1.1216

Development of Articulate Storyline-Based Interactive Learning Media to Improve Vocational High School Students' Learning Outcomes in Basic Accounting Equations

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Article History: Submission: 2025-10-18 || Accepted: 2026-03-27 || Published: 2026-04-10

Abstract

This study aims to develop interactive learning media based on Articulate Storyline for the topic of Basic Accounting Equations, evaluate its feasibility, and examine its effectiveness in improving students' learning outcomes. The study employed a Research and Development (R&D) method using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation stages. The effectiveness test was conducted using a quasi-experimental pretest–posttest control group design involving tenth-grade students of Accounting and Institutional Finance (AKL) at SMK Negeri 4 Surabaya, consisting of 30 students in the experimental group and 30 students in the control group. Data were collected through expert validation sheets, student response questionnaires, and learning outcome tests. Feasibility data were analyzed descriptively using percentage techniques, while learning outcome data were analyzed using normality tests, homogeneity tests, independent samples t-test, N-gain, and effect size. The results showed that the developed media achieved validation scores of 92% from material experts, 90% from language experts, and 96% from media/graphics experts, all categorized as highly feasible. The effectiveness test revealed that the experimental group achieved a higher mean posttest score than the control group, with a statistically significant difference between the two groups. The N-gain value of the experimental group was also higher and supported by a large effect size. In addition, students responded very positively to the use of the media. Therefore, the Articulate Storyline-based interactive learning media is considered highly feasible and effective in supporting the learning of Basic Accounting Equations.

Keywords: *Articulate Storyline, Interactive learning media, Accounting education, Learning outcomes, Vocational high school.*

I. INTRODUCTION

The rapid advancement of information and communication technology (ICT) has significantly transformed educational practices across all levels of schooling. In contemporary educational contexts, technology is no longer perceived merely as a complementary tool but as a fundamental component in shaping innovative, flexible, and student-centered learning environments. The integration of digital technology into instructional processes enables educators to design learning experiences that are more interactive, adaptive, and meaningful, thereby supporting students in constructing knowledge actively rather than passively receiving information. As emphasized by Amutha (2020), technology integration plays a crucial role in fostering active engagement and deeper learning, particularly when instructional media are designed to align with students' cognitive needs and learning characteristics.

In line with the implementation of the *Kurikulum Merdeka* in Indonesia, the orientation of learning has shifted toward student-centered approaches that emphasize autonomy, critical thinking, and meaningful learning experiences. This curriculum encourages educators to design learning processes that facilitate exploration, interaction, and conceptual understanding. However, despite these policy-level transformations, classroom practices often remain dominated by conventional teaching methods, particularly in subjects that are perceived as complex and abstract. One such subject is accounting, especially the topic of Basic Accounting Equations, which forms the foundational framework for understanding financial transactions and reporting.

Basic Accounting Equations represent a fundamental concept that underlies all accounting processes, encompassing the relationship between assets, liabilities, and equity. Mastery of this concept is essential, as it serves as the basis for subsequent topics such as journal entries, ledger preparation, and financial statement analysis. However, due to its abstract nature, students often

struggle to understand how transactions affect different accounts and maintain the balance of the accounting equation. Traditional teaching methods that rely heavily on verbal explanations and static representations, such as textbooks and PowerPoint slides, are often insufficient to support students in visualizing these relationships in a meaningful way. Consequently, students tend to memorize formulas without fully understanding the underlying concepts, which leads to difficulties in applying knowledge in more complex contexts.

Empirical evidence from classroom observations at SMK Negeri 4 Surabaya highlights these challenges. Although the school has adopted digital devices such as smartphones and laptops as part of its learning infrastructure, their utilization in accounting instruction remains suboptimal. Teaching practices are still largely dependent on conventional media, which limits opportunities for interactive engagement and independent learning. As a result, students exhibit low levels of participation, limited conceptual understanding, and difficulties in connecting theoretical knowledge with practical applications. This gap between available technological resources and their effective pedagogical use underscores the need for the development of innovative instructional media tailored to the specific demands of accounting education.

Theoretically, the need for interactive learning media can be explained through constructivist learning theory, which posits that knowledge is actively constructed through interaction, experience, and reflection (Piaget, 1972; Vygotsky, 1978). In this perspective, learning occurs most effectively when students engage in activities that allow them to manipulate information, explore relationships, and construct meaning based on prior knowledge. In addition, Mayer's Cognitive Theory of Multimedia Learning (2009) suggests that well-designed multimedia environments can enhance learning by integrating verbal and visual information, thereby reducing cognitive load and facilitating deeper understanding. These theoretical frameworks highlight the importance of designing instructional media that are interactive, multimodal, and aligned with students' cognitive processes.

Interactive learning media have been widely recognized as an effective tool for enhancing student engagement and learning outcomes. According to Harsiwi and Arini (2020), interactive media can increase students' motivation, improve conceptual understanding, and promote active participation in the learning process. Unlike traditional instructional methods, interactive media allow students to engage with content dynamically, receive immediate feedback, and learn at their own pace. This is particularly important in subjects such as accounting, where understanding is built through step-by-step processes and the ability to visualize relationships between concepts. One of the emerging platforms for developing interactive learning media is Articulate Storyline. This authoring tool enables educators to create multimedia-based instructional materials that integrate text, images, animations, audio, video, quizzes, and interactive simulations within a single digital environment. Previous studies have demonstrated the effectiveness of Articulate Storyline in enhancing learning outcomes across various disciplines. For instance, Daryanes (2023) found that Storyline-based media improved student engagement and comprehension through interactive features and immediate feedback. Similarly, Kamilah and Susanti (2022) reported that the use of Articulate Storyline facilitated more structured and engaging learning experiences, while Rizaluddin (2025) highlighted its effectiveness in supporting self-paced and independent learning.

Despite these promising findings, the existing body of research remains relatively general and has not specifically addressed the development of Articulate Storyline-based media for Basic Accounting Equations in vocational high school settings. In particular, there is a lack of studies that focus on how interactive media can support students in understanding the dynamic relationships between accounts and maintaining the balance of accounting equations. This gap indicates the need for research that not only develops such media but also evaluates its feasibility and effectiveness in real classroom contexts.

From a pedagogical perspective, the integration of interactive media with systematic instructional design models, such as ADDIE (Analysis, Design, Development, Implementation, and Evaluation), provides a structured framework for developing high-quality learning materials. The ADDIE model ensures that instructional media are developed based on learners' needs, aligned with learning objectives, and evaluated for effectiveness. This systematic approach is particularly important in ensuring that the developed media are not only visually appealing but also

pedagogically sound and effective in improving learning outcomes. In the context of Basic Accounting Equations, Articulate Storyline-based interactive media offer several advantages. The platform allows for the development of transaction simulations that enable students to observe how each transaction affects different accounts in real time. It also supports step-by-step exercises that guide students in applying concepts systematically, as well as interactive quizzes that provide immediate feedback. These features help reduce the abstract nature of accounting concepts and facilitate experiential learning, where students learn through active engagement and practice.

Furthermore, interactive media can support the development of higher-order thinking skills by encouraging students to analyze, evaluate, and apply knowledge in different contexts. Through simulation-based activities, students can explore various scenarios, test their understanding, and learn from their mistakes. This aligns with the goals of the *Kurikulum Merdeka*, which emphasizes the development of critical thinking, problem-solving, and independent learning skills. Based on the aforementioned considerations, there is a clear need to develop and evaluate interactive learning media that can effectively support the teaching of Basic Accounting Equations in vocational high schools. Therefore, this study aims to develop interactive learning media based on Articulate Storyline for Grade X Accounting and Institutional Finance (AKL) students at SMK Negeri 4 Surabaya, to assess the feasibility of the developed media through expert validation and student responses, and to examine its effectiveness in improving students' learning outcomes.

This study is expected to contribute both theoretically and practically. Theoretically, it provides insights into the role of interactive multimedia in supporting conceptual understanding in accounting education. Practically, it offers an innovative instructional solution that aligns with the demands of the *Kurikulum Merdeka* and addresses the challenges of teaching abstract accounting concepts. Ultimately, the findings of this study are expected to support the development of more effective, engaging, and meaningful learning experiences in vocational education.

II. METHOD

This study employed a Research and Development (R&D) method using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The study aimed to develop interactive learning media based on Articulate Storyline for the topic of Basic Accounting Equations for Grade X students in the Accounting and Institutional Finance (AKL) program at SMK Negeri 4 Surabaya. The ADDIE model was selected due to its systematic nature in guiding the development, revision, and evaluation of instructional products. In this study, the development process was integrated with a limited effectiveness test to ensure that the product was not only feasible but also capable of improving students' learning outcomes.

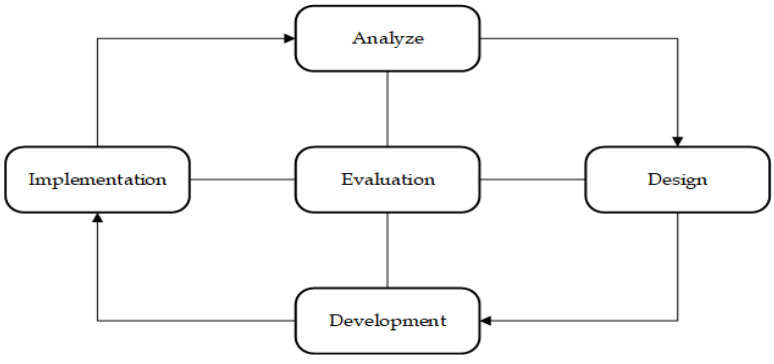


Figure 1. R&D Development Model (ADDIE)

In the analysis stage, the researcher conducted interviews with teachers and analyzed instructional documents to identify learning needs, student characteristics, and challenges in teaching Basic Accounting Equations. The design stage involved organizing the learning content, developing navigation flow, and designing interactive features of the media. The development stage included creating the initial product, validating it through three experts—material experts, language experts, and media/graphics experts—and revising the product based on their feedback. The implementation stage involved conducting a limited trial in two groups: an experimental class

that used the interactive media and a control class that received conventional instruction. The evaluation stage was carried out both formatively during the development process and summatively by analyzing students' learning outcomes after the intervention.

The effectiveness test employed a quasi-experimental pretest–posttest control group design. The research subjects consisted of two Grade X AKL classes, with 30 students in the experimental group and 30 students in the control group. Data were collected through expert validation sheets, student response questionnaires, and learning outcome tests. The validation sheets were used to assess the content, language, and graphical aspects of the media, while the questionnaire was used to measure students' responses and the practicality of the media. The learning outcome test was administered before and after instruction to measure students' mastery of the material.

The expert validation data and student responses were analyzed descriptively using percentage techniques based on feasibility criteria proposed by Riduwan (2019). Meanwhile, learning outcome data were analyzed using both descriptive and inferential statistics. Prior to hypothesis testing, the data were examined using normality and homogeneity tests. Differences in learning outcomes between the experimental and control groups were analyzed using an independent samples t-test, while the improvement in learning outcomes was measured using N-Gain and further supported by effect size (Cohen's d).

III. RESULTS AND DISCUSSION

A. Results

This study employed the ADDIE development model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The analysis stage serves as the initial phase to identify learning needs and problems prior to product development. At this stage, the researcher conducted several activities, including interviews with the accounting teacher, document analysis of lesson plans and syllabi, and classroom observations of Grade X AKL students at SMK Negeri 4 Surabaya. The results of the analysis revealed that accounting instruction was still dominated by lecture-based methods and the use of textbooks as the primary learning resources. In addition, there was no digital learning media available to support the instructional process. The teacher also acknowledged that students experienced difficulties in understanding the concept of Basic Accounting Equations.

Table 1. Learning Problems and Needs Analysis

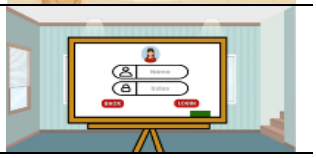
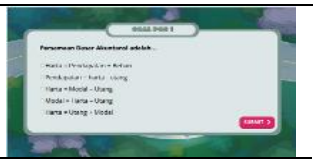
Aspect	Identified Problems	Learning Needs
Teaching Method	Dominance of lectures and passive learning	Interactive media that supports active and independent learning
Student Characteristics	Difficulty understanding material and low motivation	Engaging, contextual, and case-based learning
Learning Media	No technology-based or online learning media available	Web-based digital media that is accessible and supports flexible learning
Teacher's Role	Teacher-centered approach	Student-centered learning model

Based on these findings, it can be concluded that there is a need for innovative, accessible, and technology-based learning media. Therefore, the researcher developed interactive learning media based on Articulate Storyline to address these needs and support the implementation of the Kurikulum Merdeka. In the next stage, namely the design stage, the researcher began organizing and designing the structure of the interactive learning media based on the results of the needs analysis. The initial design included the organization of learning materials and the planning of key menu features. Articulate Storyline was selected due to its responsive nature, ease of access, and capability to support interactive multimedia learning environments.

The developed media integrates not only textual content but also images, videos, external links, and interactive components. The structure of the media was designed to facilitate students' understanding of Basic Accounting Equations through a contextual learning approach. The design emphasized principles of interactivity, readability, and ease of navigation. The components of the interactive learning media include general description, introduction, learning

materials, games, evaluation, user instructions, and developer profile. Each section was designed to present concise yet meaningful content, supported by illustrations and simulations that help students better understand abstract accounting concepts.

Table 2. Learning Media Flow

No.	Page	Description	Media Display
1	Home Page	The initial page of the learning media displays the title "Marbelak," accompanied by animations and a Start button to begin the learning session.	
2	Login Page	This page presents a login form that must be completed by students, including fields for name and class.	
3	Main Menu Page	This page contains the main navigation menu, allowing users to explore various sections of the media, including general description, introduction, learning materials, games, and evaluation.	
4	Games Page	This section features an adventure-based game in which each stage contains questions that must be answered correctly in order to proceed to the next level.	
5	Evaluation Page	This page provides a set of questions designed to measure students' level of understanding after using the interactive learning media.	

The development of the interactive learning media based on Articulate Storyline was carried out systematically following the ADDIE model. The resulting product reflects the integration of instructional design principles, multimedia elements, and interactive features tailored to support students' understanding of Basic Accounting Equations. Before being implemented in the classroom, it is essential to ensure that the developed product meets established standards of quality and feasibility. Therefore, an expert validation process was conducted to evaluate the media from multiple perspectives, including content accuracy, language clarity, instructional quality, and graphical presentation.

The validation process involved three experts representing different domains: a material expert, a language expert, and a media/graphics expert. Each expert assessed the product using structured validation instruments designed to capture both the accuracy and appropriateness of the media. The results of this validation process provide a comprehensive overview of the product's readiness for classroom implementation. The detailed results of the expert validation are presented in Table 3.

Table 3. Expert Validation Results

No.	Aspect	Percentage	Category
1	Material Expert	92%	Highly Feasible
2	Language Expert	90%	Highly Feasible
3	Graphics Expert	96%	Highly Feasible
	Average	92%	Highly Feasible

The results presented in Table 3 indicate that the developed media achieved a high level of feasibility across all evaluated aspects. The material expert score of 92% confirms that the content is accurate, relevant, and aligned with learning objectives. The language expert score of 90% indicates that the instructional language is clear, appropriate, and understandable for students. Meanwhile, the graphics expert score of 96% reflects the high quality of visual design,

layout, and interactivity, which are crucial in supporting students' engagement and comprehension. The overall average score of 92% places the media in the "highly feasible" category, indicating that it meets the required standards for implementation. These findings suggest that the developed media is not only technically sound but also pedagogically appropriate for supporting learning in vocational education. Consequently, the product was deemed suitable for further implementation and effectiveness testing in real classroom settings.

Following the validation stage, the implementation phase was conducted to examine how the developed media performs in actual learning environments. The trial was carried out with Grade X AKL students, focusing on their interaction with the media, level of engagement, and overall learning experience. This stage is critical in determining not only the usability of the product but also its acceptance among students as end users. The implementation process was structured to simulate real classroom conditions, beginning with an introduction to the learning objectives, followed by guided use of the interactive media, and concluding with evaluation activities. During this process, students were actively involved in exploring the content, completing exercises, and interacting with multimedia elements embedded in the media.

The evaluation stage combined both formative and summative approaches. Formative evaluation occurred during development and implementation through expert feedback and observation, while summative evaluation focused on analyzing learning outcomes and student responses. To assess the effectiveness of the media, a quasi-experimental design was employed, and the results are presented in the following tables.

Table 4. Descriptive Statistics of Learning Outcomes

Group	N	Pretest Mean	SD	Posttest Mean	SD	Gain Mean
Experimental	30	56.40	8.72	84.13	6.95	27.73
Control	30	55.87	8.15	74.20	7.84	18.33

Table 4 presents the descriptive statistics of students' learning outcomes in both the experimental and control groups. The results show that both groups had relatively similar pretest mean scores (56.40 and 55.87), indicating comparable initial abilities. However, after the intervention, the experimental group achieved a significantly higher posttest mean (84.13) compared to the control group (74.20). The gain mean also reveals a notable difference, with the experimental group achieving a higher improvement (27.73) than the control group (18.33). This indicates that the use of Articulate Storyline-based interactive media contributed to a more substantial increase in students' learning outcomes. These descriptive findings provide an initial indication of the effectiveness of the developed media, which is further confirmed through inferential statistical analysis.

Table 5. Independent Samples t-test Results

Variable	t	df	Sig. (2-tailed)	Mean Difference	Interpretation
Pretest	0.243	58	0.809	0.53	Not significantly different
Posttest	5.191	58	0.000	9.93	Significantly different

The results of the independent samples t-test presented in Table 5 provide statistical confirmation of the observed differences. The pretest results show no significant difference between groups ($p = 0.809 > 0.05$), indicating that both groups started from a similar baseline. This strengthens the validity of the experimental comparison. In contrast, the posttest results reveal a significant difference ($p = 0.000 < 0.05$), with a mean difference of 9.93 points. This confirms that the interactive learning media had a statistically significant impact on improving students' learning outcomes. The findings demonstrate that the intervention not only enhances learning but does so in a measurable and reliable manner.

Table 6. N-Gain Results

Group	Mean N-Gain	Category
Experimental	0.64	Moderate
Control	0.41	Moderate

The N-Gain analysis presented in Table 6 further illustrates the level of improvement in students' learning outcomes. Although both groups fall within the moderate category, the experimental group achieved a higher N-Gain value (0.64) compared to the control group (0.41). This indicates that the learning gains in the experimental group were more substantial, reflecting the effectiveness of the interactive media in facilitating conceptual understanding.

Table 7. Effect Size (Cohen's d)

Comparison	Cohen's d	Interpretation
Experimental vs Control	1.34	Large Effect

Finally, the effect size analysis presented in Table 7 provides additional insight into the practical significance of the findings. The Cohen's d value of 1.34 indicates a large effect size, suggesting that the impact of the interactive media is not only statistically significant but also practically meaningful. This result highlights that the developed media has a strong influence on students' learning outcomes, making it a highly effective instructional tool. Overall, the combination of descriptive, inferential, and effect size analyses confirms that the Articulate Storyline-based interactive learning media is both feasible and effective in improving students' understanding of Basic Accounting Equations.

B. Discussion

The findings of this study demonstrate that the Articulate Storyline-based interactive learning media developed through the ADDIE model possesses a very high level of feasibility, as evidenced by expert validation results. The validation scores obtained from the material expert (92%), language expert (90%), and media/graphics expert (96%) all fall within the "highly feasible" category. These results indicate that the developed media has met essential quality standards in terms of content accuracy, linguistic clarity, instructional structure, and visual design. From an instructional design perspective, this confirms that the development process successfully aligned learning objectives, content organization, and delivery methods, ensuring that the media is both pedagogically sound and technically appropriate for classroom use.

The high feasibility of the developed media can be understood in relation to the nature of the Basic Accounting Equations topic, which is inherently abstract and requires a strong conceptual foundation. Students are expected to understand not only the components of assets, liabilities, and equity but also the dynamic relationships among them as financial transactions occur. Without appropriate instructional support, these concepts are often perceived as complex and difficult to internalize. Therefore, the use of interactive media that visually represents these relationships plays a crucial role in facilitating conceptual understanding. This finding is consistent with prior studies by Rahmadani and Mursid (2021) and Reeve and Gallimore (2020), which emphasize that accounting concepts require visual and interactive representations to enhance comprehension.

From the perspective of cognitive learning theory, the effectiveness of such media can be explained through Mayer's Cognitive Theory of Multimedia Learning (2009), which posits that meaningful learning occurs when learners are able to integrate verbal and visual information through well-designed multimedia environments. In this study, the use of animations, diagrams, and interactive simulations in the Articulate Storyline media likely contributed to reducing cognitive load and supporting the dual processing of information. As a result, students were better able to construct mental models of accounting relationships, rather than relying solely on memorization.

In addition to content and instructional quality, the graphical and interactive aspects of the media also played a significant role in its feasibility. The high score from the media/graphics expert (96%) reflects the effectiveness of visual design elements such as layout, color composition, navigation, and interactivity. These elements are not merely aesthetic but serve important pedagogical functions by guiding attention, enhancing engagement, and facilitating information processing. Previous research by Daryanes (2023), Sapitri and Bentri (2021), and Adawi and Eviyanti (2022) supports this finding, indicating that Articulate Storyline is an effective platform for developing engaging and structured digital learning media. Another

important finding of this study is the highly positive response from students, with a percentage of 99.13%. This result suggests that the developed media is not only usable but also highly accepted by learners. Students reported that the media was easy to use, visually appealing, and helpful in understanding the material. This aligns with the concept of usability and user experience in educational technology, where effective media should be intuitive, engaging, and supportive of learning goals.

The positive student response can also be interpreted as an indicator of increased motivation and engagement during the learning process. According to Harsiwi and Arini (2020) and Wulandari (2020), interactive learning media can enhance students' interest, participation, and overall learning experience. In the present study, the inclusion of interactive elements such as quizzes, simulations, and immediate feedback likely contributed to maintaining students' attention and encouraging active participation. This is particularly important in vocational education, where learning is expected to be practical, contextual, and closely related to real-world applications. From the perspective of effectiveness, the results of this study provide strong evidence that the developed media significantly improves students' learning outcomes. The experimental group achieved a higher mean posttest score compared to the control group, supported by a statistically significant difference, higher N-Gain values, and a large effect size. These findings indicate that the use of Articulate Storyline-based media not only enhances learning outcomes but does so with a substantial level of practical impact.

The N-Gain results show that the experimental group achieved a higher level of learning improvement compared to the control group, indicating that the media effectively facilitates conceptual understanding. Meanwhile, the effect size value in the large category suggests that the observed differences are not only statistically significant but also meaningful in real educational contexts. This reinforces the argument that interactive media can serve as a powerful instructional tool, particularly when designed based on sound pedagogical principles. These findings are consistent with previous studies conducted by Rizaluddin (2025), Kamilah and Susanti (2022), and Daryanes (2023), which demonstrate that Articulate Storyline-based media can improve learning outcomes by providing interactive content, structured learning pathways, and immediate feedback. The ability of such media to combine multiple forms of representation—textual, visual, and interactive—enables students to engage with content more deeply and meaningfully.

From a constructivist perspective, the effectiveness of the developed media can also be explained by its ability to support active learning. According to Piaget (1972) and Vygotsky (1978), learning occurs when students actively construct knowledge through interaction and experience. In this study, students interacted with the media by exploring content, completing exercises, and receiving feedback, which likely facilitated the construction of knowledge and the development of understanding. This active engagement contrasts with conventional learning methods, which often position students as passive recipients of information. Furthermore, the interactive features of the media support the development of higher-order thinking skills. Students are not only required to recall information but also to analyze transactions, evaluate their impact on the accounting equation, and apply concepts in different scenarios. This aligns with the objectives of the *Kurikulum Merdeka*, which emphasizes critical thinking, problem-solving, and independent learning.

The integration of Articulate Storyline-based media into accounting instruction also addresses the limitations of conventional teaching methods. Traditional approaches that rely heavily on lectures and textbooks often fail to provide opportunities for active engagement and practical application. In contrast, interactive media offers a more dynamic learning environment where students can learn at their own pace, receive immediate feedback, and engage in repeated practice. This shift from passive to active learning is essential for improving both the quality of the learning process and its outcomes. Overall, the findings of this study confirm that Articulate Storyline-based interactive learning media is a highly feasible, well-accepted, and effective instructional solution for teaching Basic Accounting Equations in vocational high schools. The media not only enhances students' understanding of abstract concepts but also increases their motivation, engagement, and learning outcomes.

These findings have important implications for both theory and practice. Theoretically, the study contributes to the growing body of literature on the effectiveness of multimedia learning and interactive instructional design in vocational education. Practically, it provides educators with a viable alternative to conventional teaching methods, offering a tool that supports the implementation of student-centered learning in line with the *Kurikulum Merdeka*. In conclusion, the use of interactive learning media based on Articulate Storyline represents a promising approach to addressing the challenges of teaching abstract accounting concepts. By combining interactivity, multimedia elements, and systematic instructional design, such media can create meaningful learning experiences that support both conceptual understanding and skill development. Therefore, its adoption is strongly recommended as part of efforts to improve the quality of accounting education in vocational schools.

IV. CONCLUSION

Based on the findings of this study, the Articulate Storyline-based interactive learning media developed for the topic of Basic Accounting Equations for Grade X Accounting and Institutional Finance (AKL) students at SMK Negeri 4 Surabaya was successfully designed using the ADDIE model. The validation results indicate that the media achieved high feasibility, with scores of 92% from material experts, 90% from language experts, and 96% from media/graphics experts, all categorized as highly feasible. In addition, students' responses to the media were highly positive, reaching 99.13%, indicating that the media is easy to use, engaging, and supportive of the learning process. The effectiveness test further demonstrates that the use of Articulate Storyline-based interactive learning media results in better learning outcomes compared to conventional instruction. Therefore, it can be concluded that the developed media is both highly feasible and effective in supporting the learning of Basic Accounting Equations, and it can serve as an innovative instructional solution for enhancing learning quality in vocational education.

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