



DIGITAL INNOVATION IN AUTOMOTIVE EDUCATION : IMPROVING COLLABORATION SKILL OF STUDENT USING INTERACTIVE FLIPBOOK

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ABSTRACT

Students in the twenty-first century need to be able to work together effectively and be actively involved in their own education. Creating interactive learning material based on flipbooks is one way to bolster these abilities. The purpose of this research is to investigate how students' collaborative abilities are impacted by the use of flipbook media and to document their reactions to the created materials. The researchers in this study used a quasi experimental (group posstest design), which meant that only one set of students received the instructional materials (flipbooks) and the associated activities. An observation sheet for teamwork abilities and a questionnaire for student feedback made up the study tools. After using flipbook media, students cooperation abilities significantly improved, as shown by a significance value of $0.000 < 0.05$ in the comparative test on collaboration skills. In addition, the reliability test yielded a Cronbach's Alpha score of 0.846, reflecting strong reliability, and the validity test showed that all ten questionnaire questions had correlation coefficients higher than 0.361, proving that all items were valid. Evident from these results, the flipbook medium was well-received by the student. Thus, the created flipbook-based learning material is well-received and useful for improving students teamwork abilities and receives positive responses, making it suitable for use as an interactive learning medium in twenty-first century learning.

Keywords: *Flipbook, Collaboration Skills, Student Responses, Learning*

ABSTRAK

Siswa di abad ke-21 perlu mampu bekerja sama secara efektif dan terlibat aktif dalam pendidikan mereka sendiri. Membuat materi pembelajaran interaktif berbasis flipbook adalah salah satu cara untuk meningkatkan kemampuan ini. Tujuan penelitian ini adalah untuk menyelidiki bagaimana kemampuan kolaborasi siswa dipengaruhi oleh penggunaan media flipbook dan untuk mendokumentasikan reaksi mereka terhadap materi yang dibuat. Para peneliti dalam studi ini menggunakan desain kuasi eksperimental (desain posttest kelompok), yang berarti hanya satu kelompok siswa yang menerima materi pembelajaran (flipbook) dan aktivitas terkait. Lembar observasi untuk kemampuan kerja tim dan kuesioner untuk umpan balik siswa merupakan alat penelitian. Setelah menggunakan media flipbook, kemampuan kerja sama siswa meningkat secara signifikan, seperti yang ditunjukkan oleh nilai signifikansi $0,000 < 0,05$ dalam uji komparatif pada keterampilan kolaborasi. Selain itu, uji reliabilitas menghasilkan skor Alpha Cronbach sebesar 0,846, yang mencerminkan reliabilitas yang kuat, dan uji validitas menunjukkan bahwa semua sepuluh pertanyaan kuesioner memiliki koefisien korelasi lebih tinggi dari 0,361, membuktikan bahwa semua item valid. Terbukti dari hasil ini, media flipbook diterima dengan baik oleh siswa. Dengan demikian, materi pembelajaran berbasis flipbook yang dibuat diterima dengan baik dan bermanfaat untuk meningkatkan



kemampuan kerja tim siswa serta mendapat respons positif, sehingga cocok digunakan sebagai media pembelajaran interaktif dalam pembelajaran abad ke-21.

Kata kunci: *Flipbook, Keterampilan Kolaborasi, Respons Siswa, Pembelajaran*

INTRODUCTION

Vocational High Schools serve as a primary foundation for developing human resources equipped with both specialized technical expertise and essential interpersonal competencies required by the rapidly evolving global industry. In this contemporary era, the ability to collaborate stands out as a paramount skill, enabling individuals to navigate complex professional environments through effective teamwork, collective problem-solving, and clear communication. Ideally, these educational institutions should cultivate a learning atmosphere where students can exchange ideas fluently and work synergistically to address industrial challenges (Haase et al., 2023; Jantassova et al., 2023; Murray et al., 2020; Santos & Ramos, 2024). Collaboration is not merely a supplementary skill but a core competency that determines a graduate's readiness to integrate into professional teams where cross-functional cooperation is the standard. When students are proficient in working together, they develop a higher level of social intelligence and adaptability, which are highly valued by employers across various sectors. Therefore, the curriculum must prioritize pedagogical strategies that move beyond individualistic learning toward a more social and interactive model. This approach ensures that the transition from the classroom to the workstation is seamless, allowing students to contribute meaningfully to their organizations from the very first day of their employment (Ortiz et al., 2021; Popli & Singh, 2024; Wang et al., 2024).

Despite the ideal expectations for collaborative excellence, the actual conditions observed in many vocational classrooms reveal a significant discrepancy that hinders student development. Traditional teaching methods still dominate the landscape, where the teacher remains the sole source of information, leaving students in a passive state with minimal opportunity for meaningful peer interaction. Initial observations conducted at a local vocational school provided startling quantitative evidence of this deficiency in collaboration skills. Data showed that only 32.5% of students actively participated in group discussions, while a staggering 67.5% remained silent or disengaged during collective tasks. Furthermore, when assessed on their ability to distribute roles within a team, only 28.0% of students demonstrated clear leadership or coordination, leaving the majority struggling with disorganized workflows. Student engagement levels were equally concerning, with only 41.0% reporting high motivation during conventional lessons. These figures underscore a critical failure in current instructional designs to foster the social dynamics necessary for modern industry. Such a gap necessitates an immediate shift toward more innovative and technologically integrated learning media that can stimulate active participation and transform the classroom into a dynamic hub of collaborative inquiry (Aljamaan et al., 2025; Daraz et al., 2024; Sharma et al., 2023).

One highly promising technological intervention to bridge this gap is the implementation of flipbook-based digital learning media, which offers a multidimensional approach to information delivery. Flipbooks represent an evolution of traditional textbooks, integrating text, vivid imagery, *animasi*, high-definition video, and synchronized audio into a single, cohesive digital interface that is both attractive and systematic (Hardiansyah & Mulyadi, 2022; Nafiah et al., 2023; Perdana et al., 2021; Villanueva & Salazar, 2021). Unlike static materials, this interactive medium allows students to navigate through complex procedures at their own pace while facilitating simultaneous access for group members. This shared digital



space encourages students to discuss content in real-time, brainstorm solutions, and complete structured learning activities together. By transforming abstract concepts into visual and interactive experiences, flipbooks can significantly boost student engagement and foster a sense of collective ownership over the learning process. The versatility of this format ensures that different learning styles are accommodated, whether auditory, visual, or kinesthetic, thereby creating a more inclusive environment for collaboration. Consequently, the adoption of such digital resources is expected to replace the monotony of conventional lectures with a student-centered paradigm that naturally promotes interpersonal communication and shared intellectual discovery among vocational learners in a more efficient *modus operandi* (Noguera et al., 2024; Zhang, 2025; Zhu et al., 2023).

Extensive academic discourse has already highlighted the transformative potential of interactive digital media in enhancing educational outcomes across various disciplines. Previous investigations have consistently demonstrated that such technologies have a profound impact on improving teamwork and increasing the quality of communication among peers during group-based activities. Researchers have found that digital platforms often serve as a catalyst for collaborative behavior, as they require all group members to explore materials and solve problems through a shared digital lens. Beyond just technical skills, these multimedia tools are known to influence student responses positively, particularly in areas of emotional engagement, intrinsic motivation, and overall satisfaction with the learning process. A positive student response is an essential indicator of educational success, as it reflects the learner's internal state and their willingness to invest effort into complex collaborative tasks. When students feel motivated by the media they use, their level of active involvement increases, which in turn strengthens the bonds of cooperation within their respective groups. Thus, understanding the nexus between interactive media and student perception is vital for creating effective pedagogical frameworks that resonate with the digital-native generation in vocational settings (Chastnyk et al., 2024; Hadiani et al., 2023; Wu, 2024).

Notwithstanding the existing body of research on digital learning, there remains a noticeable lack of empirical evidence specifically focusing on the application of flipbook media within the unique context of vocational education to boost collaboration. This study identifies a critical research gap by focusing on how this specific interactive format can be tailored to meet the rigorous demands of vocational training while simultaneously measuring student responses. The innovative value of this research lies in its integrated approach, which not only seeks to develop a functional flipbook but also rigorously analyzes its effectiveness through the prism of 21st-century collaboration metrics. By examining perceptions, motivation, and the depth of active involvement, this study provides a holistic view of the technology's impact on the learner. The novelty also extends to providing practical, evidence-based guidance for vocational instructors who are looking to transition from traditional methods to a more technologically advanced, collaborative classroom environment. Ultimately, this research aims to offer a new perspective on digital pedagogy, ensuring that the development of collaborative skills is grounded in authentic student experiences and supported by state-of-the-art instructional tools that reflect the requirements of the modern industrial world.

METHOD

This study employed a quantitative approach using an experimental design with a two-group test design involving a comparison between two classes. Class X TKR 1 was designated as the experimental group that implemented flipbook-based e-modules, while Class X TKR 2

served as the comparison group and received instruction without the use of flipbook media (Sugiyono, 2015). The research design can be seen in figure 1.

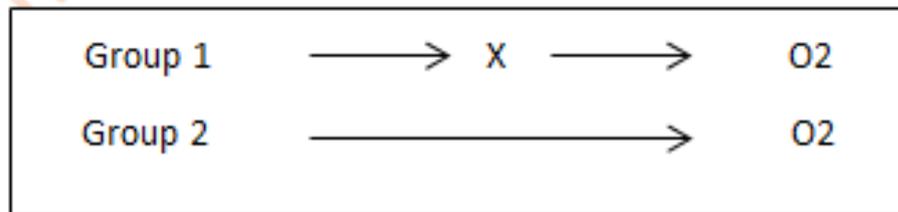


Figure 1. Research Design

The research participants consisted of tenth-grade students from the Automotive Light Vehicle Engineering (TKR) program at a vocational high school. The classes were selected based on similar academic characteristics and curriculum implementation. The independent variable in this study was the use of flipbook-based e-modules, while the dependent variables were students' collaboration skills and student responses.

Data collection techniques included a collaboration skills observation sheet and a student response questionnaire. The collaboration observation sheet was used to assess students' abilities in teamwork, communication, and active participation during the learning process. This instrument had been validated by experts to ensure the appropriateness of indicators, clarity of assessment criteria, and measurement feasibility. The student response questionnaire was administered to capture students' perceptions and learning experiences after using the flipbook-based e-module and was also validated by experts prior to implementation.

Data analysis was conducted using IBM SPSS software. Instrument quality was examined through validity and reliability tests on the student response questionnaire, with validity assessed using product-moment correlation and reliability measured using Cronbach's Alpha coefficient. Furthermore, to determine differences in students' collaboration skills between the experimental and comparison groups, the U-test of Mann-Whitney was used. A significance threshold of 0,05 was used. The investigation was conducted to determine how e-modules based on flipbooks impacted students' ability to work together and how they reacted to the instructional materials.

RESULT & DISCUSSION

This section presents the results of the study on the use of a flipbook-based e-module to enhance students' collaboration skills in learning battery maintenance. The analysis compares a class that used the flipbook with a class that did not, and also examines students' responses to the learning media. Data were collected through collaboration observation sheets and student response questionnaires, and then analyzed statistically to determine the effect of the flipbook on students' teamwork, interaction, and participation in the learning process.

A. Result

a. Analyze of Collaboration Skill

To determine the effectiveness of the flipbook-based e-module in the battery maintenance subject for improving students' collaboration skills, a comparative test was conducted between two different classes. The results of this test are presented in the following table 1.



Table 1. The Result Of Collaboration Between Class Students Of X TKR 1

| Group | Number | V1 | V2 | V3 | Score |
|-------|--------------|-----|--------------|-----|-------|
| Tim 1 | 13 | 75 | 80 | 80 | 78,33 |
| | 20 | 75 | 80 | 80 | 78,33 |
| | 34 | 80 | 85 | 90 | 85,00 |
| | 35 | 85 | 90 | 95 | 90,00 |
| | 26 | 95 | 95 | 95 | 95,00 |
| | 9 | 80 | 85 | 85 | 83,33 |
| Tim 2 | 21 | 95 | 95 | 90 | 93,33 |
| | 15 | 85 | 90 | 95 | 90,00 |
| | 8 | 95 | 90 | 95 | 93,33 |
| | 22 | 80 | 85 | 90 | 85,00 |
| | 33 | 85 | 90 | 90 | 88,33 |
| | 36 | 90 | 90 | 85 | 88,33 |
| Tim 3 | 24 | 95 | 95 | 90 | 93,33 |
| | 19 | 100 | 90 | 95 | 95,00 |
| | 12 | 95 | 95 | 100 | 96,67 |
| | 31 | 95 | 95 | 90 | 93,33 |
| | 25 | 95 | 95 | 90 | 93,33 |
| | 5 | 90 | 90 | 90 | 90,00 |
| Tim 4 | 30 | 80 | 85 | 85 | 83,33 |
| | 3 | 80 | 85 | 85 | 83,33 |
| | 14 | 90 | 95 | 85 | 90,00 |
| | 23 | 100 | 95 | 95 | 96,67 |
| | 10 | 95 | 90 | 95 | 93,33 |
| | 28 | 100 | 95 | 90 | 95,00 |
| Tim 5 | 6 | 95 | 90 | 95 | 93,33 |
| | 4 | 85 | 90 | 85 | 86,67 |
| | 29 | 90 | 95 | 85 | 90,00 |
| | 11 | 90 | 95 | 85 | 90,00 |
| | 27 | 95 | 90 | 85 | 90,00 |
| | 2 | 85 | 90 | 80 | 85,00 |
| Tim 6 | 17 | 95 | 90 | 95 | 93,33 |
| | 32 | 90 | 95 | 90 | 91,67 |
| | 18 | 90 | 95 | 90 | 91,67 |
| | 1 | 75 | 80 | 85 | 80,00 |
| | 16 | 95 | 90 | 90 | 91,67 |
| | Total | | 89,54 | | |

The recapitulation results table 1 indicate that almost all students achieved high scores, generally ranging from 83,33 to 96,67, reflecting very good collaboration skills. Overall, the average total score reached 89,54, which falls into the very good category. These findings demonstrate that students' collaboration skills were generally at a highly satisfactory level, and the use of the flipbook contributed positively to the improvement of



collaboration among students. Next, the results of the TKR 2, collaboration are displayed in the following table 2.

Table 2. The Result Of Collaboration Between Class Students Of X TKR 2

| Group | Number | V1 | V2 | V3 | Score |
|--------------|--------|--------------|----|----|--------------------|
| Tim 1 | 13 | 70 | 70 | 65 | 68,33 |
| | 24 | 65 | 65 | 50 | 60,00 |
| | 1 | 65 | 65 | 70 | 66,67 |
| | 23 | 65 | 65 | 60 | 63,33 |
| | 18 | 65 | 65 | 70 | 66,67 |
| | 25 | 70 | 70 | 55 | 65,00 |
| | 33 | 65 | 55 | 75 | 65,00 |
| | 21 | 60 | 60 | 55 | 58,33 |
| Tim 2 | 15 | 65 | 60 | 75 | 66,67 |
| | 28 | 65 | 70 | 55 | 63,33 |
| | 12 | 60 | 50 | 65 | 58,33 |
| | 34 | 60 | 60 | 60 | 60,00 |
| | 29 | 60 | 65 | 55 | 60,00 |
| | 11 | 60 | 65 | 65 | 63,33 |
| Tim 3 | 26 | 60 | 70 | 60 | 63,33 |
| | 9 | 65 | 65 | 60 | 63,33 |
| | 2 | 60 | 50 | 65 | 58,33 |
| | 20 | 50 | 70 | 65 | 61,67 |
| | 32 | 60 | 60 | 55 | 58,33 |
| Tim 4 | 17 | 70 | 75 | 50 | 65,00 |
| | 6 | 55 | 55 | 50 | 53,33 |
| | 4 | 65 | 65 | 65 | 65,00 |
| | 30 | 70 | 60 | 60 | 63,33 |
| | 16 | 60 | 70 | 50 | 60,00 |
| Tim 5 | 31 | 55 | 65 | 55 | 58,33 |
| | 10 | 55 | 65 | 50 | 56,67 |
| | 27 | 60 | 65 | 55 | 60,00 |
| | 37 | 65 | 65 | 55 | 61,67 |
| | 8 | 60 | 70 | 55 | 61,67 |
| Tim 6 | 36 | 55 | 70 | 50 | 58,33 |
| | 3 | 60 | 60 | 60 | 60,00 |
| | 22 | 60 | 60 | 55 | 58,33 |
| | 7 | 60 | 55 | 65 | 60,00 |
| | 5 | 65 | 55 | 60 | 60,00 |
| | 19 | 60 | 65 | 70 | 65,00 |
| Total | 14 | 65 | 55 | 60 | 60,00 |
| | 35 | 60 | 65 | 60 | 61,67 |
| Total | | 61,58 | | | Good Enough |

The collaboration assessment results on table 2 of six teams show that individual scores ranged from 53,33 to 68,33, with an overall average of 61,58, categorized as fairly good. This indicates that students' collaboration skills were reasonably adequate but still require improvement. To see an illustration of the two data, see the following figure 2.

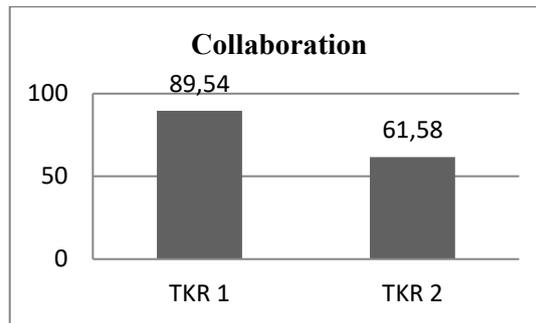


Figure 2. The Result of Comparison Between X TKR 1 & X TKR 2

Overall, there is a marked difference between the two sets of data. The first dataset reflects a very good level of collaboration, whereas the second dataset falls only within the fairly good category. These findings suggest that under certain conditions or within specific groups, students are able to demonstrate highly effective collaboration, while in other groups their collaboration skills remain underdeveloped. To verify this assumption, a comparison test (t-test) was conducted to determine whether there was a significant difference between the two classes in relation to the developed flipbook media. The results of the comparison test for both classes are presented in the following table 3.

Table 3. The Result Of Comparison Test Between TKR 1 And TKR 2

| Hypothesis Test Summary | | | |
|-------------------------|---|---|---|
| | Null Hypothesis | Test | Sig. ^{a,b} |
| 1 | The distribution of Hasil is the same across categories of Kelas. | Independent-Samples Mann-Whitney U Test | ,000 |
| | | | If the significance value is <0.05 then there is a difference |

The test results in table 3 comparing the collaboration abilities of the two classes showed a significance value of 0,000, which means there was a significant difference between the two groups. The significance value of 0,000 confirmed that flipbooks had a positive and significant influence on increasing collaboration between the two classes, making them an effective learning medium in supporting teamwork activities in the classroom.

b. Analyze Of Student Respons

To determine students' responses to the developed flipbook-based e-module, a questionnaire was administered to students after the implementation of learning activities using the flipbook-based e-module in class X TKR 1. The questionnaire aimed to examine whether the developed flipbook-based e-module was aligned with the concept of students' collaborative skills. The results of the questionnaire are presented in the following table 4.

Table 4. Student Respons

| Number | ΣP | Percentage(%) | Condition |
|--------|----|---------------|-----------|
| 1 | 45 | 90 | Very Good |
| 2 | 41 | 82 | Good |
| 3 | 40 | 80 | Good |



| Number | ΣP | Percentage(%) | Condition |
|--------|------------|---------------|----------------|
| 4 | 41 | 82 | Good |
| 5 | 37 | 74 | Good |
| 6 | | Alpha | |
| 7 | 37 | 74 | Good |
| 8 | 40 | 80 | Good |
| 9 | 44 | 88 | Very Good |
| 10 | | Alpha | |
| 11 | 40 | 80 | Good |
| 12 | 34 | 68 | Good Enough |
| 13 | 40 | 80 | Good |
| 14 | 36 | 72 | Good |
| 15 | 50 | 100 | Very Good |
| 16 | 46 | 92 | Good |
| 17 | 39 | 78 | Good |
| 18 | 39 | 78 | Good |
| 19 | | Alpha | |
| 20 | 39 | 78 | Good |
| 21 | 50 | 100 | Very Good |
| 22 | | Alpha | |
| 23 | 39 | 78 | Good |
| 24 | 40 | 80 | Good |
| 25 | 37 | 74 | Good |
| 26 | 40 | 80 | Good |
| 27 | 39 | 78 | Good |
| 28 | | Alpha | |
| 29 | | Alpha | |
| 30 | 38 | 76 | Good |
| 31 | 40 | 80 | Good |
| 32 | 46 | 92 | Very Good |
| 33 | 40 | 80 | Good |
| 34 | 41 | 82 | Good |



| Number | ΣP | Percentage(%) | Condition |
|--------------|-------------|---------------|-------------|
| 35 | 43 | 86 | Very Good |
| 36 | 37 | 74 | Good |
| Total | 40,6 | 81,2 | Good |

Based on the table 4 results of the student response questionnaire toward the flipbook, the average score obtained was 81,2, which falls into the good category according to the percentage criteria established by experts. To determine whether the questionnaire items were able to measure the intended aspects, namely critical thinking and collaboration skills, validity and reliability tests were conducted on the questionnaire administered to the respondents. The results of these tests are presented in Table 5.

Table 5. Validity Test

| Correlation of validity | | | | | | | | | |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 |
| ,592** | ,658** | ,863** | ,757** | ,619** | ,669** | ,624** | ,615** | ,471** | ,668** |
| Accept | Accept | Accept | Accept | Accept | Accept | Accept | Accept | Accept | Accept |

R table with N = 30 with a significance level of 5% is 0.361

Every one of the ten items passed in table 5 the validity test with a correlation coefficient higher than 0.361, indicating that they are all legitimate and appropriate for usage. In addition, Table 6 displays the results of the reliability tests.

Table 6. Reliabel Test

| Reliability Statistics | |
|--|----|
| Cronbach's Alpha | N |
| .846 | 10 |
| Normal reliability if the value is greater than 0.05 | |

The reliability table 6 test results obtained a Cronbach's Alpha value of 0,846, which is above 0.06, so the questionnaire instrument was declared reliable. Thus, the student response questionnaire to the flipbook media was proven valid and reliable, and can be used consistently to measure student responses to the flipbook used.

B. Discussion

The research findings indicate that the implementation of a flipbook-based *e-module* in battery maintenance lessons significantly transforms students' interpersonal dynamics. Quantitative analysis of the experimental group, Class X TKR 1, showed impressive collaboration scores ranging between 78.33 and 96.67. This class achieved a high average score of 89.54, placing it firmly in the very good category. In contrast, the control group, Class X TKR 2, which did not utilize the digital media, recorded a much lower average of 61.58. Individual scores in the control group were notably lower, falling between 53.33 and 68.33, categorized only as fairly good. This substantial gap demonstrates that the structured digital format of the flipbook provides a superior platform for students to engage in meaningful teamwork. The interactive nature of the media likely bridges the gap between individual understanding and collective execution. By providing a clear, shared visual reference, the tool minimizes confusion and maximizes the efficiency of task distribution among team members



during technical practice (Grinde, 2021; Hopwood et al., 2020; Kim et al., 2025; Seo et al., 2025).

Statistical verification further reinforces the superiority of the digital intervention through rigorous comparative testing. The *Mann-Whitney U* test yielded a significance value of 0.000, which is well below the 0.05 threshold required to reject the null hypothesis. This result confirms that the difference in collaboration abilities between the two classes is not due to chance but is a direct result of the flipbook-based *e-module*. The experimental class demonstrated more robust communication and more equitable group contributions than their counterparts. These data points suggest that the *e-module* serves as more than just a source of information; it acts as a catalyst for social interaction and cooperative problem-solving. By aligning learning materials with 21st-century technological expectations, the media creates an environment where students feel more competent and connected. The significant statistical margin highlights the necessity of integrating such digital tools into vocational education to meet modern industry standards for teamwork and professional interaction (Barboutidis & Stiakakis, 2023; Noguera et al., 2024; Roslin et al., 2022; Zervas & Stiakakis, 2024; Zhang et al., 2024).

Student reception of the flipbook-based *e-module* was overwhelmingly positive, as evidenced by the detailed questionnaire results. The average response score reached 81.2, which is categorized as good, reflecting high student acceptance of the new learning technology. Specific items in the survey revealed exceptional satisfaction levels, with several indicators achieving 100, such as items 15 and 21. Other high-performing aspects included item 16 at 92 and item 32 also at 92. These figures indicate that students found the media not only easy to use but also highly engaging and relevant to their learning needs. Only a few areas showed room for improvement, such as item 12, which scored 68, indicating minor technical or navigational hurdles for some users. Overall, the high level of engagement suggests that the digital format successfully stimulated student motivation. When students find the learning interface intuitive and visually appealing, they are more likely to participate actively in group discussions and practical applications. This positive feedback loop is essential for sustaining long-term interest in complex technical subjects like automotive battery maintenance (Arsenijević et al., 2020; Aziz et al., 2020; Dahlan et al., 2023; Firdaus et al., 2024; Harahus et al., 2023).

To ensure the scientific integrity of the feedback, the research instrument underwent comprehensive validation and reliability checks. All 10 items in the validity test surpassed the 0.361 correlation coefficient requirement for a sample of 30, with some items reaching as high as 0.863. The reliability analysis produced a *Cronbach's Alpha* value of 0.846, which is significantly higher than the 0.60 benchmark. These values confirm that the questionnaire was a stable and accurate tool for measuring student perceptions and collaboration skills. The high reliability score ensures that if the study were repeated under similar conditions, the results would remain consistent. This methodological rigor strengthens the claim that the observed improvements in teamwork were genuine and accurately captured. By using a validated instrument, the study avoids the pitfalls of subjective bias and provides a trustworthy baseline for future educational research. The consistency between the observed classroom behavior and the recorded survey data paints a complete picture of an effective instructional design that meets both technical and pedagogical requirements.

Despite the clear successes, the study acknowledges certain limitations that should guide future research and implementation. While the flipbook significantly improved collaboration,



the 61.58 average in the control class suggests that traditional methods alone are insufficient for developing complex social skills in a modern vocational context. The 81.2 student response score, while good, also hints at a 18.8 margin of potential refinement in user interface design or instructional flow. Furthermore, the reliance on a specific sample size of 30 students per class means that broader generalizations across different school environments should be made with caution. Future developments should focus on optimizing the *e-module* to address the lower-scoring response items and exploring its impact on a wider variety of technical subjects. The ultimate goal is to create a seamless integration of digital media that not only teaches technical content but also inherently builds the interpersonal skills required in the modern workforce. This research provides a solid foundation for the continued evolution of digital vocational pedagogy, emphasizing that technology and human collaboration must advance hand in hand.

CONCLUSSION

The research found that students' ability to work together improved significantly when they used e-modules based on flipbooks. The Mann–Whitney test results showed a significance value lower than the predetermined threshold, indicating a significant difference in collaboration skills between the class that used the flipbook and the class that did not. These findings confirm that flipbook-assisted learning is more effective in enhancing students' teamwork, communication, and participation. In addition, the results of the student response questionnaire indicated that the flipbook-based e-module obtained a very good category, reflecting positive student responses toward the learning media. The questionnaire instrument was also confirmed to be valid and reliable, with a Cronbach's Alpha value exceeding the minimum required standard. Therefore, it can be concluded that the developed flipbook-based e-module is feasible, effective, and well accepted as a learning medium to support the instructional process in vocational education.

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