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The Impact of Implementing a Collaborative Learning Model on the Learning Independence of Prospective Science Teacher Students in Developing Educational Media.

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ABSTRAK

Kemandirian belajar merupakan kompetensi penting yang harus dimiliki calon guru dalam menghadapi tantangan pendidikan abad ke-21. Penelitian ini bertujuan untuk mengkaji pengaruh penerapan model pembelajaran kolaboratif terhadap kemandirian belajar mahasiswa calon guru sains dalam mengembangkan media pembelajaran. Penelitian menggunakan pendekatan *mixed methods* dengan desain kuasi eksperimen *posttest-only non-equivalent control group*. Sampel terdiri dari 34 mahasiswa dari salah satu perguruan tinggi negeri di Indonesia, yang dibagi ke dalam kelas eksperimen dan kelas kontrol. Kelas eksperimen menerapkan model pembelajaran kolaboratif, sedangkan kelas kontrol menggunakan pembelajaran konvensional berbasis ceramah dan tugas individu. Data dikumpulkan melalui angket kemandirian belajar, jurnal refleksi, dan lembar observasi. Analisis data dilakukan melalui uji normalitas, homogenitas, dan uji-t independen. Hasil analisis menunjukkan terdapat perbedaan signifikan antara kedua kelompok ($t(32) = 3{,}412$; $p = 0{,}002$), dengan skor kemandirian belajar lebih tinggi pada kelas eksperimen. Selain itu, kualitas media pembelajaran yang dihasilkan mahasiswa kelas eksperimen menunjukkan keunggulan dalam aspek orisinalitas, keterpaduan isi, ketepatan sasaran, dan pemanfaatan teknologi. Penelitian ini menyimpulkan bahwa pembelajaran kolaboratif efektif dalam meningkatkan kemandirian belajar dan mutu karya mahasiswa. Implikasinya, model ini layak diintegrasikan dalam kurikulum pendidikan guru untuk mendukung pengembangan keterampilan abad ke-21.

Kata Kunci: kemandirian belajar, media pembelajaran, pembelajaran kolaboratif

ABSTRACT

Learning independence is an important competency that prospective teachers must possess in facing the challenges of 21st-century education. This study aims to examine the effect of implementing a collaborative learning model on the learning independence of prospective science teacher students in developing learning media. The study used a mixed methods approach with a quasi-experimental posttest-only non-equivalent control group design. The sample consisted of 34 students from one of the state universities in Indonesia, who were divided into an experimental class and a control class. The experimental class implemented a collaborative learning model, while the control class used conventional learning based on lectures and individual assignments. Data were collected through a learning independence questionnaire, reflection journals, and observation sheets. Data analysis was carried out through normality tests, homogeneity tests, and independent t-tests. The results of the analysis showed a significant difference between the two groups ($t(32) = 3.412$; $p = 0.002$), with higher learning independence scores in the experimental class. In addition, the quality of the learning media produced by students in the experimental class showed excellence in aspects of originality, content integration, target accuracy, and technology utilization. This study concluded that collaborative learning is efficacious in improving learning independence and the quality of student work. The implication is that this model is worthy of being integrated into the teacher education curriculum to support the development of 21st-century skills.

***Keywords**: collaborative learning, learning independence, learning media*

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INTRODUCTION

Fostering independent learning is an essential element that must be prioritised in education, particularly for future educators. Independent learning refers to an individual's capacity to autonomously manage and regulate their educational process without dependence on external assistance. This is essential for aspiring educators, since they must comprehend the topic and adeptly facilitate the learning process. Prior academics have undertaken multiple studies to improve autonomous learning among students, utilising diverse methodologies and educational frameworks.

Researchers have conducted numerous studies and formulated learning models to enhance various cognitive, affective, and psychomotor dimensions of students ((Linda Mauliana et al., 2025; Mashuri, 2015; Mashuri et al., 2016, 2024, 2025; Maziah & Wardhani, 2019; Muktar et al., 2023; Solehah & Mashuri, 2018; Sukarsih et al., 2018). A learning approach that can enhance students' autonomy is the collaborative learning model (Mashuri et al., 2024, 2025). The collaborative learning model is an educational technique that prioritises cooperation among students in small groups to attain common learning objectives. This methodology boosts academic capabilities while simultaneously cultivating social skills such as communication, collaboration, and dispute resolution. In the realm of scientific teacher education, the implementation of collaborative learning models can yield more significant and pertinent learning experiences, particularly in the development of educational media.

A more significant learning experience that directly correlates with daily life would enhance students' motivation and engagement in learning. Students will possess a greater familiarity with the chemistry subjects and concepts they are studying than if they were to learn exclusively from literature. This difference results in heightened student interest and motivation, which will later influence their learning autonomy during the educational process. The capacity to create educational material is an essential quality for aspiring scientific educators. This commences with recognising the significance of media in the educational process. Educational media is an essential instrument in the learning process, as it facilitates the effective and interesting delivery of open-ended content. Aspiring scientific educators must have the ability to develop and produce creative educational materials customised to meet student requirements. Consequently, the implementation of collaborative learning

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models in the development of educational media is anticipated to improve the learning autonomy of future scientific educators.

This study seeks to investigate the impact of a collaborative learning model on the learning autonomy of science teacher students in the development of educational media. This research will enhance the understanding of the efficacy of collaborative learning models and contribute to the advancement of more successful educational approaches in higher education, especially within science teacher education programs.

RESEARCH METHOD

This research utilised a quasi-experimental method to examine the effect of a collaborative learning model on the learning autonomy of prospective science teachers. A mixed methods approach was utilised, integrating quantitative and qualitative techniques to achieve a more thorough comprehension of the phenomenon being examined. This study utilised a mixed-methods approach to assess the efficacy of the collaborative learning model and to examine prospective science teachers' experiences during its execution.

Qualitative data were acquired using Likert scale scores from a questionnaire assessing the learning independence of aspiring science educators. The learning independence questionnaire comprised 30 statements derived from six principal indicators: 1) autonomy from others, 2) self-assurance, 3) disciplined behaviour, 4) sense of responsibility, 5) initiative-driven conduct, and 6) self-regulation (Hidayati & Listyani, 2010). The study population comprised all prospective science teacher students enrolled in the fourth-semester Learning Media course of the Biology Science Education Study Program at the State Islamic University of Mataram for the 2023-2024 academic year. The research sample was chosen using purposive sampling, a technique utilised in this study to attain data saturation. A learning independence questionnaire was employed to assess the degree of student learning autonomy following the implementation of the collaborative learning model, complemented by a reflection journal from prospective teachers and an observation sheet to monitor group dynamics and the collaboration process during the model's execution.

A statistical test, namely the independent t-test, was employed to analyse data on learning independence. The assessment was performed to compare the outcomes of the learning independence posttest between the experimental group and the control group. The

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instrument's validity was evaluated via content validity by consulting three experts to determine its appropriateness for the research aims. The instrument's reliability was evaluated using Cronbach's Alpha test, conducted with SPSS version 22 to determine the questionnaire's internal consistency. This study utilises a quasi-experimental design and a mixed-methods approach to quantitatively evaluate the effects of the collaborative learning model on learning independence while also providing comprehensive qualitative insights into students' experiences during its implementation.

RESULTS & DISCUSSION

The validity assessment of the learning independence questionnaire instrument was performed via Pearson's Product-Moment correlation analysis. Out of the 30 statements, 27 items were deemed legitimate (r count > r table, $p < 0.05$). The reliability test utilised the Cronbach's Alpha formula, yielding a reliability coefficient of 0.876, categorising it as extremely high and confirming the instrument's appropriateness for this study. Additionally, Table 1 provides a comprehensive summary of the degree of learning autonomy among students in both the experimental and control groups.

Table 1. Learning independence score

Class	N	Mean	Standard Deviation
Experiment	17	82,35	5,21
Control	17	75,12	6,14

The Shapiro-Wilk Normality Test indicated that the data from both groups exhibited a normal distribution ($p > 0.05$). Levene's Homogeneity Test produced a p-value of 0.342, beyond 0.05, signifying that the variances of both groups are homogenous. Table 2 presents the outcomes of the independent t-test comparing learning independence scores between the experimental and control groups.

Table 2. Independent sample t-test result

Test Statistics	Value
t	3,412
Degrees of freedom (df)	32
Sig. (2-tailed)	0,002
α (alpha)	0,05
Conclusion	Significant

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Analysis of reflection journal indicated that students in the experimental class had heightened motivation, responsibility, and confidence in creating learning media. They additionally noted enhanced collaboration and efficient task distribution. Observations during the educational process indicated that prospective science teachers in the experimental group exhibited greater engagement in conversations, displayed initiative in the design and creation of media, and offered constructive comments to their peers. This was not regularly observed in the control class, where prospective science teachers interactions were predominantly individual and passive. The assessment results of the developed media products indicated that the experimental class created learning media that were more inventive and aligned with the characteristics of science content and the requirements of high school students. The evaluation criteria encompassed design elements, interaction, material precision, and the capacity for student participation.

Traditional lecture-based instruction and collaborative learning represent two distinct facets of the educational process. The two learning techniques or models possess distinct qualities, objectives, and effects on the educational experiences of potential teacher students. Traditional lecture-based education positions the instructor as the primary source of information, delivering content while students remain passive recipients. The instructor delivers oral explanations on a designated subject, and students are anticipated to listen, take notes, and comprehend the content delivered. Lectures possess numerous fundamental attributes: 1) instructor-centered, 2) inflexible framework, 3) uniform evaluation, and 4) effective transmission of content.

The educator is the focal point of the educational process and serves as the exclusive provider of information during lectures. Students engage in passive listening and note-taking instead of interacting or participating actively. Lectures generally possess a defined and inflexible format, characterised by minimal contact between students and the instructor. The time allocated for discussion or questions and answers is restricted and typically takes place at the conclusion of the learning session. Evaluation in this learning modality frequently relies on written examinations and solitary tasks that measure students' capacity to memorise and replicate material. Nonetheless, lectures are effective at disseminating substantial information to several pupils within a brief timeframe. This is advantageous in scenarios requiring the rapid communication of fundamental knowledge on a subject.

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In contrast to lectures, collaborative learning offers opportunity for students to engage in small groups to attain common educational objectives. The educator serves as a facilitator, directing and assisting the learning process, while students remain the focal point of the educational activity. The primary attributes of collaborative learning encompass: 1) student-centredness, 2) interaction and cooperation, 3) process-oriented evaluation, and 4) the cultivation of critical thinking abilities.

Collaborative learning necessitates that students engage actively in the educational process. They participate in dialogues, cooperate, and support each other in comprehending the content and fulfilling duties. Collaborative learning prioritises student interaction. They exchange ideas, offer comments, and collaboratively devise solutions, enhancing social and communication competencies. Assessment in collaborative learning typically encompasses the evaluation of both the group work process and individual contributions, alongside the final assignment result. This may encompass self-evaluation and peer evaluation. Collaborative learning emphasises not only comprehension of the content but also the cultivation of critical thinking, problem-solving, and creativity skills. Students are urged to engage in profound contemplation, examine diverse viewpoints, and devise inventive resolutions to intricate issues.

The primary distinction between these two strategies resides in the degree of student engagement and the pedagogical style employed. Traditional lecture-based education frequently results in passive learners who may exhibit insufficient emotional involvement with the content. Students acquire the ability to memorise material but frequently encounter difficulties in applying that knowledge to real-world scenarios. Conversely, collaborative learning fosters active student participation and enhances comprehension. Students enhance their comprehension of the material while simultaneously cultivating essential interpersonal and intrapersonal skills, including collaboration, empathy, and accountability. This approach also inspires and stimulates students to exhibit greater enthusiasm for learning, since they perceive themselves as integral members of a vibrant educational community. Conventional lecture-based learning efficiently delivers material, but collaborative learning offers a more comprehensive and student-centered approach, yielding a richer and more significant educational experience.

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The findings of this study demonstrate that the use of the collaborative learning model markedly enhanced the learning autonomy of prospective science teacher students in the creation of educational media. The enhancement is evident in the elevated average learning independence score of the experimental class relative to the control class, alongside the t-test findings indicating a statistically significant difference.

The collaborative learning model offers students an environment to engage in active learning, exchange knowledge, and collaborate on tasks. This corresponds with constructivist theory, which posits that effective learning transpires when students are actively involved in the construction of knowledge through social interaction. A collaborative learning setting fosters student accountability for their educational journey, embodying the core principle of independent learning.

Moreover, qualitative data from reflective journals and observations support the quantitative findings, indicating that students in the experimental class exhibited greater initiative, motivation, and engagement. They successfully generated more inventive and pertinent learning media, demonstrating enhanced critical and creative thinking abilities that facilitate independence.

These findings align with other studies indicating that collaborative learning models can improve self-regulated learning and teamwork abilities. Consequently, the use of collaborative methodologies in the training of future science educators is strongly advocated as a means to cultivate independent, innovative, and flexible instructors suited to the requirements of 21st-century education.

CONCLUSION

The use of a collaborative learning approach has demonstrated a beneficial effect on enhancing the learning autonomy of prospective science teachers in developing instructional media. This conclusion is substantiated by questionnaires, reflective journals, observations, and tangible items created by prospective science teachers.

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