**Journal of Advanced Sciences and Mathematics Education**
**Volume 5, Issue 2, 527 - 540**
e_ISSN: 2798-2351
DOI: 10.58524/jasme.v5i2.987

# Needs analysis of digital learning media to enhance ownership of learning and collaboration skills in biology education students

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**Article Info**

***Article history:***

Received: Oct 11, 2025
Revised: Nov 15, 2025
Accepted: Dec 23, 2025

***Keywords:***

Collaboration Skills;
Digital Learning Media;
Ownership of Learning;
Problem-Based Learning (PBL);
SDGs (Sustainable Development Goals).

**Abstract**

**Background:** The shift toward a student-centered educational paradigm in the 21st century requires the use of effective digital learning media to enhance students' ownership of learning and collaboration skills. However, challenges such as low learning motivation, limited student engagement, and the underutilization of diverse learning media remain evident in the Plant Physiology course within Biology Education programs.

**Aims:** This study aims to analyze the need for digital learning media that can enhance students' ownership of learning and collaboration skills in the Plant Physiology course.

**Methods:** This study employed a quantitative descriptive research design involving 42 undergraduate students and 4 lecturers from the Biology Education program. Data were collected through questionnaires, interviews, and document analysis of the Course Syllabus (RPS) and Lesson Plans (SAP). The collected data were analyzed descriptively to evaluate the extent to which existing learning media support ownership of learning and collaboration skills.

**Results:** The findings reveal that PowerPoint is the most dominant learning medium used, with a usage rate of 58.6%, followed by teaching modules at 21.4% and learning videos at 15.7%. The use of academic articles is very limited, with only 4.3% utilization. Students' ownership of learning is generally categorized as good, with an average score of 78.4%; however, the indicators of goal orientation and self-direction remain relatively low at 69.64%. Collaboration skills demonstrate a positive average score of 84.66%, yet several indicators have not reached optimal levels.

**Conclusion:** The study concludes that learning in the Plant Physiology course still relies heavily on conventional digital media. Although ownership of learning and collaboration skills show positive trends, they are not yet optimal. These findings emphasize the need to develop innovative digital learning media to strengthen students' ownership of learning and collaboration skills.

**To cite this article:** Rahayu, A., Balqis, B., & Sulisetijono, S. (2025). Needs analysis of digital learning media to enhance ownership of learning and collaboration skills in biology education students. *Journal of Advanced Sciences and Mathematics Education, 5(*2), 527-540.

## INTRODUCTION

The paradigm shift in 21st-century education emphasizes the importance of student-centered learning, which requires students to actively engage in their own learning process, while the lecturer acts as a facilitator who assists and guides them (Bhardwaj et al., 2025; Dada et al., 2023; Ghaleb, 2024). This paradigm not only focuses on mastering academic knowledge but also on developing broader skills, such as collaboration, critical thinking, creativity, and the ability to engage in lifelong learning (Mielkov et al., 2021; Sean & William, 2021). Nevertheless, the implementation of student-centered learning still faces several challenges, particularly regarding low motivation, student engagement, and the suboptimal use of learning media, especially in the course of Plant Physiology within the context of Biology Education (Khatter et al., 2024; Putri & Alwi, 2023).

Ownership of learning is a crucial aspect in supporting student-centered learning (Katawazai, 2021; Lysne et al., 2023). This concept refers to the sense of responsibility and control that students

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have over their learning process and outcomes, which are key components in creating meaningful and effective learning (Barbera et al., 2020; Hauzel et al., 2024). Students who possess ownership of learning tend to be more engaged in the learning process and take greater responsibility for the results they achieve (Conley & French, 2014; Walkington & Bernacki, 2020). This is closely related to collaboration skills, as students who are actively engaged in learning tend to be more proactive in collaborating with their peers to achieve shared learning goals (Conley & French, 2014). Collaboration skills are essential in the professional world; however, students often face difficulties in working effectively within teams, particularly due to a stronger focus on individual achievements rather than collaboration (Case, 2022).

The main obstacle affecting the low ownership of learning and collaboration skills is the limited variety of learning media used. Conventional learning media, such as PowerPoint, still dominate teaching in many higher education institutions (Yuniarti et al., 2023). The limitations in the innovation of learning media are directly related to the low level of student engagement in learning and the lack of opportunities to develop collaboration skills (Ilma et al., 2022; Wijaya & Vidianti, 2020). Therefore, students require innovative digital learning media that not only presents material in a one-way manner but also encourages the exploration of concepts, strengthens personal reflection, and facilitates collaboration in more authentic and contextual situations, in line with real-world challenges (Delita et al., 2022; Dias & Victor, 2022).

Based on the research conducted by Putri & Alwi (2023), approximately 40.9% of students exhibit passive behavior in class activities, such as an inability to ask questions, low concentration, and a tendency to procrastinate on assignments. Additionally, around 36.4% of students stated that they are passive in expressing opinions or suggestions, and 58% of students frequently engage in learning without focusing on the material being taught. This decline indicates that low motivation and self-confidence among students present significant barriers to achieving optimal learning outcomes. Additionally, another challenge affecting the effectiveness of learning is the low level of collaboration skills among students. Research shows that students tend to focus more on individual achievement and are less motivated to share ideas or collaborate with their groupmates (Thornhill-Miller et al., 2023), Which hinders the development of collaboration skills that should be a core competency in higher education, particularly in sectors that require cooperation among various stakeholders (Herrera-Pavo, 2021). Therefore, it is crucial to strengthen students' collaboration skills, as the ability to work in teams and collaborate is a key element in solving complex problems and supporting the achievement of sustainable global goals (Ashley & Patrone, 2022).

Based on these findings, conducting a needs analysis for digital learning media becomes a crucial step in designing educational technology innovations that align with the characteristics of students and learning objectives (Walkington & Bernacki, 2020). A thorough analysis will help identify the gap between the actual learning conditions and the ideal conditions expected, as well as provide guidance for the development of effective media to enhance student ownership of learning and collaboration skills (González-salamanca et al., 2020). This need is highly relevant in the context of Plant Physiology learning, which requires visual representation of complex biological processes, enabling students to understand abstract concepts through illustrations of real-world phenomena (Ali et al., 2022; Dita et al., 2021). Digital media embedded with Sustainable Development Goals (SDGs), particularly those related to sustainable agriculture, are highly relevant to support more contextual and problem-based learning that addresses the real challenges faced by the world today (Handayani et al., 2024; Hurduzeu et al., 2022; Otekunrin, 2021).

The implementation of Problem-Based Learning (PBL)-based e-modules in learning can encourage students to collaborate, think critically, and manage their own learning process, thereby enhancing ownership of learning and students' collaboration skills. This is supported by the research conducted by Linda Dwi Astuti (2024), which concluded that the development of PBL-based

electronic modules is essential for improving students' collaboration skills, especially on challenging topics. This is particularly relevant to Plant Physiology, which involves abstract concepts that require an approach that can facilitate effective collaboration. PBL-based e-modules, integrating SDGs target 2.4 related to sustainable agriculture, will provide students with the opportunity to learn about sustainable agriculture through a more interactive, problem-solving approach, in line with the demands of 21st-century education that emphasize skills such as collaboration, critical thinking, and creativity. This is further supported by research conducted by Carrió Llach & Llerena Bastida (2022), which shows that the implementation of the PBL model integrated with Sustainable Development Goals (SDGs) in higher education can help students develop sustainability competencies.

Although previous studies have shown the effectiveness of PBL in enhancing critical thinking and collaboration skills, the findings of this study are expected to fill the gap by adapting this approach in the context of Plant Physiology, which deals with abstract and complex concepts. Furthermore, by integrating SDGs, particularly those related to sustainable agriculture, into digital learning media, this study aims to provide greater relevance in the context of global challenges in the 21st century. This study aims to analyze the need for digital learning media that can enhance ownership of learning and collaboration skills among students in the Plant Physiology course. Through this analysis, it is expected that key aspects will be identified that should be considered in the development of effective digital learning media, which not only improves students' understanding of the material but also strengthens their sense of ownership of the learning process. In addition, this study aims to explore how digital learning media can facilitate better collaboration among students, which is an essential skill in the context of 21st-century education.

## METHOD

### Research Design

This study uses a quantitative descriptive design to analyze the need for digital learning media that can enhance students' ownership of learning and collaboration skills in the Plant Physiology course. This design was chosen because it aims to systematically describe the current conditions, with a focus on identifying students' needs for digital learning media that can support the improvement of ownership of learning and collaboration skills. The study aims to collect quantitative data on the utilization of existing learning media, as well as students' needs and preferences for more innovative and effective digital learning media. The results of this needs analysis are expected to provide a foundation for the development of digital learning media that can strengthen students' ownership of learning and collaboration skills in the Plant Physiology course.

### Participants

The participants in this study consisted of third-semester students from the Biology Education Program who had taken the Plant Physiology course, as well as four lecturers who taught the course. The sample selection was done using purposive sampling, where participants were chosen based on specific criteria relevant to the research objectives. A total of 42 students enrolled in the Plant Physiology course at Universitas Negeri Malang were selected as the sample for the study. The sample selection considered the students' direct involvement in the learning process within the Plant Physiology course, ensuring that they could provide the necessary information to analyze the needs for appropriate learning media. Additionally, four lecturers who taught the Plant Physiology course participated in the study. The selection of lecturers was based on their teaching experience in the course and their ability to provide an in-depth perspective on the learning conditions and the need for the development of more effective learning media. The criteria for selecting lecturers included teaching experience and their willingness to participate and provide the required information for this study.

**Instrument**

The instruments used in this study consist of a structured questionnaire given to students and a semi-structured interview guide used for the lecturers teaching the Plant Physiology course. This questionnaire was developed independently and has undergone an instrument validation process, including content validity, construct validity, and reliability testing, to ensure that the instrument accurately and consistently measures in accordance with the research objectives.

1. Learning Media Needs Analysis Questionnaire: This questionnaire is designed to analyze the learning media needs relevant to the Plant Physiology course. The instrument aims to identify the types of learning media needed to support the learning process and enhance student engagement. It includes questions that assess students' perceptions of the existing learning media and their preferences for more innovative digital media, such as e-modules, educational videos, or interactive simulations. The questionnaire also explores how students perceive the potential of learning media to help them understand complex concepts in Plant Physiology, such as metabolic processes and nutrient transport in plants.
2. Ownership of Learning Questionnaire: The Ownership of Learning Questionnaire is designed to measure students' level of ownership in their learning. It consists of a series of statements that measure the key indicators of ownership of learning, including: Motivation and Engagement, which assesses how motivated and engaged students are in the learning process; Goal Orientation and Self-Direction, which evaluates students' ability to set learning goals and take initiative independently; Self-Efficacy and Self-Confidence, which measures students' confidence in their ability to achieve learning goals; Metacognition and Self-Monitoring, which assesses how well students can monitor and regulate their own learning strategies; and Persistence, which gauges students' resilience in facing academic challenges. Each item in this questionnaire is designed to explore how much control students feel they have over their learning experience, as well as how effectively they manage and organize their learning goals and strategies.
3. Collaboration Skills Questionnaire: This questionnaire aims to assess the extent to which students possess collaboration skills in the context of group learning. The collaboration skills measured in this questionnaire include: Work Productivity, which evaluates how effectively students contribute to achieving the group's goals; Demonstrates Respect, which assesses how much students show appreciation for differing opinions and contributions from their peers; Compromises, which measures students' ability to reach agreements in situations requiring adjustment between different viewpoints; and Shared Responsibility; Everyone Contributes, which evaluates how much students take responsibility for group tasks and actively contribute to completing the collective assignment.

Semi-Structured Interview Guidelines with Lecturers: These interview guidelines are designed to gain deeper insights from the lecturers of the Plant Physiology course regarding their perceptions as instructors on ownership of learning and students' collaboration skills in learning. The semi-structured interview format allows researchers to explore further responses based on the lecturers' answers while remaining focused on themes relevant to the research objectives. The guidelines include questions centered on the use of learning media to support these two aspects, as well as the challenges faced in encouraging students to engage more actively in collaborative learning processes.

**Data Collection and Analysis**

This study adopts a comprehensive approach to collect and analyze the necessary data in order to assess the need for digital learning media to enhance ownership of learning and collaborative skills among students. Data were collected using three main methods: structured questionnaires administered to students, semi-structured interviews with lecturers teaching the Plant Physiology

course, and document analysis of the RPS (Semester Learning Plan) and SAP (Learning Activity Syllabus). Each of these instruments was designed to gather relevant data and provide deeper insights into the learning conditions and the need for effective learning media.

Data collection through a structured questionnaire was conducted to gather quantitative information regarding students' perceptions of ownership of learning and collaboration skills in the learning process. The data obtained from the questionnaire was then analyzed descriptively and quantitatively. The analysis process began with calculating the frequency of responses for each question and each option chosen by the respondents. For example, for a question measuring ownership of learning, the number of students selecting each option (such as 'strongly agree', 'agree', 'disagree', etc.) was counted. Then, the percentage for each category was calculated by dividing the number of respondents selecting a particular option by the total number of respondents, and multiplying by 100. For instance, if 30 out of 42 students selected 'agree', the percentage would be (30/42) * 100 = 71.4%. The results were then presented in the form of frequencies and percentages, illustrating the extent to which students felt engaged in the learning process and felt they had control over their learning outcomes. This analysis provides an overview of students' needs for learning media that could enhance their involvement in the learning process.

**Semi-structured interviews**

Semi-structured interviews were conducted with four lecturers teaching the Plant Physiology course to gain deeper insights into the use of technology in teaching and the challenges faced in enhancing students' ownership of learning and collaboration skills. The interviews used an interview guide containing open-ended questions to explore the lecturers' views on how they utilize learning media in their teaching process and how these media affect student engagement in learning. The data obtained from the interviews were then analyzed using thematic analysis. The analysis process began with transcribing the entire conversation, then the main themes related to the use of learning media, challenges in classroom management, and factors influencing student collaboration were extracted. After identifying these themes, the data were grouped and categorized based on similarities in topics and context. This approach allowed the researcher to gain a deeper understanding of the lecturers' perceptions regarding the existing learning conditions, as well as the factors that may affect the improvement of students' ownership of learning and collaboration skills.

**Analysis of the RPS (Semester Learning Plan) and SAP (Learning Activity Syllabus)**

Analysis of the RPS (Semester Learning Plan) and SAP (Learning Activity Syllabus) documents is conducted to assess the alignment of the taught material and teaching methods with the desired learning objectives. The collected RPS and SAP documents provide information about the teaching strategies applied by the lecturers, including the learning objectives, methods used, and types of learning media implemented. These documents are then analyzed to ensure that the teaching strategies align with the principles of learning that support ownership of learning and collaboration skills among students. The analysis also includes evaluating the gap between the material and methods being taught and the need for more innovative and effective learning media. Thus, this document analysis not only helps assess the alignment of teaching strategies with learning objectives but also provides insights into the need for developing learning media that can support the enhancement of ownership of learning and collaboration skills.

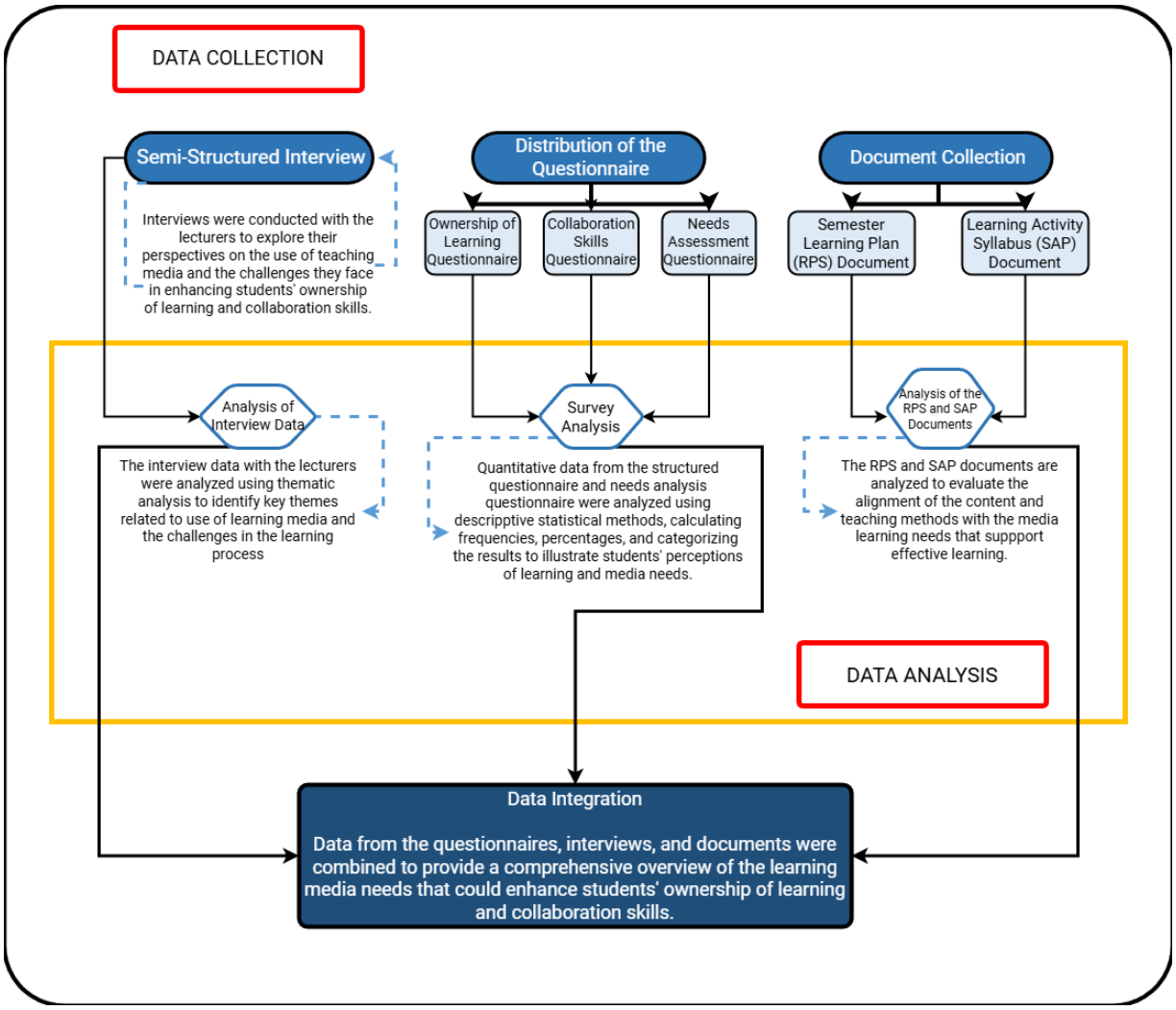


**Figure 1.** Research Data Collection and Analysis Flow

## RESULTS AND DISCUSSION

### Results

This study aims to analyze the need for digital learning media in enhancing students' ownership of learning and collaboration skills in the Plant Physiology course. The data obtained through surveys and interviews revealed several key findings regarding the use of existing learning media and students' need for more innovative learning media.

### The Dominance of Learning Media Usage in Plant Physiology Education

The results of the study show that PowerPoint is the most dominant learning media used in the learning process, with a usage percentage of 58.6%. Teaching modules occupy the second position with a percentage of 21.4%, while learning videos are used by 15.7% of students. The use of academic articles in learning is still very limited, with only 4.3% of students utilizing them. However, there is a significant gap between the current condition and the ideal condition in the use of learning media. Ideally, learning media should be more varied and interactive to enhance students' understanding of the material, especially concerning abstract concepts in plant physiology. The use of media such as learning videos and academic articles should be further encouraged to enrich students' learning experiences, thus making the learning process more effective and in-depth.

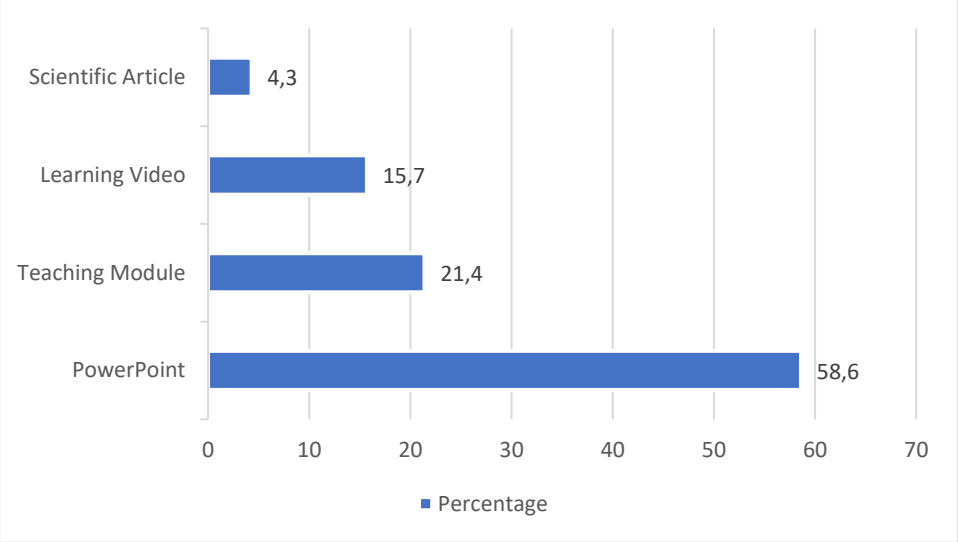


**Figure 2.** Percentage of Learning Media Usage in Plant Physiology Course

Figure 2 illustrates the percentage distribution of various learning media usage in the Plant Physiology course, reflecting students' preferences for the types of media used in the learning process. The diagram shows that PowerPoint is the most dominant learning media, followed by teaching modules and learning videos. Meanwhile, the use of academic articles remains limited. Table 1 below presents a summary of the key findings related to the use of learning media, along with the implications for the development and need for more varied and effective learning media to support more interactive and digital-based learning.

**Table 1**. Summary of Key Findings and Implications for Learning Media Needs

| Aspect | Findings | Implications for Needs |
|---|---|---|
| **Dominance of Learning Media** | PowerPoint (58.6%) is the most widely used media. | Encourage the use of more diverse and interactive digital media to increase student engagement in learning. |
| **Use of Teaching Modules** | Teaching modules (21.4%) are in second place. | Develop internet-based learning modules that are interactive and accessible online to improve accessibility and support distance learning. |
| **Use of Learning Videos** | Learning videos (15.7%) are used by a small proportion of students. | Promote the use of interactive learning videos, especially for abstract topics in plant physiology, focusing on digital media quality and ease of access for students. |
| **Use of Academic Articles** | Only 4.3% of students use academic articles in learning. | Introduce academic articles in digital formats that are easy for students to access, providing additional resources to deepen their understanding of scientific concepts in plant physiology. |

## The Need for Learning Media to Enhance Ownership of Learning

The survey results indicate that the average level of students' ownership of learning is 78.4%, which falls within the “good” category. The indicators of Persistence (84%) and Motivation and Engagement (81%) reflect students' ability to stay focused, persist in the face of challenges, and maintain consistent involvement in learning. The research findings show that most dimensions of students' ownership of learning are categorized as good, with the highest score recorded in Persistence (84.08%), indicating excellent perseverance in facing learning challenges. The Motivation and Engagement dimension also received a high score of 81.10%, reflecting good motivation and involvement from students in the learning process. Additionally, Self-Efficacy and Self-Confidence also scored 81.10%, demonstrating students' fairly good self-confidence in their ability to achieve learning goals. However, the Goal Orientation and Self-Direction dimension recorded a lower score of 69.64%, indicating room for improvement in goal setting and students' independence in the learning process. Metacognition and Self-Monitoring, with a score of 76.19%,

show students' ability to monitor and evaluate their learning process, but there is still potential to optimize this aspect further. Overall, the average score for students' ownership of learning is 78.4%, which is categorized as good, although there are several areas that could be further improved to reach students' full potential in the learning process. The results are presented in Table 2 below:

**Table 2.** Level of Student Ownership of Learning

| No | Indicator | Total Score | Maximum Score | Percentage (%) | Category |
|---|---|---|---|---|---|
| 1 | *Motivation and Engagement* | 545 | 672 | 81.0 | Good |
| 2 | *Goal Orientation and Self-Direction* | 468 | 672 | 69.4 | Adequate |
| 3 | *Self-Efficacy and Self-Confidence* | 545 | 672 | 81.0 | Good |
| 4 | *Metacognition and Self-Monitoring* | 512 | 672 | 76.2 | Good |
| 5 | *Persistence* | 565 | 672 | 84.0 | Good |
| | **Average** | **527.0** | **672** | **78.4** | **Good** |

## The Need for Learning Media to Enhance Collaborative Skills

The research findings show that students' collaboration skills have an average score of 84.66%, which falls into the "Good" category. The "Demonstrates Respect" indicator scored the highest at 92.06%, reflecting excellent relationships among team members. The “Works Productively” indicator recorded a score of 82.90%, indicating a fairly good ability to collaborate, although there is room for improvement to achieve more optimal work outcomes. The “Compromises” indicator scored 82.96%, signaling students' ability to reach agreements, though it can be further strengthened. The “Shared Responsibility; Everyone Contributes” indicator earned a score of 80.74%, showing good contributions from team members, but still needing improvement to ensure more active participation from all members. Overall, although the average collaboration skills scores of students show positive results, the findings indicate a strong need to develop digital learning media that can optimize collaboration skills, particularly in enhancing productive work and ensuring equal contributions among team members.

**Table 3**. Level of Student Collaboration Skills

| No | Indicator | Total Score | Maximum Score | Percentage (%) | Category |
|---|---|---|---|---|---|
| 1 | *Works Productivity* | 418 | 504 | 82,90 | Good |
| 2 | *Demonstrates respect* | 619 | 672 | 92,06 | Excellent |
| 3 | *Compromises* | 557 | 672 | 82,96 | Good |
| 4 | *Shared responsibiliy; Everyone Contributes* | 543 | 672 | 80,74 | Good |
| | **Average** | 534.25 | 630 | 84,66 | Good |

## Key Findings from Lecturer Interviews on Learning Media Needs

In the context of the Plant Physiology course, the effectiveness of learning media plays a crucial role in enhancing students' understanding and engagement. Through interviews with lecturers, this study aims to identify key aspects of the current media being used in teaching and highlight areas that require improvement. The findings reveal lecturers' perspectives on the challenges they face with existing media, the gaps in supporting student collaboration, and the need for more interactive and effective tools, especially for explaining complex physiological processes. The following table summarizes the key findings from the lecturer interviews, along with the implications for the development of more effective and innovative learning media that can better support students' learning experiences and enhance their ownership of learning and collaboration skills.

**Table 4**. Key Findings from Lecturer Interviews on Learning Media Needs

| Aspect | Findings | Implications for Needs |
|---|---|---|
| **Interactivity of Media** | Lecturers reported that the existing media (such as PowerPoint, e-modules, and Sipejar) are not sufficiently interactive, and Sipejar often experiences technical issues. | There is a need to develop more interactive and stable learning media, reducing the technical issues present in Sipejar. |

| Aspect | Findings | Implications for Needs |
|---|---|---|
| **Use of Technology** | Technology is applied, but its use in optimizing learning media is still limited, such as SIPEJAR, which sometimes lags. | A more stable and efficient technological solution is needed to support learning. |
| **Selection of Learning Media** | The media used include PPT, e-modules, videos, and academic articles; however, these media have not fully been effective in increasing ownership of learning. | There is a need for further evaluation and development of media that better suit learning needs. |
| **Student Collaboration** | Some lecturers stated that student collaboration through learning media is not functioning optimally. | Learning media that promote effective student collaboration, such as discussion forums or group tasks based on technology, are needed to help students understand physiological concepts in groups. |
| **Explanation of Plant Physiological Processes** | Lecturers expressed the need for learning media that can clearly and easily explain plant physiological processes such as transpiration, water transport, and photosynthesis. | There is a need to develop media that can visualize plant physiological processes in a more interactive and comprehensive manner, such as using digital simulations or animations to depict these processes. |

## Discussion

This discussion addresses key findings related to the need for the development of digital learning media to enhance students' ownership of learning and collaboration skills in the Plant Physiology course. The research highlights the urgent need for digital learning media development to improve ownership of learning and collaboration skills, particularly in the Plant Physiology course. Based on the analysis, it was found that conventional learning media such as PowerPoint (58.6%) dominated the learning process, while other media, such as teaching modules (21.4%) and instructional videos (15.7%), were used less frequently. The use of scientific articles in learning was very limited, with only 4.3% of students using them. These findings suggest that while PowerPoint remains the primary medium, there is a clear need for innovation in the use of technology-based learning media, such as e-modules and instructional videos, which are more interactive and engaging for students.

The dominant use of PowerPoint reflects a tendency to continue using tools that are easily accessible to instructors. This has become one of the reasons for the low level of student engagement in learning. This aligns with findings from Wulandari (2022), which highlight a major drawback of PowerPoint's one-way (teacher-centered) characteristic, hindering the creation of more active and participatory interaction between instructors and students in the learning process. The results also show that, although students demonstrate relatively good ownership of learning (78.4%), the Goal Orientation and Self-Direction indicators were lower (69.64%), suggesting that students are not yet fully capable of managing their learning goals independently.

The study reveals that while students have demonstrated persistence and good engagement in learning, they still face challenges in optimizing ownership of learning, especially in terms of goal setting and independence in the learning process. This finding is supported by statements from lecturers during interviews, who observed that students, especially in the early semesters, were not fully able to manage their learning independently and still required clear guidance. For instance, some lecturers mentioned that students tended to attend class and sit without a deep understanding unless provided with an "initial input" through tasks like mind maps. Lecturers also noted that students tended to follow the teaching flow and required further guidance in setting their learning steps. Additionally, information was obtained that low engagement in the use of digital learning media and teaching strategies that were not fully technology-based were major barriers to optimizing the achievement of ownership of learning.

These findings are in line with research by by Putri & Alwi (2023), which shows that the low use of digital learning media, such as e-modules and instructional videos, negatively impacts student engagement in learning. Moreover, research by Yuniarti et al. (2023) also noted the dominance of

PowerPoint in learning and showed that, while this media is popular, its effectiveness in encouraging student engagement and collaboration remains limited. This is also confirmed by Fradila et al (2021), who revealed that, despite the increased use of digital media, challenges in their usage still persist, especially in student-centered learning contexts. The results of this study align with the constructivist theory proposed by Piaget (1970) and Vygotsky (1978) (Suhirman et al., 2021) which emphasizes the importance of personal experience and reflection in learning. The concept of ownership of learning, as described by Conley & French (2014), reflects the fundamental principle of constructivism, where students are active in managing and directing their own learning. Students with strong ownership of learning tend to be more motivated and actively involved in their learning processes. This is supported by the findings of Magin (2025), which show that students with high ownership of learning possess the ability to set goals, choose learning strategies, and assess their progress independently.

The ability to manage the learning process independently (ownership of learning) also supports better collaboration skills. Although the average score for students' collaboration skills was categorized as good (84.66%), the indicator results showed that there are still areas that need improvement, such as Work Productivity (82.90%) and Shared Responsibility (80.74%), indicating a need for improvements in group work productivity and equitable contribution among team members. This is consistent with research by Sakai (2022), which stated that increased independence in learning can encourage students to be more responsible and contribute more effectively in collaborative activities. Furthermore, low collaboration skills are also influenced by the learning media currently used. The dominance of PowerPoint as the main learning media limits active interaction between instructors and students, as its one-way nature does not encourage effective collaboration among students. Interactive and technology-based learning media, such as e-modules or instructional videos, should be used to improve collaboration skills by encouraging students to engage more actively in discussions, share ideas, and work together to solve problems. Research by Gusman (2023) states that more innovative and technology-based learning media will not only strengthen ownership of learning but also increase student engagement in collaborative learning, enabling them to contribute more effectively to teams and manage their learning process independently.

The research conducted by Ghani et al., (2021) suggests that the use of PBL-based e-modules is an effective solution for enhancing student engagement in contextual and problem-based learning. The Problem-Based Learning (PBL) concept, integrated into the development of SDG-based e-modules (specifically SDG Target 2.4), further supports these findings. A study by Hadira et al., (2024) shows that PBL is effective in improving critical thinking, collaboration, and problem-solving skills among students. Additionally, research by Carrió Llach & Llerena Bastida (2022) emphasizes that PBL, when integrated with sustainability principles such as the SDGs, can help students develop competencies relevant to global challenges, including food security and sustainable agriculture issues. PBL not only enhances academic skills but also fosters collaboration and a deeper sense of social responsibility.

Overall, this study emphasizes that the development of digital learning media is crucial to improving ownership of learning and collaboration skills among students in the Plant Physiology course. Although PowerPoint remains the primary medium used, other learning media, such as teaching modules and instructional videos, have not been optimally utilized.

## Implications

The findings of this study highlight the importance of digital learning media in enhancing ownership of learning and student collaboration skills, particularly in the Plant Physiology course within the Biology Education Program. Although conventional media such as PowerPoint and textbooks still dominate, the findings show a need for more innovative, interactive, and technology-

appropriate media, such as e-modules and video-based content. The use of digital learning media that aligns with the context of 21st-century education, which emphasizes the development of collaboration, critical thinking, and self-directed learning skills, is crucial to consider.

Based on these findings, the implication for educators is the need to reassess the design and implementation of existing learning media. Shifting from the use of one-way media to a more interactive, collaborative approach will significantly increase student engagement and strengthen their ownership of learning. Furthermore, the findings that indicate low scores in the Goal Orientation and Self-Direction indicators suggest that students still require greater support in managing their learning process independently. Therefore, applying a more structured approach to enhance student autonomy in learning is essential to help them take responsibility for their learning process and outcomes. Furthermore, although student collaboration skills are already performing well, there is still potential for improvement. Therefore, educators need to implement more effective strategies to improve teamwork, such as through more organized collaborative tasks and joint problem-solving. This will help students work more productively in teams and strengthen their collaboration skills, which are essential in the professional world. Improving these collaboration skills will enhance students' capacity to face future challenges.

**Limitations and Suggestions**

Although this study provides important insights into the need for digital learning media to enhance ownership of learning and collaboration skills among students, there are several limitations that should be considered. First, the sample used in this study is limited to 42 students and 4 lecturers from the Biology Education Program at Universitas Negeri Malang, meaning the findings may not be fully generalizable to other study programs or institutions. Additionally, the use of questionnaires as the primary instrument for collecting data on students' and lecturers' perceptions may have limitations in capturing a deeper understanding of the factors influencing the use of digital learning media. Second, this study primarily focuses on analyzing the need for learning media without testing or implementing the Problem-Based Learning (PBL)-based e-modules directly in the classroom. Therefore, the concrete impact of the implementation of such digital learning media on improving ownership of learning and collaboration skills among students has not been empirically assessed. Third, although interviews were conducted with lecturers, the data collected is qualitative and may not represent the full range of perspectives from all lecturers involved in teaching the Plant Physiology course. Therefore, more in-depth interviews with a larger sample size could provide a more comprehensive understanding of the challenges faced in optimizing the use of digital media in teaching.

Given the existing limitations, several recommendations can be made for future research and development. First, further studies could involve a larger and more diverse sample, including students and faculty from various academic programs, to gain a more general understanding of the digital learning media needs across different academic contexts. Second, the direct implementation and evaluation of the PBL-based e-modules designed in this study should be conducted to test their effectiveness in enhancing ownership of learning and student collaboration skills. Taking into account the existing limitations and the recommendations provided, this study is expected to make a significant contribution to the development of effective digital learning media that support the improvement of ownership of learning and student collaboration skills.

## CONCLUSION

This study aims to analyze the need for digital learning media that can enhance ownership of learning and collaboration skills among students in the Plant Physiology course. Based on the results of the needs analysis, PowerPoint remains the most dominant learning media used in the learning

process, with a usage percentage of 58.6%. Teaching modules occupy the second position with 21.4%, while learning videos are used by only 15.7% of students. The use of academic articles in learning is still very limited, with only 4.3% of students utilizing them. Although students' ownership of learning is quite good (78.4%), there are weaknesses in the indicators of Goal Orientation and Self-Direction, which remain low (69.64%). Collaboration skills also show positive results, with an average of 84.66%, but there is still room for improvement across several indicators to optimize them. These findings highlight the need for the development of digital learning media that can effectively support the improvement of ownership of learning and collaboration skills.

## AUTHOR CONTRIBUTIONS STATEMENT

**ASR** Conducted preliminary studies, literature review, and developed the theoretical framework. Made significant contributions to data collection, including distributing questionnaires to students, and assisted in data analysis and interpretation.
**Bal** Developed the research methodology, provided supervision throughout the research process, and contributed to the analysis of findings. Reviewed and edited the manuscript to ensure clarity and accuracy.
**Sul** Supervised the entire research process, provided guidance in data analysis, and played a crucial role in the interpretation of research results. Contributed to the preparation and revision of the manuscript, ensuring the research aligned with academic standards.

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