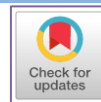# Applying problem-based learning to entrepreneurship education and innovation through an online laboratory

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Abstract: The research is essential to be conducted as the shift from traditional classroom instruction to online instruction becomes a requirement for 21st-century environmental learning. Before implementing e-learning, everything must be ready, and students' attitudes must be taken into account. This study, therefore, sought to describe students' attitudes regarding online learning in entrepreneurship courses following the implementation of problem-based learning through online laboratory entrepreneurship (PBL-OLE). The research design applied is combination of quantitative and qualitative. The analysis of the data was done with quantitative descriptive techniques. The phenomenon of students' attitudes toward e-learning was documented in a number of contexts, including the TelRA domain and students' attitudes toward economic learning. The results of the student surveys were compared and explained in this descriptive quantitative study. According to the students' attitudes toward entrepreneurship, e-learning, and gender, students' perspectives were described. 28 college students who were chosen at random from University of PGRI Jombang in economic education program in East Java, Indonesia, participated in this study as respondents. Based on the E-learning challenges, the results revealed that the mean score was. Educational Institutions must be conscientious in order to produce creative classroom instruction if it wants to increase and improve students' attitudes with regard to e-learning and business.

Keywords: Problem-Based Learning, Entrepreneurship Education, Online Laboratory, Social Media
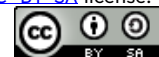
INTRODUCTION

Many industrialized countries' economic success and social stability can be directly attributed to entrepreneurship. Entrepreneurship is acknowledged in the realm of education as one of the most creative and significant factors influencing the health of a nation's competitive economy (Jena, 2020). Additionally, it is important to effectively manage the endeavor to maintain the nation's economic health in order to foster prosperity for both the nation and its people. There are a variety of actions that the government can take, such as giving citizens the chance to start their independent businesses. However, the process of establishing a citizen's working independence should start early. Every level of the educational system can begin with the educational field. A learning program called the Entrepreneurship Education Program uses years of academic study to provide expertise and knowledge (Ahmed et al., 2020). Before students

graduate from this program, it is expected that they will have acquired knowledge and expertise in entrepreneurship.

Additionally, because they possess another talent, they are not dependent on finding employment based just on their university diploma. One of the crucial components of the educational system is the entrepreneurial education program. Another phrase used to describe the educational system is teacher education, which is crucial to the process of social transformation and the way to a sustainable future (Jadmiko, Azliyanti., & Putri, 2018; Ridayanti, 2019; Nousheen et al., 2020; Alhamuddin & Zebua, 2021; Zaleha et al., 2022; Rosmiati, 2022).

Supporting students' entrepreneurial skills depends heavily on the quality of teacher education. Applying a problem-based learning paradigm is one way to raise the standard of teacher education. In problem-based learning, situations are developed together with solutions based on original research on the issues the students have raised (Lynne Wyness & Dalton, 2018). Through questioning and research into people, places, things, books, facts, and information, students who are engaged in problem-based learning utilize "exploratory approaches" to learn more and find solutions (Phungsuk, et al., 2017). Problem-based learning has currently been modified by a number of learning methods, including online learning. Both teachers and students can profit from the use of online PBL. For instance, it can enhance students' scientific argumentation abilities more so than PBL alone (Jumadi et al., 2021; Farhan et al., 2019).

The previous researchers have researched entrepreneurial skills, but they still left the research gaps since they had yet to describe further the PBL online instruction to improve entrepreneurial skills. It can be seen that Cardella, Sanchez, and Garcia (2020) only analyzed entrepreneurship and family role; Purwanto (2017) only described the way to become a successful entrepreneur; Verheul et al. (2005) only explained the allocation and productivity of time in new ventures of female and male entrepreneurs; and Afghah, Raoofi, & Hashyar (2014) had focused only on the effect of entrepreneurship on economic growth. This research is essential to fill the gap in finding out the role of applying Problem-Based Learning to entrepreneurship education and innovation through an online laboratory.

In addition, PBL online instruction helps improve students' digital literacy. An online lab business can be used as an example of four indicators: product, price, promotion, and place. Students in this online laboratory must expand their knowledge to appreciate the criteria that determine whether a product can be sold. In fact, online PBL is still underutilized in entrepreneurship education, especially in terms of identifying and improving students' attitudes about e-learning, as conventional PBL is usually used. In addition, because students were not used to using e-learning before the COVID-19 pandemic, their attitude must be taken into account before using it.

In the PBL method, students are given the freedom to explore and learn on their own while working to solve problems from real life and in challenging areas like genetics (Choden & Kijkuakul, 2020). Although problem-based learning has many advantages, research on PBL shows struggles to combine their understanding of the basic sciences with clinical applications (Khoiriyah & Wijaya, 2022) and is a teaching framework that focuses on topical issues and organizes the classroom activities so that the team develops applicable fact-based answers (Biello, et al., 2022). They also highlighted the possibility of incorporating educational materials into game situations, but few studies have thoroughly examined how students learn simultaneously considering their learning anxiety (Hwang, et al., 2017).

Agency has been examined in learning, and it has been shown that greater student agency leads to greater learning outcomes. Game-based learning environments give students the flexibility to move around a space and engage with game features that stimulate learning (Taub et al., 2020). We demonstrate significant promise for revealing students' (Liu & Israel, 2022). Unrealistic student expectations regarding the nature of learning in a PBL environment can result in the use of inefficient self-study strategies, which in turn result in substandard learning during self-study. Highlight successful learning during self-study than emphasize time spent studying, according to research, which shows that a problem-based approach positively improves students' outcomes (Rovers, et al., 2018; Wyness, 2018; Song, et al., 2022). A conclusion or problem-solving initiative was required in the final session of the PBL (Hussain, et al., 2019). The institutional and organizational frameworks of higher education must incorporate appropriate teaching methods and learning settings while also being tailored to the target audience (Fassbender, et al., 2022). The primary learning activity in PBL is small group discussion (tutorial), the required PBL components (Khoiriyah & Wijaya, 2022; Biello, et al., 2022).

Although a variety of instructional approaches encourage student-centered learning, problem-based learning is preferred because it increases student involvement by including them in the identification and resolution of emergent, unstructured situations. Everyday life-relevant issues are addressed and productively discussed.

Entrepreneurship Education

These factors should be encouraged in students of entrepreneurship to help them bounce back from failure, try again, and succeed. (Zotov, 2021; Sheng & Wang, 2022). Entrepreneurship education has the chance to provide pertinent skills to assist young people in developing resilience, independence, creativity, and the capacity to recognize possibilities in this new post-COVID-19 environment. The government initiated to address the worsening economic issues (Highfield et al., 2020). They have contributed to the development of an entrepreneurial mindset among the populace by reflecting on entrepreneurship from an academic perspective by lecturing on practical and useful or fundamental but generalizable theories (transmitting knowledge) and by disseminating the perspective to the larger community through higher education students (Mohammed et al., 2021; Sassmannshausen, 2015). Programs that promote or encourage local economic development are one possibility. As a result, each technology offers advantages and disadvantages in terms of entrepreneurship education (Pittz, 2018; Chen et al., 2021).

The entrepreneurial concept of work and the abilities of undergraduate students are also the mainstream of the future labor market, employers are now paying more and more attention to employee initiative, risk-taking spirit, pioneering spirit, self-employment ability, technical ability, social skills, and management skills, as well as professional achievements (Zhu et al., 2021; Qin et al., 2020). In deepening curriculum reform in a new chapter of basic education, fostering student effectiveness in entrepreneurship education is one of the core goals of quality-oriented education. In addition, it also provides references to prepare carriers for the effectiveness of cultivating entrepreneurship education, such as entrepreneurship education programs or incorporating the effectiveness of cultivating entrepreneurship education into interdisciplinary collaborative teaching (Rahim & Usman, 2016; Yu, 2021).

METHOD

The analysis of the data was done with quantitative descriptive techniques to describe the data and conclude the phenomena in the form of numbers as the result of tests (Sulistyawati, Wahyudi, & Trinuryono, 2022). There were 28 students were randomly chosen from the economic education program at University of PGRI Jombang in East Java, Indonesia, to participate in this study in the odd semester in academic year 2023/2024. In this study, 25 female students and 3 male students both took part. The research used the Linear Regression Test or ANOVA test to find out the indicator of students' attitudes about e-learning following learning with Problem-Based Learning with Online Learning (PBL-OLE) and the MANOVA Test to see significant variations in students' attitudes about e-learning and entrepreneurial learning (Iqbal, et.al., 2020). The research also used a questionnaire to investigate the level of students' attitudes regarding online learning. The phenomena of students' attitudes toward e-learning after using the Problem-Based Learning methodology via Online Laboratory Entrepreneurship is described in this study (PBL-OLE). The Test of e-Learning Related Attitudes (TeLRA) scale, developed by Rahim & Usman (2016), was also applied in this research to support the result of the questionnaire and ANOVA test. The Cronbach alpha for the TeLRA scale is 0.871. The 36 questions in TelRA are broken down into 12 things concerning e-learning problems, 10 items about e-learning benefits, 7 pieces about computer attitude, and 7 items about leisure.

RESULTS AND DISCUSSION

Results

The indicators of the test items used are displayed in Table 1. The phenomenon of students' attitudes toward e-learning was documented in a number of contexts, including the TelRA domain and students' attitudes toward economic learning.

Tabel 1. Indicator of the Item

Aspect	Statement	Item
E-learning challenges	Facilitating students in an e-learning environment is very difficult to do	1
	E-learning requires expensive technical support	2
	Discussion about e-learning technology is not interesting	3
	Using a computer system requires much mental effort	4
	E-learning infrastructure is very expensive	5
	E-learning increases social isolation for students.	6
	E-learning technology is difficult to use	7
	Interacting with computer systems is often frustrating	8
	E-learning reduces the quality of knowledge acquired.	9
	E-learning is a threat to teacher jobs	10
	The face-to-face method is more learner-centered than the E-learning method	11
	I feel more comfortable reading a textbook physically than on a computer screen	12
Benefits of e-learning	I believe using e-learning will improve the quality of my assignments.	13
	I believe using e-learning technology will improve my task performance.	14
	E-learning will increase teacher efficiency	15
	E-learning is very economical to be adopted by educational institutions	16
	It is easier to revise electronic educational materials than printed materials	17

Aspect	Statement	Item
	Computers make work more interesting	18
	I prefer to read articles on e-learning	19
	E-learning will give me a better learning opportunity than the traditional way of learning	20
	I prefer to use the computer to prepare my lessons.	21
	Using e-learning technology will allow me to get more work done than would otherwise be possible	22
Attitude in using computer systems	It will be difficult for me to become skilled in the use of e-learning tools.	23
	Using a computer at home is very frustrating	24
	I often make mistakes when using the Computer.	25
	I think that online interactions are unattractive	26
	Communicating via electronic mail (email etc.) is annoying	27
	Teaching through e-learning is tiring	28
	Delivering lectures through electronic technology is very difficult	29
Interest in e-learning innovation and computer use	I would like to discuss new e-learning innovations	30
	I like reading magazines about new technological innovations	31
	Working with a computer is fun	32
	I really enjoy computer games.	33
	Communicating through social networks is fun	34
	My institution has sufficient teaching and learning resources to implement e-learning	35
	I like to teach using a computer	36
The benefits of e-learning in learning Economics	I can display product design with entrepreneurship e-learning.	37
	I can display product quality with e-learning entrepreneurship.	38
	I can distribute products with entrepreneurship e-learning.	39
	I can adjust product prices with entrepreneurship e-learning.	40
	I can learn marketing communication with entrepreneurship e-learning.	41
	I can promote products with e-learning entrepreneurship	42

The rubric of the provided questionnaire was categorized as shown in Table 2 in order to ascertain the level of students' sentiments.

Tabel 2. Rubric of Questionnaire

Range	Level
x ≤ 2.00	Very low
2.00 <x ≤ 3.00	Low
3.00 <x ≤ 4.00	Moderate
4.00 <x ≤ 4.50	High
4.50 <x ≤ 5.00	Very high

Based on the aspect and gender, this section describes the students' attitudes regarding online learning. Additionally, the researcher used SPSS to evaluate the data after collecting it for the study. The outcome demonstrated a high dependability scale, with an alpha Cronbach value of 0.87. The complete outcome is displayed below; based on the Aspect, students' attitudes toward online learning. The researchers discovered the outcome of students' attitudes about e-learning based on the feature in Table 3 below after analyzing the research data.

Following the implementation of PBL-OLE, students' attitudes about e-learning are explained in Table 3 based on the analysis of their responses to the questionnaire. According to the results of the e-learning challenge, "I feel uncomfortable reading textbooks on a computer screen rather than physical textbooks" had the highest average indicator for entrepreneurial students, scoring 3.61 (medium); the indicator with the lowest average score was "E-learning is a threat to teacher work," scoring 2.43

(low). This result is comparable to that (Dahan Golan et al., 2018), which demonstrated that students preferred to read from screens. (Loh & Sun, 2019) It demonstrates that as teenagers, they start to read more online rather than offline. This demonstration is due to teenagers reading online.

Tabel 3. Students Attitude toward E-Learning Based on the Aspect

Aspect	Mean	SD	Description
E-learning challenges	2.92	1.09	Low
Benefits of e-learning	3.71	0.85	Moderate
Attitude in using computer systems	2.79	0.96	Low
Interest in e-learning innovation and computer use	3.66	0.86	Moderate
The benefits of e-learning in learning Entrepreneurship	3.89	0.79	Moderate
Overall	3.35	1.03	Moderate

The advantage of the e-learning domain is that "Computers make work more exciting" has the greatest average, and "I prefer reading articles in e-learning" has the lowest average, both with scores of 3.39 (moderate). The lowest indicator is "Using e-learning technologies would allow me to accomplish more work than would otherwise be possible" (item 6) with a score of 2.64, while the highest mean is "I make errors frequently while using a computer" with a score of 3.00 (moderate) (low), this is due to the fact that using technology has increased both students' and lecturers' enjoyment of the teaching and learning process (Roy, 2019). Additionally, computers enable teachers to dramatically customize lessons (Tamara, 2020).

The highest average indicator of entrepreneurial students is "Delivering a lecture through electronic technologies is very difficult," scoring 3.85 (moderate), while the lowest indicator is "I enjoy computer games very much," scoring 3.32. These results are based on interest in e-learning innovation and computer use (moderate). I can market items with entrepreneurship e-learning, which has a score of 4.04 (high) on the advantages of e-learning in the economics indicator scale. At the same time, I can display product design with entrepreneurship e-learning, which has a score of 3.68. Even game-based education has the power to inspire and develop students (Gallegos et al., 2017).

Additionally, he found that game-based learning applications increased student engagement (Khan et al., 2017). Using a Linear Regression test, we also looked at the indicator of students' attitudes about e-learning following learning with PBL-OLE. Table 4 displays the outcome:

Tabel 4. One-way ANOVA test results

Model	df	Mean Square	F	Sig
Regression	24	2.089	10.143	.000[a]
Residual	23	.206		
Total	27			

Tabel 5. Result of Multiple Regressions

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.944	.811		1.164	.256
indicator1	.095	.241	.083	.394	.697
indicator2	.597	.265	.546	2.255	.034
indicator3	-.153	.216	-.161	-.709	.486
indicator4	.244	.257	.221	.947	.353

a. Dependent Variable: Attitude

Indicators 1-4 have a simultaneous impact on students' views about e-learning after being taught using PBL-OLE, according to Table 4. The next analysis will determine whether each indicator has a marginal influence on students' attitudes following PBL-OLE instruction. Multiple regression techniques were used to conduct the analysis, and Table 5 shows the findings. Only indicator 2 (Benefits of e-learning), according to Table 5, has a marginal impact on students' attitudes about e-learning.

In this section, the students' attitudes towards e-learning after learning with PBL-OLE were described according to gender. The results can be seen in Table 6:

Tabel 6. Student's Attitude Based Gender

Aspect	Male			Female		
	Mean	SD	Description	Mean	SD	Description
E-learning challenges	3.25	0.80	Moderate	2.88	1.12	Low
Benefits of e-learning	3.53	0.89	Moderate	3.72	0.84	Moderate
Attitude in using computer systems	2.95	0.80	Low	2.77	0.97	Low
Interest in e-learning innovation and computer use	3.54	0.90	Moderate	3.68	0.84	Moderate
The benefits of e-learning in learning Economics	4.00	0.76	Moderate	3.86	0.79	Moderate
Overall	3.42	0.89	Moderate	3.34	1.05	Moderate

The highest mean indicator for male students, according to the e-learning challenges indicator, is "E-learning requires expensive technical support," which received a score of 4.0 (moderate), while the lowest indicator, "Interacting with the computer system is often frustrating," received a score of 2.33 (low). The lowest mean indicator is that Discussions on e-learning technologies are dull, with a score of 2.40, while the highest mean indicator for female students is "I feel uncomfortable reading a textbook on a computer screen than a real textbook (Mirza et al., 2021). These findings mirror those of (Khan et al., 2017), where the majority of pupils chose e-books for reading academic materials (Rahman et al., 2019). The majority of pupils prefer to read on technological devices.

According to the benefits of e-learning indicator, the highest mean indicator for male students is "I believe using e-learning will improve the quality of my work," with a score of 3.00, while the lowest is "Using e-learning technologies will allow me to accomplish more work than would otherwise be possible," with a score of 4.3 (high) (low). The lowest indicator for female students is "I prefer reading articles in e-learning," with a score of 3.44, while the highest mean for female students is "Computers make work more fun," with a score of 3.96 (moderate) (moderate). (Jin et al., 2018) Male students demonstrated that engaging in playful learning activities was more enjoyable and amusing than it was for female students (Bagon et al., 2018). According to the indicator for attitudes about utilizing computer systems, the greatest mean attitude among female students is "I frequently make mistakes when using a computer," scoring 3.00 (poor), while the lowest is "Teaching through e-learning is monotonous," scoring 2.60 (low). The highest mean for men was "I find computer internet interaction unexciting," which had a moderate score of 3.67, while the lowest was "Communicating through electronic mail is unpleasant," which received a score of 2.33 (low).

The highest mean indicator for male students on the interest in e-learning innovation and computer use indicator is "Communicating through social networks is fun," with a score of 4.00 (moderate), while the lowest is " Working with computers is fascinating," with a score of 3.00 (low). The lowest indicator for female students is "I enjoy computer games very lot," with a score of 3.28, while the highest mean for female students is "My institution has enough teaching-learning resources to carry out e-learning," with a score

of 3.84 (moderate). Boys liked receiving likes and comments from their friends on social media (Yau & Reich, 2019). Men's propensity to seek out novelties and new technology, which have a higher impact on hedonic outcomes, was discovered in research on gender effects.

The greatest mean indicator of male students on the benefits of e-learning in studying entrepreneurship is "I can distribute products with entrepreneurship e-learning," scoring 4.67 (high), while the lowest is "I can display product design with entrepreneurship e-learning," scoring 3.67 (medium). I can advertise items with entrepreneurship e-learning having the greatest mean for female students and a score of 4.04 (high). At the same time, I can display that product design with entrepreneurship e-learning has the lowest mean for female students and a score of 3.68 (moderate). Male students exhibit a more positive attitude than female students (Al-Jaberi, 2018), which is supported by research. The ongoing interaction between experience using computer programs and technology improves self-efficacy and self-confidence in online learning.

The Manova test was used to determine whether gender-based had significant variations in student attitudes about e-learning and entrepreneurial learning in order to deepen our understanding. When the sig value is > 0.05, there are no gender-based differences that are statistically significant. Other research revealed that views and use of e-learning did not significantly differ between male and female students (Ghenghesh et al., 2018). Additionally, as shown by both quantitative and qualitative analyses, students generally have a positive attitude toward online learning (Rafiq, 2020). Table 7 lists the aspects of students' attitudes about e-learning and entrepreneurship that do not significantly change based on gender:

Tabel 7. Students' Attitude E-Learning and Entrepreneurship Based on Gender

Source	Dependent Variable	df	Mean Square	F	Sig.
Gender	Indicator1	1	.360	.976	.332
	indicator2	1	.102	.243	.626
	indicator3	1	.082	.149	.703
	indicator4	1	.056	.137	.714
	indicator5	1	.034	.069	.795

Referring to the findings (Table 7), it shows that the findings support the statements stated by Kijkuakul (2022) who confirms that the PBL method can help students to show freedom to explore and learn on their own while working to solve problems from real life and in challenging areas like genetics and PBL method has shown positive attitudes and positive outcome (Rovers, et al., 2018; Wyness, 2018; Song, et al., 2022; Hussain, et al., 2019; Khoiriyah & Wijaya, 2022; Biello, et al., 2022) while male students exhibit a more positive attitude than female students (Al-Jaberi, 2018).

This research also confirms new things that have not been stated by the previous researchers, namely: (1) PBL is helpful in learning process when it is supported with online reading and e-learning as well. If PBL is done without e learning, it will be uninteresting, (2) The discussion method as one of steps in PBL seems unsuccessful when there's no technology support or using conventional method.

CONCLUSION

After PBL-OLE was introduced via the online entrepreneurship laboratory, students' views about e-learning and entrepreneurship were generally at a moderate level. Not all e-learning attitude markers are favorably associated with entrepreneurship. The opinions of students regarding entrepreneurship and e-learning did not change significantly

based on gender. To improve and increase students' attitudes toward e-learning and entrepreneurship, educational institutions should concentrate on generating creative learning. The study's drawback, though, is that it only assesses students' sentiments during their final semester; it needs to assess their attitudes throughout previous semesters. Additionally, the reasons behind students' negative attitudes towards entrepreneurship and online learning need to be clearly stated. Further study can be done by examining the factors that contributed to the poor views that students had about entrepreneurship and e-learning over all semesters, not just the most recent one.

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