The Effect of The Development Results of Teaching Materials, Research, and Teaching Methodologies on The Learning Outcomes and Student's Write Research Proposals Ability

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Abstract: Development results need to be further researched to determine the effects on learning, such as in the development of teaching materials that were experimented with learning outcomes and other related abilities. The research aims to determine the influence of applying the development of teaching materials, research, and teaching methodologies results on learning outcomes and student's ability to write research proposals. The research was a quasi-experimental type with a nonequivalent control group design. The subject was the S1 Mathematics Education, FKIP, USN Kolaka. Research instruments on learning outcomes with essay questions and the ability to write proposals with the PKM-R Simbelmawa rubric. Data collection by tests, demonstrations, and documentation, then analyzed with parametric inferential statistics through the MANOVA test. The research results showed the significant value of teaching materials with learning outcomes of 0.000 and the application of teaching materials to students' ability to write research proposals of 0.000. This shows that applying the results of developing teaching materials, research, and teaching methodologies affects learning outcomes and the ability to write student research proposals. The material and summary in the teaching materials add to students' insight and independence in finding knowledge related to the material in the mathematics research methodology course. The exercises billed in the teaching materials make students easier to practice writing research proposals.

Keywords: Learning outcomes; Research methodology; Research proposal ability

Introduction

Teaching materials are researched and developed in research and development as learning materials that make students achieve learning outcomes easier. Teaching materials include learning steps, materials, summaries, exercises, and reference materials for learning (Hartini et al., 2018). The teaching materials development has gone through various development steps, such as 4D, Borg and Gall, Dick and Carey, Addie, Assure, and other models (HL et al., 2020). In certain conditions, teaching materials can be supplemented if they focus on one subject (Ensiyawatin et al., 2021).

Research and learning methodology courses are spread across almost all educational programs. This course is also available in all study programs in the FKIP, USN Kolaka. Research and teaching methodology (RTM) courses are spread out with different names according to the field of study program science. The teaching materials development for this course is based on the unavailability of teaching materials prepared by the academic community, especially course teachers. All study programs have not developed yet the teaching materials. The absence of teaching materials is a strong basis due to the analysis of the need for learning

materials (Indrawini et al., 2017; Prawindia et al., 2016; Syafiudin et al., 2016).

Teaching materials Research and development for RTM courses have been carried out with a 4D model. The analysis of research and development data obtained from validators shows that the teaching material products must be partially revised with 76.37%, good criteria, and suitable for use. The products can be well accepted. The products received approval from experts, who decided to partially revise the test according to essential notes as a reference. The process of preparation, validation, testing, and revision of the teaching materials is the procedure that is often carried out (Andriana et al., 2017; Siagian et al., 2019).

The results of the teaching materials, RTM, need to be carried out further to determine the influence on the learning of related courses. The quasi-experimental research will apply the results of teaching materials of RTM with variables related to learning outcomes and students' ability to write research proposals. Further research on development results strengthens the development results themselves (Mayasari & Noeruddin, 2017; Nida et al., 2021).

Teaching materials were developed in print and e-books to facilitate the lecture process. E-book can be studied by students via online. Teaching materials with files and Internet-based can improve learning outcomes of students (Solehana et al., 2019).

Further research into applying the developing teaching materials results in the course must be carried out because it can improve the course's learning. The teaching materials are designed to increase students' learning independence and are allegedly related to the knowledge and skills of preparing research proposals. The application of teaching materials development can increase motivation in the character of memorized material, to be more fun (Rianti et al., 2021).

Research and development efforts on teaching materials for research and learning methodology courses have been previously explored by Tegeh & Kirna (2013). In their study, they utilized the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to create teaching materials specifically tailored for research methods. The trial phase of their development process included various target groups: one supporting lecturer participated in the initial evaluation, followed by six students for small group trials and 18 students for larger group trials. This systematic approach ensured the teaching materials were thoroughly tested for effectiveness and suitability across different learning contexts. According to content experts, the study results show that teaching materials are reasonably good quality and learning and media design experts are good quality. The individual trial results were of sufficient

qualifications, and the field test results were of good qualifications. The revision was based on input from the validator and field trial subjects.

Research Qondias et al. (2019) That develops teaching materials for research methods in general research methodology courses based on a scientific approach. The research was carried out using the ASSURE model and piloted on STKIP Citra Bakti students. The study results showed that the content, design, and language validators all showed very good categories. The results of student assessments are also in a very good category, and teaching materials are ready to be implemented.

Research Adriani et al. (2019) Developed a HOT-based educational research methodology course module. Research with a 4D model with the subject of economic education, Medan State University. The 4D research results were carried out in all stages, and the distribution is limited to students in the fifth semester as test subjects.

Building on previous research that primarily focused on the development of teaching materials, it is clear that there remains a gap in understanding their impact on learning outcome variables and specific skill sets, such as the ability to write research proposals. While several studies, including Ridhwan et al. (2019), have explored teaching materials tailored to particular themes—such as maritime potential in Aceh, Indonesia—these efforts predominantly emphasize the content and its perception-based effectiveness among students. However, the quasi-experimental validation of these teaching materials in enhancing measurable outcomes, such as proposal-writing skills and comprehensive understanding of research methodologies, remains underexplored. This highlights the need for further advanced research to assess the practical efficacy of such materials in real-world learning environments, ensuring they not only convey knowledge but also foster critical academic skills.

Further research on the results of developing teaching materials for research and education methodologies courses is essential to increase student knowledge and skills effectiveness. The research is expected to empirically prove that teaching materials are suitable for RTM courses that meet learning objectives and complete the acquisition of comprehensive knowledge of the subject matter. This research aimed to determine the influence of applying the results of developing teaching materials, research, and teaching methodologies on learning outcomes and the ability to write student research proposals.

Research on the development of teaching materials for research methodology and learning courses is very important because of its role in improving the effectiveness of student learning and skills, such as the

ability to write research proposals. Many study programs at FKIP USN Kolaka do not yet have standardized teaching materials. Hence, the development of model-based teaching materials such as 4D, ADDIE, or ASSURE is a strategic solution to meet academic needs. Teaching materials that are validated by experts and tested through field trials can provide a clear, relevant, and focused learning structure while increasing student learning motivation. The integration of technology in the form of e-books and online files allows for more flexible and adaptive learning, supporting student learning independence (Solehana et al., 2019).

This research also has broad practical implications for students, lecturers, and educational institutions. For students, the teaching materials developed can improve their understanding of research methodology and critical skills such as formulating research problems (Rianti et al., 2021). For lecturers, these teaching materials can be a guide to designing more effective learning. In contrast, for institutions, the development of these teaching materials can be an indicator of the quality of learning that supports the accreditation of study programs. This study also has the potential to provide empirical evidence on the impact of teaching materials on learning outcomes so that it can be a reference for the development of teaching materials in other fields and support the transformation of education towards the digital era (Ridhwan et al., 2019).

Method

The study employed a quasi-experimental approach, specifically utilizing a nonequivalent control group design. The research focused on the experimental class within the S1 Mathematics Education program at the Faculty of Teacher Training and Education (FKIP), Universitas Sembilanbelas November (USN) Kolaka, involving students from the Class of 2018 during the odd semester of the 2020/2021 academic year. The selection of the research classes was based on the students' performance in closely related courses from previous semesters, ensuring comparability between groups (Hidayati et al., 2017; Sejati et al., 2017). Class A from the 2018 cohort served as the experimental group, where teaching was conducted using newly developed teaching materials tailored to enhance research and teaching methodology skills. Conversely, Class B was designated as the control group, which followed the standard curriculum by utilizing textbook materials from the official RPS reading list and supplementary PowerPoint presentations. This design enabled a structured comparison of the impact of the innovative teaching materials against traditional instructional methods.

The learning outcome research instrument with essay questions is tested for validity and reliability. The result of the validity test in questions 1 to 5 has a significance value of 0.00, which correlates with the total score showing all valid questions. The reliability test result showed a Cronbach's Alpha value of 0.630 or above 0.600, which indicated that all the questions were reliable. The validity test and the reliability test prove that essay question instruments can be used in research (Aliman et al., 2019; Apuke & Iyendo, 2018; Arifin et al., 2021). The ability to write proposals is assessed by the rubric of the Simbelmawa Research Student Creativity Program (PKM-R) of the Ministry of Education and Culture (Nizam & Junaidi, 2021).

Data in the form of gain scores from the gap between initial and final learning outcomes in the research class. The gain score of the ability to write research proposals is also obtained from the gap between the initial and final proposals. The research also uses secondary data in the form of school documents. Data is collected through tests (pretest and posttest), work performance (initial and final proposals), and documentation.

The data was analyzed with parametric inferential statistics. Test of prerequisites for analysis with normality and homogeneity. Test normality with Saphiro-Wilk because the number of samples is less than 50. Homogeneity test with Levene Test. The hypothesis Test used MANOVA. Figure 1 shows the research flowchart.
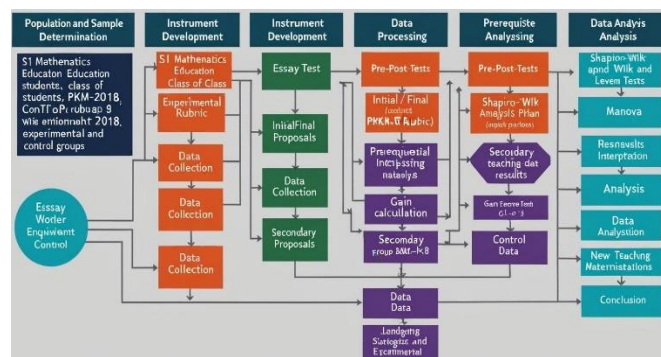

Figure 1. Research Flowchart

Result and Discussion

The normality test results obtained through the Shapiro-Wilk method, conducted using SPSS 21.0 for Windows, demonstrated that the learning outcomes of both the experimental and control classes were normally distributed. Specifically, the significance value for the experimental class was 0.222, while the control class showed a significance value of 0.208. Both values are

well above the threshold of 0.05, confirming the normal distribution of gain scores for each group. These results reinforce the validity of subsequent statistical analyses, as the assumption of normality is a critical prerequisite for many parametric tests. Moreover, these findings are consistent with prior research that employed similar normality assessments using the One-Sample Kolmogorov-Smirnov test (Aliman et al., 2019; Shana & Abulibdeh, 2020; Sumarmi et al., 2021). The alignment with these studies further supports the robustness of the results and highlights the reliability of the methods used in evaluating the distribution of learning outcomes in experimental and control groups. Such consistency underscores the applicability of the normality tests for educational research and provides a foundation for interpreting the effects of experimental interventions on learning outcomes.

The normality test conducted for the experimental and control class variables in the research proposal indicates that both datasets follow a normal distribution. For the experimental class, the significance value was determined to be 0.661, while the control class yielded a significance value of 0.112. These values surpass the standard threshold of 0.05, confirming that the null hypothesis of normal distribution cannot be rejected. This suggests that the data for both groups is adequately modeled by a normal distribution, validating the assumption required for further parametric statistical analysis. This implies that the gain scores for the research proposals in both the experimental and control groups follow a normal distribution pattern. Table 1 provides a detailed summary of the gain score normality test results using the Shapiro-Wilk method, further validating the assumption of normality in the data.

Table 1. Normality Test Results

Variable	Class	Shapiro-Wilk Significance
Learning Outcomes	Experiment	0.222
Learning Outcomes	Control	0.208
Research Proposal	Experiment	0.661
Research Proposal	Control	0.112

The results of the homogeneity test, conducted using the Levene Statistic with SPSS 21.0 for Windows, reveal consistent findings across variables. For learning outcomes, the test produced a significant value of 0.356, greater than the threshold of 0.05, signifying that the gain scores for learning outcomes are homogeneously distributed. Similarly, the homogeneity test for the research proposal variable yielded a significant value of 0.691, exceeding the 0.05 threshold. This indicates that the gain scores for research proposals exhibit a homogeneous distribution. These findings align with standard practices in statistical analysis, where the

Levene Test is commonly employed to assess the assumption of homogeneity of variances (Sumarmi et al., 2022; Sumarmi, et al., 2021). The results support the robustness of subsequent analyses that depend on this assumption being met. Table 2 summarizes the homogeneity test results with Levene Statistic for the gain score.

Table 2. Homogeneity Test Results

Variable	Levene Statistical Significance
Learning Outcomes	0.691
Research Proposal	0.356

The findings from the prerequisite and hypothesis tests underscore the efficacy of applying teaching material development in RTM to enhance student learning outcomes. The gain score analysis revealed that both learning outcomes and the ability to write research proposals demonstrated normal and homogeneous distributions, affirming the robustness of the data. Furthermore, the hypothesis test, conducted through MANOVA with SPSS 21.0 for Windows, produced a significant value of 0.000. This result, being well below the threshold of 0.05, confirms the acceptance of the hypothesis. These outcomes suggest that the structured application of RTM significantly impacts the students' academic achievements, particularly in their ability to grasp and apply research methodologies effectively. The evidence highlights the critical role of well-developed teaching materials in fostering deeper understanding and skill acquisition, underscoring their importance in academic environments committed to excellence in learning and research.

The results of the hypothesis test on the application of the development of teaching materials for research and teaching methodologies with the ability to write student research proposals amounted to 0.000. The significance value is less than 0.05, which indicates that the hypothesis is accepted. This shows that the application of teaching material development in research and teaching methodologies influences students' ability to write research proposals.

The variables of learning outcomes and students' ability to write research proposals have a significant value of 0.000. Both significance values are less than 0.05. It can be concluded that the application of the development of teaching materials research and teaching methodologies influences learning outcomes and the ability to write student research proposals. MANOVA analyzed more than one variable to generate influence (Kim & Md-Ali, 2017). The variable significance value is also supported by the significance value of MANOVA analysis based on Pillai's Trace,

Wilks' Lamda, Hotelling's Trace, and Roy's Largest Root, which gets a significance value 0.000.

The learning outcomes of the experimental and control classes in the pretest had the same value as the tendency to be greater in the dick class. The same ability in the initial test and the previous semester's score are the reasons for choosing the experimental class (Amaluddin et al., 2019). The average distribution of scores from the first to the fifth question is always larger than that of the control class. The average total score was also 4.09, greater than that of the control class compared to the experimental class. The unique thing about the initial learning outcome is the value of the second question related to the study of the library, which has a close difference. Knowledge of literature study is easy to find in students (Djidu et al., 2021; Sejati et al., 2016). Figure 2 shows the average score of question items in the experimental and control classes in the pretest.
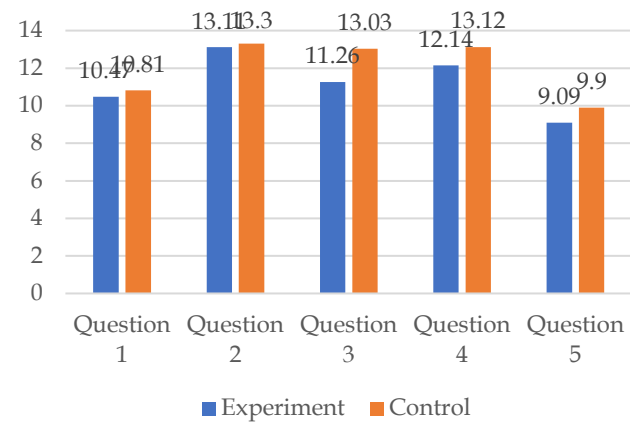

Figure 2. Average Pretest Score of The Experimental Class and Control Class Questions

The learning outcomes of the experimental and control classes in the posttest have different values from those of larger experimental classes. The average distribution of scores from the first to the fifth question is always larger than that of the experimental class. The average total score was also 14.23, greater than the control class's. There was an increase in the experimental class in all question items, with question number five related to the research instrument having the largest increase. This is because the material and summary in the teaching materials are very technical, with examples of research instruments according to the type of research. The instrument was developed from the results of research that has been carried out (Kuntarto et al., 2019).

Question four, related to the bibliography and citations, has a similar value because the teaching materials have not technically written about the

bibliography list or reference managers such as Mendeley or Zotero. Mendeley should be applied to the CPM guidelines in writing (Nizam & Junaidi, 2021). Figure 3 shows the average score of question items in the experimental and control classes in the post-test.
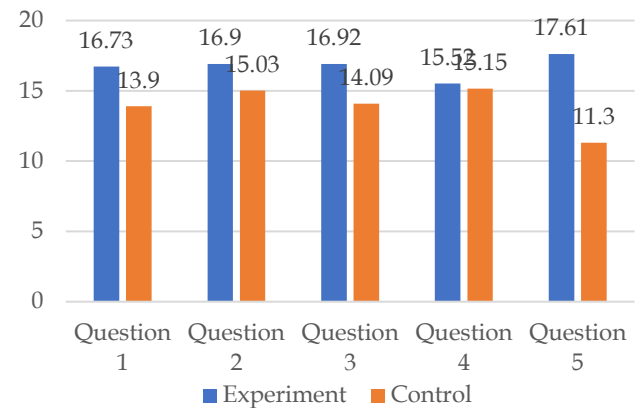

Figure 3. Average posttest score of the experimental class and control class questions

The ability to write research proposals for experimental and control classes in early works has the same value as the tendency to be greater in the dick class. The average spread of the first part of the proposal to the fourth part is always larger than the control class, except for the potential part of the proposal, which is 0.01 greater than the experimental class. The average total score was also 0.27, greater than the control class compared to the experimental class.

The unique thing about the initial research proposal is that the value of the third part related to the potential of the proposal has a close difference. This shows the ability to relate to the potential of proposals in which elements of literature study are easy for students to find and master. The research class can master literature review in scientific paper writing research (Sejati et al., 2017). Table 3 shows the average score of the research proposal section in the experimental and control classes at the initial collection.

Table 3. Average Score of The Initial Research Proposal Section of The Experimental Class and Control Class

Average Score	Experiment	Control
Creativeness	22.83	22.87
Method	8.38	8.45
Potential Proposals	23.97	23.96
Implementation Opportunities	4.90	5.06
Total Score	60.09	60.36

The findings indicate a significant difference in the ability to write research proposals between the experimental and control classes, particularly as observed in the post-test results. The experimental class

consistently demonstrated higher scores across all four proposal sections, reflecting a stronger grasp of the material and a more comprehensive understanding of research proposal writing. This trend is further supported by the overall average score, where the experimental class achieved a notable margin of 7.76 points higher than the control class. These results highlight the effectiveness of the intervention or teaching strategy implemented in the experimental class, suggesting that it positively impacted the student's ability to structure, analyze, and articulate their research proposals with clarity and depth. The total average indicates the influence of variables that strengthen the hypothesis test results (Sejati et al., 2016).

The experimental class increased in all parts of the proposal, with the third part, which was related to the proposal's potential, having the greatest increase. This is because the exercises in the teaching materials are very technical in terms of the benefits and contributions to the development of science and technology. Structured exercises make it easier for someone to master writing skills (Singh et al., 2020).

The fourth part, related to opportunities for online implementation and health protocols, has close value because the teaching materials have not technically written about the research situation during the COVID-19 pandemic. Implementation of activities during the pandemic with various breakthroughs needs to be done (Halil, 2020; Hariyadi et al., 2022; Saputra et al., 2021). Table 4 shows the average score of the proposal section in the experimental class and the control class in the final submission.

Table 4. Average score of the final research proposal section in the experimental class and the control class

Average Score	Experiment	Control
Creativeness	29.42	26.75
Method	13.28	10.39
Potential Proposals	33.16	30.78
Implementation Opportunities	7.95	7.93
Total Score	83.83	75.87

Implementing RTM teaching materials significantly enhances the quality of learning outcomes in the mathematics research methodology course. This improvement is largely attributed to the novelty and relevance of the materials, which were meticulously developed to fill a gap in the instructional resources provided by the course instructor. These tailored teaching materials, especially the sections focused on research proposal components, serve as a practical guide for students, enabling them to grasp complex concepts more effectively. Including comprehensive and well-structured content not only supports students in navigating the intricacies of research methodology but

also motivates them to engage with the learning process actively. High-quality teaching materials are essential for academic success, as they help students understand complex concepts and stay engaged. Studies by outcomes Biduri et al. (2018) & Sistriana et al. (2019) highlight that well-designed resources bridge theory and practice, while Sejati et al. (2021).emphasizes that complete content enables students to achieve learning goals more easily. Prioritizing effective materials ensures better outcomes and fosters lifelong learning.

Introductory material, theoretical studies, methodologies spread across populations, samples, research subjects, data, data analysis, and research instruments make it easier for students to understand the ins and outs of mathematics research methodology. Research instruments have the highest increase because the examples given in the teaching materials are very technical. The method is the second increase because the material in the complex process is spread across populations, samples, research subjects, data, and data analysis. The organization of the material is a factor that improves the interaction in learning (Sejati et al., 2019).

The inclusion of summaries in teaching materials plays a crucial role in enhancing students' learning experiences. Summaries serve as concise reiterations of key concepts and ideas covered in the main content, enabling students to consolidate their understanding effectively. By highlighting the most critical points, summaries function as a cognitive reinforcement tool, helping students retain information through repetition. This approach aligns with the principle that repeated exposure to learning material fosters habitual mastery and improves knowledge retention (Harun et al., 2017). Specifically, in courses like mathematics research methodology, where complex theories and processes are involved, summaries act as a bridge between theoretical understanding and practical application. They empower students to revisit essential content with ease, facilitating independent study and promoting deeper engagement with the material. Consequently, the strategic use of summaries not only supports academic success but also instills confidence in students as they progress through their learning journey.

The improvement in this teaching material is not writing a reference manager or how to write citations and bibliographies in full. This makes the scores in the experimental and control classes less prominent. Likewise, in the literature review, although there is already special material in the teaching material, the details of the material still need to be improved. The bibliography is an important thing that needs to be learned when writing scientific papers (LaPlaca et al., 2018).

The application of teaching materials for research methodology and teaching student research proposals

had an influence. Student proposal assessment follows PKM-R Nizam & Junaidi (2021) with a creative section comprising original, unique, valuable ideas, problem formulation, and state-of-the-art. The suitability and sophistication of the research methods section. The potential program section consists of contributions to the development of science and technology, literature review synthesis, potential and prediction of research results, and benefits. The opportunity section is for online implementation and health protocols.

Practice in teaching materials improves students' abilities in compiling backgrounds, literature reviews, and especially research methodology. Repeated practice is vital to mastering scientific writing skills (Shubrook et al., 2012). Teaching materials have not covered research techniques during the COVID-19 pandemic, so they do not provide many changes in assessing the opportunity component for online implementation and Health protocols.

Skills and Practice are interrelated. Repeated and focused practice makes the abilities related to Practice good (Halil, 2016; Jailani et al., 2020). This occurs in the Exercise on the research methodology and teaching module, which helps students improve their research proposal writing skills, especially in the mathematics research methodology course.

The findings from this study align with previous research emphasizing the importance of well-developed teaching materials in enhancing student learning outcomes. For instance, Biduri et al. (2018) and Sistriana et al. (2019) highlighted that high-quality teaching materials bridge the gap between theoretical knowledge and practical application, facilitating better comprehension and retention of complex concepts. Similarly, Sejati et al. (2021) emphasized that well-structured, complete content in teaching resources allows students to achieve learning objectives more efficiently, fostering a deeper understanding of the subject matter. These prior studies reinforce the argument that the development of teaching materials tailored to specific learning outcomes, like research proposal writing, significantly boosts students' academic performance. The findings of this research contribute to this body of knowledge by demonstrating that the systematic application of research teaching materials in mathematics research methodology courses led to a substantial improvement in students' ability to understand and apply research methodologies in their proposals, aligning with the positive impacts noted in earlier studies.

Furthermore, the significant increase in students' ability to write research proposals as a result of using RTM teaching materials in this study is supported by the research conducted by Sejati et al. (2016) and Kuntarto et al. (2019), who found that structured teaching materials have a direct impact on the quality of students' research proposals. Sejati et al. (2016) emphasized that comprehensive teaching materials enhance students' capacity to master writing research proposals, particularly by facilitating better organization and articulation of ideas. and Kuntarto et al. (2019) echoed these findings, noting that well-designed teaching modules enable students to engage with research instruments and methods effectively. This research supports the idea that structured materials, particularly those that include practical examples and detailed instructions, significantly aid students in improving their research proposal writing skills. The increase in students' post-test scores in all sections of the proposal, especially in areas like research instruments, aligns with these studies, underlining the positive impact of RTM materials on student performance in research methodology courses.

Conclusion

The development of structured and relevant teaching materials in the research methodology course significantly improves students' learning outcomes and the ability to write research proposals. The most striking improvement occurred in the proposal section related to research instruments, which was caused by the highly technical material in the teaching materials. There are still several aspects, such as citation and bibliography management, that require further improvement. Overall, this study strengthens the findings of previous studies showing that quality teaching materials can improve understanding of complex concepts and support the achievement of learning objectives more effectively.

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