

The influence of blended learning using the science technology society approach on learning independence

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Abstract: Independent learning facilitates students in improving their competencies according to the challenges of the current era. However, learning in schools often does not empower students to become independent learners. This research aims to find out whether the application of blended learning with the Science Technology Society (STS) approach can increase student independence in learning or not. This research is quantitative. The sample for this research was students from the informatics engineering and communication science study program at Dr Soetomo University. The instrument used in this research was a questionnaire. Questionnaires are used to find out information about independence. Data analysis involved conducting normality and homogeneity tests, followed by an independent sample test. The results of the analysis suggest an influence of blended learning with an STS approach on learning independence in higher education ($t = 21.246$, $p < 0.001$), implying the potential effectiveness of integrating STS principles into educational practices to foster greater autonomy among students.

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1. Introduction

In the current era, independent learning competencies are considered crucial for students (Kárpáti & Filep, 2023). Rapid technological developments and massive globalization in various aspects of life and job competition are characteristics of the current era (Knez et al., 2022). These condition force individuals to be able to become self-directed learners who can adapt to various challenges and opportunities (Marope, 2014). Independent learners can regulate their own learning methods, which is an essential component for lifelong learning. Students can become individuals who are able to determine their goals, identify their needs, and reflect on their way of learning through lifelong learning (Boyer et al., 2014).

Universities play an important role in accommodating students to develop independent learning skills. Higher education institutions must design curricula and forms of learning that enable students to gain experience and skills that are relevant to current developments (Rony et al., 2022). Universities must also be able to create a learning environment that stimulates thinking skills and independent skills (Krapivina, 2023). Furthermore, by using new network technology, educational institutions will be able to encourage the development of independent learning skills and good learning environment (Chen, 2022) that supports optimizing student competencies to improve processes in autonomous learning (Khompodoeva et al., 2020).

In line with technological developments, universities must also adapt blended learning (Özdemir et al., 2023). This learning combines face-to-face learning with virtual learning which involves the use of technology (Mnisi, 2023). The implementation of blended

learning is a response that educational institutions must make in the current digital era (Paudyal, 2022). By implementing blended learning, the education provided will be relevant as an effort to modernize education at universities (Salavatulina et al., 2022). The implementation of blended learning can also encourage self-regulated learning and increase student engagement (Özdemir et al., 2023). Several previous studies also reported that blended learning can accommodate students to become independent learners (Ballouk et al., 2022; Onah et al., 2020).

Apart from blended learning, learning at universities should also implement a Science Technology Society (STS)-based learning approach. STS has been used in various educational institutions to increase students' understanding of the interconnections between science, technology and society. Applying this approach can increase students' affinities and learning in science (Yoon & Olsen, 2023). Apart from that, implementing STES will also increase students' scientific literacy and awareness of environmental issues (Jumini et al., 2022). Furthermore, the STS approach also encourages improvements in learning outcomes, science process skills, and students' scientific attitudes (Meganita et al., 2022). From its various benefits, it is possible that STS also has a positive impact on improving independent learning skills, although research reporting this impact is still rare.

In contrast to STS, blended learning has been reported several times to have a positive influence on increasing independent learning competence. Several studies in various locations have confirmed this information, such as in Scotland (Wong, 2013) and other cities in Indonesia (Wahyuni, 2018; Wijanayu et al., 2018). On the other hand, the application of STS is more often researched for its effect on students' thinking skills. Therefore, to reveal the influence of STS on independent learning competence, the aim of this research is to analyze the influence of blended learning which applies the STS approach to increasing student independence in higher education.

2. Materials and Methods

The research method used in this study is descriptive quantitative research. The type of research used in this study is a quasi-experimental design, which uses models of nonequivalent control group design. Before being given treatment, both the experimental group and the control group were given pretest, with a view to knowing the state of the group before treatment. Then, after treatment, the experimental group and the control group were given posttest. An experimental group is a group that obtains application blended learning with an STS approach. Meanwhile, the control group is a group that obtains conventional learning. Figure 1 depict the quasi-experimental design model with a nonequivalent control group design used in this research (Sugiyono, 2014).

O1	X	O2
O3		O4

Figure 1. Research design (note: O1: Experimental group before being given treatment (Discipline, independence and learning outcomes); O2: Experimental group after treatment; O3: Control group before treatment; O4: Untreated control group; X: Treatment (application of Blended learning with STS approach).

Furthermore, in this study, observation instruments were used by researchers in obtaining data on learning independence. The grid used is as in the Table 1.

Table 1. Indicator of student independence

Aspects	Indicator	Statement
Level (The level of confidence of the counselor to determine the level of difficulty in the task or work that is able to be carried out.	Students with optimistic insight	The courses taken within my ability environment Successfully completing the courses taken is within the scope of my ability
	Students feel confident that they can complete their assignments as students well	Can judge my own ability Others who know me well see me as capable
Streght (the degree of consistency of counseling in doing a task or job).	Improve efforts to the best of your ability	Can do the things that need to be done to complete the courses I take When taking courses that involve multiple tasks, I will do well almost any assignment When I took courses that I didn't know before, I was able to complete the courses successfully
	Committed to carrying out duties as a student	I can usually complete every task to achieve my college goals. I am confident that I can understand the course well and can apply it in everyday life problems
Generality (the student's level of confidence and ability to generalize previous experiences)	Respond to diverse situations and conditions in a good and positive way	When asked to take courses that I didn't know much about, I was able to finish well When I took courses that were not widely known, I was able to finish well
	Rely on previous life experiences as a step to success	Past experiences and achievements have increased my confidence that I will be able to study well in college. Past experiences and achievements increased my confidence that I would successfully complete college.

3. Results

After learning was carried out using STS-based blended learning, the results of the student independence questionnaire were obtained as in [Table 2](#). Before doing the hypothesis test, normality test using the Kolmogorov-Smirnov Test were conducted, and obtained the results presented in [Table 3](#).

Table 2. Maximum value, minimum value, and average of the research sample

Class	Minimum	Maximum	Mean
Control Class	82.00	92.00	87.000
Experimental Class	91.00	100.00	95.841

Table 3. Maximum value, minimum value, and average of the research sample

Class	Assymp Sig (2 tailed)
Control Class	0.200
Experimental Class	0.200

The probability value in the control class and the experimental class was 0.200. Therefore, both samples came from normally distributed populations. Furthermore, the results of the homogeneity test in this study were carried out using the Levene's test. The results of the homogeneity test of student independence data are presented in Table 4. Based on Table 4, the data met homogeneity assumption (Sig = 0.953). Furthermore, the result of t-test is presented in Table 5. Based on the result, the application of a blended learning using STS approach significantly affects student independence, $t(124) = 21.246$, $p < 0.001$.

Table 4. Homogeneity test results

F	Sig.
0.003	0.953

Table 5. Hasil two independent sample t-test

t	df	Sig (2 tailed)
-21.246	124	<0.001

4. Discussion

The results of the study show that blended learning affects student independence. This finding supported by several results of previous research. Several studies in other locations report that the blended learning environment has a positive impact on independent learning skills, such as in Glasgow (Wong, 2013), Semarang (Wijanayu et al., 2018), and Malang (Wahyuni, 2018). Several other studies have also reported the presence of blended learning which accommodates activities related to independent learning. Research at the University of Rijeka (Croatia) reports the positive impact of using blended e-learning which involves independent learning as one of its components (Hoic-Bozic et al., 2009). Other research in Chile also combines face-to-face activities with self-directed online learning (Martínez et al., 2020) where this kind of learning can increase opportunities for independent learning. Furthermore, research in other locations also found that blended learning was able to facilitate students' involvement in class and increase their technology readiness.

Blended learning is considered to be able to optimize the learning process (Mastur, 2023). This form of learning can increase students' opportunities to learn by increasing their access to learning, thereby increasing their opportunities to learn independently (Pashine, 2022). Furthermore, this learning also increases flexibility and individual educational needs and increases the effectiveness of the educational process in higher education institutions (Chervinska et al., 2023).

Apart from the blended-learning aspect, choosing the STS approach also has a positive impact on student competence. Various previous studies have also reported the positive influence of STS on various student competencies. Applying this approach has the potential to enhance students' interest and learning in the field of science (Yoon & Olsen, 2023). Furthermore, the implementation of Science, Technology, Environment, and Society (STES) can also contribute to the development of students' scientific literacy and their awareness of environmental issues (Jumini et al., 2022). Additionally, the STS approach has been found to be associated with improvements in learning outcomes, science process skills, and students' scientific attitudes (Meganita et al., 2022). Furthermore, this approach may enhance students' science literacy and equip them with essential life skills that are aligned with the demands of the 21st century (Ntelok et al., 2022). This approach can also

encourage students to empower critical thinking skills and develop a responsible spirit regarding science and technological developments (Hansen et al., 2021).

The choice of independent learning as the focus of this research is mainly due to this competency in the current era. Independent learning competencies are considered crucial for students (Kárpáti & Filep, 2023). The current era is characterized by rapid technological developments and massive globalization in various aspects of life and job competition (Knez et al., 2022). These conditions force individuals to become self-directed learners who can adapt to various challenges and opportunities (Marope, 2014). Independent learners can regulate their own learning methods, which is an essential component for lifelong learning. Through lifelong learning (Collins, 2009), students can become individuals who are able to determine their goals, identify their needs, and reflect on their way of learning. Therefore, considering the importance of this competency, further research that explores more deeply the influence of blended learning and the STS approach on independent learning needs to be explored more deeply.

5. Conclusions

Based on the results and discussion, it was concluded that the application of Blended Learning with the STS Approach got significant results and could make students in higher education more independent in learning. Blended learning, in general, can increase independence in learning. The application of universities in learning planning needs to be emphasized on learning methods that encourage independence, one of which is with a community science and technology approach. So overall, blended learning is not only the answer to the need for flexible learning but also the key to creating student independence.

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