Problem-based learning with library e-resources to enhance student information literacy self-efficacy

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Abstract

Purpose – This study investigates the effectiveness of problem-based learning (PBL) in information literacy curricula using library e-resources to enhance information literacy self-efficacy (ILSE) of students in two universities in Indonesia, in Java Island (University A) and Sumatra Island (University B).

Design/methodology/approach – A comparison of the effectiveness of the approach in the two universities forms the focus of the study, which has adopted a single group quasi-experimental design which was conducted in one online teaching-learning session. The authors compared the pre-test and post-test scores of 65 library and information science (LIS) students from both universities.

Findings – The results show that the treatment enhanced ILSE effectively. After the treatment, University A students performed better than those at University B.

Research limitations/implications – The factors which affected the success of PBL using library e-resources have not been identified in this study, a task for a future qualitative research study.

Practical implications – This study will both inspire the use of library e-resources in learning activities and promote ILSE.

Originality/value – Integrating PBL with library e-resources provides opportunity to identify the advantages of library e-resources in supporting student ILSE, resulting a better learning achievement.

Keywords Problem-based learning, Library e-resources, Information literacy, Self-efficacy, Information literacy self-efficacy, Indonesian universities

**Paper type** Research paper

Introduction

Most learners today tend to be frequent users of both computers and the Internet to seek the information related to their academic activities (Chuang *et al.*, 2015), and Google has become one of the primary search tools (Swanson and Green, 2011), especially for students. Usually, they use it to solve their academic problems (Falagas *et al.*, 2009), however searching for information in Google (or any search engine) needs a good strategy (Olfert and Arnold, 2012). Not all information contained in Google is authoritative (Flaherty, 2016), and the students have to master the skills in how to use it effectively (Olfert and Arnold, 2012). In line with this, developing information literacy (IL) skills is an integral part of the curriculum which

promotes successful study (Stričević and Rubinić, 2022), and information seeking is one of the most important skills (Uslu and Durak, 2022). There are three types of online academic help seeking, namely: (1) information searching (e.g. searching for information on Google or relevant websites), (2) formal queries (e.g. emailing teachers to request help) and (3) informal queries (e.g. making online requests to peers) (Cheng *et al.*, 2013; Fan and Lin, 2023). The students who prefer information searching rather than formal or informal queries are generally more confident in using the Internet and applying applications, and they are also more confident in using the Internet to learn (Fan and Lin, 2023). This suggests that students with high confidence in their information searching skills will learn effectively. Students who received IL training in the class have higher IL skills and are more confident in using library sources (Zhao *et al.*, 2023). The problem-based learning (PBL) environment of the classroom can offer cues and opportunities for students to engage and develop their IL skills. By structuring learning activities around real-world problems that require students to locate, evaluate and use information from a variety of sources, PBL can create an environment that promotes the development of students' information literacy self-efficacy (ILSE) (see Figures 1 and 2).

However, few studies have investigated what the role of library e-resources is in PBL, and the present study seeks to explore this area. Numerous studies have explored the impact of PBL on developing students' learning achievements, and problem-solving and critical thinking skills (Aslan, 2021; Hursen, 2021; Seibert, 2021), but few have considered the specific role of library e-resources in the PBL process. Library e-resources have been built differently to other web search engines, and have an explicit goal of providing elaborately selected high-quality resources to ensure they are relevant to the users' needs (Fu *et al.*, 2021). Some online databases (for example Web of Science, Scopus, etc.) that are subscribed to by a library contain selected information. They have a good reputation in the academic environment (Nicholas *et al.*, 2017), and that is why they are used by many scholars and researchers. Most online electronic library resources are the trusted sources of academic information (Ramadhan *et al.*, 2022), but most library users do not know how to use them (Hong and Thi, 2012). However, students in this era are "digital natives", they easily learn information and digital literacy (Ng, 2012). By exploring the potential of library e-resources to facilitate PBL, this study has the potential to inform pedagogical practices and curricula development in higher education. Chen and Chen (2010) summarized library e-resources' roles in PBL, and argued that a combination of PBL and library e-resources was associated with constructivist learning. Constructivist learning focuses on the process through which people acquire knowledge, and emphasizes discussions, learning environments and active explorations.
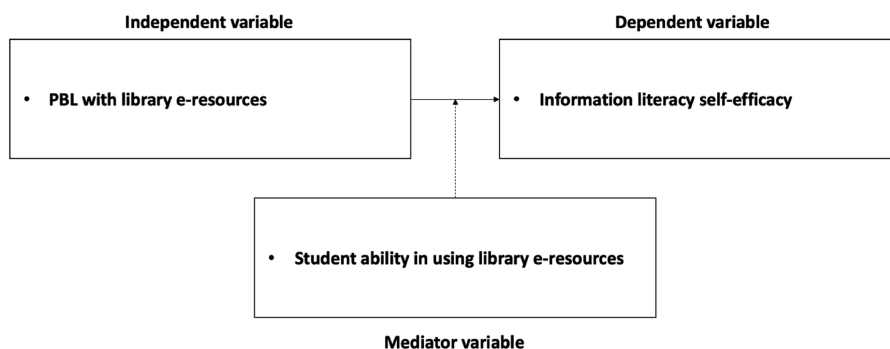
Source(s): Authors' own creation

Those main ideas are important in a library e-resources context. In other words, constructivist learning focuses on how students construct their own knowledge representations.

IL skills are needed to help students initiate search strategies, assess and comprehend information, as well as interpret, synthesize and use information. IL needs to be developed as part of the learning process (Odede, 2018) and by mastering IL, students are motivated to study more (Flierl *et al.*, 2018). Another study found that the students who never received IL instruction showed poor results in self-directed learning (Kaplan, 2022). Understanding information content and information and communications technology (ICT) competency are two important components of IL (Yu *et al.*, 2017), and to enhance IL skills those two should not be separated. Besides the two factors mentioned above, self-efficacy also contributes to the enhancing of IL skills, and a learner who has good self-efficacy has been shown to perform better in IL (Tang and Tseng, 2017). Self-efficacy is also an important facilitator of academic success. It is related to self-belief that has an impact on people's emotions, actions and motives, which in turn has a significant impact on how they handle objectives, difficulties and obligations (Tang *et al.*, 2022). Students with strong self-efficacy will embrace an academic assignment as a challenge to enhance their knowledge (Kurbanoglu and Akim, 2010). A further study has found that there is a correlation between self-efficacy in information seeking and self-efficacy in learning (Daniel, 2014). It also has a direct significant impact on the usage of e-library resources (Ramayah and Aafaqi, 2004). ILSE refers to the students' self-belief in their capacity to handle and evaluate the vast amount of information they find to support their study (Aharony and Gazit, 2020). A number of studies have found that students with higher self-efficacy have better IL skills (Adalier and Serin, 2012; Atikuzzaman and Ahmed, 2022).

In this study, the authors delivered PBL activities using library e-resources in two universities in Indonesia. University A is located in Java Island. University B is located in Sumatra Island, and has the same excellent grade as University A. PBL in those universities is expected to enhance student ILSE, since a study found that PBL has a significant impact on how students find and use information (Dodd, 2007). This study aims to examine the effectiveness of PBL using library e-resources in the IL curricula in the LIS departments in University A and University B. The authors wished also to examine the difference of PBL effectiveness in both universities. This study contributes to improving the IL teaching strategy and help teachers to consider which tools are more effective to enhance student ILSE.

Literature review
There have been several studies relating to the using of library resources for PBL. Chen and Chen (2010) reported that the use of library resources for PBL helps teachers to assess learning performance. The use of digital libraries together with PBL was able to improve the
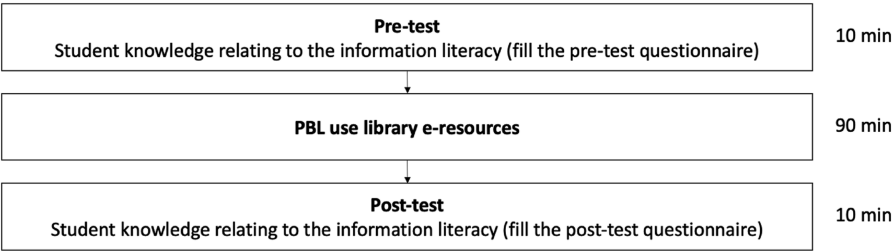
Figure 2.
Experiment activities

Source(s): Authors' own creation

learning achievements, learning effectiveness as well as the learning attitudes of the students (Shih *et al.*, 2011), and library e-resources have a significant influence on student academic performance (Chohan *et al.*, 2018). Some types of library resources used for PBL include digital libraries (Chen and Chen, 2010), electronic libraries (Tsai *et al.*, 2012) and other library resources (Chen *et al.*, 2011; Chen and Huang, 2012; Liu *et al.*, 2022). Besides the single use of library e-resources to support PBL, Chen and Chen (2010) conducted a comparison study of the effectiveness of digital libraries and the Google search engine. The learning performance and the satisfaction of learners supported by PBL and digital archival resources were superior to those of learners who were supported by search engine resources alone (Chen and Chen, 2010). The reason library e-resources were used for supporting PBL was that they have the potential to support traditional in-class learning, and can also assist teachers in developing learning activities for training students in web-based problem-solving abilities (Tsai *et al.*, 2012). Compared with conventional web-based research, it improves the students' learning achievements and attitudes, and students tend to use the library resources during PBL activities (Chen and Huang, 2012). The use of library resources, especially digital libraries, during PBL activities, has shown a greater impact than simple use of Internet resources (Chuang *et al.*, 2011).

Several studies relate to the use of library resources in PBL and other teaching-learning activities. For example, Goh *et al.* (2005) used a digital library to support geography students in Singapore, and Chu *et al.* (2010) developed an e-library to teach elementary school students. Furthermore, Marshall *et al.* (2006) developed the "GetSmart" system to support theoretically sound learning. Oldenettel *et al.* (2003) have integrated digital libraries and their content into web-based learning environments, and Chen and Huang (2012) have explored the use of library resources to support PBL for medical students by interviewing medical students, teachers and librarians. Chen and Chen (2010) compared the effectiveness of library resources with a search engine to support PBL for library science students by experimental research. They found that PBL with archived e-resources conducted for the experimental group yielded superior results to those of the control group who learned simply with the support of a search engine. Liu *et al.* (2022) assessed the educational technology levels and growth mindsets of postgraduate students and their perceptions of library-supported learning. The use of library e-resources to support PBL has been conducted not only in universities, but also in elementary schools (Tsai *et al.*, 2012).

Research questions

As a pedagogical strategy that allows students to gain knowledge while actively participating in problem solving, PBL students are given the chance to work together to answer problems, develop mental models of what they are learning and develop self-directed learning habits through practice and reflection (Yew and Goh, 2016). As students work on their PBL projects, they are likely to encounter information gaps or need to find additional information, to support their problem-solving process. This can drive them to use library resources such as databases, books and journals, to find relevant information. By using library resources, students can develop their IL skills, such as evaluating information sources, citing references and effectively searching for information (Chen and Chen, 2010).

Self-efficacy is the belief in one's ability to carry out a particular action or inaction (Liu, 2023; Ross *et al.*, 2016). ILSE has been associated with a higher level of motivation and student academic success (Ross *et al.*, 2016). ILSE can be evaluated directly using self-evaluation tools, and has been a popular method for assessing IL skills in recent years (Atikuzzaman and Ahmed, 2022). Kurbanoglu *et al.* (2006) identified seven main dimensions of ILSE: (1) defining the need for information; (2) initiating the search strategy; (3) locating and accessing the resources; (4) assessing and comprehending the information; (5)

interpreting, synthesizing and using the information; (6) communicating the information; and (7) evaluating the product and process.

PBL gives students a learning scaffold that integrates curriculum, learning materials, ICT and real-world situations, to offer timely learning support for solving a goal issue in a designed problem-oriented learning process (Chen and Chen, 2010). The teacher can share their "problem" or question to be solved or answered by the students. To solve the problem and to answer the question, the students need to conduct research using available information resources they can find, both offline and online. PBL with library resources (which are structured information resources) has been found to be more effective than provision of unstructured information resources (Chen and Chen, 2010). A recent study has found that there are significant relationships between computer self-efficacy and the use of electronic library resources (Popoola and Adedokun, 2021). Another study also found that students with multiple library instruction have a significantly higher information self-efficacy (Tang and Tseng, 2017).

It is crucial for educators to make sure that students are able to use and manage electronic library resources, as well as having the confidence to retrieve valuable information (Tang and Tseng, 2013). In a class, each student may have different self-efficacy toward the use of library resources (Liu, 2023). PBL helps students to situate IL in a problem context (Diekema *et al.*, 2011). The authors are curious: can PBL with library e-resources enhance student ILSE? How effective is PBL?

Based on the statements above, we have formulated the research questions below, which are to be considered in the specific context of LIS students following an IL curriculum at the two universities.

The first research question was influenced by the results of several previous studies which considered the effectiveness of structured information sources and suggested that library e-resources could support PBL and enhance ILSE (Chen and Chen, 2010; Popoola and Adedokun, 2021; Tang and Tseng, 2017).

RQ1. Is there a significant difference in **student performance** before and after the application of PBL using organized library e-resources on student ILSE in both universities?

The second research question was influenced by Diekema *et al.* (2011), who found that teaching IL with PBL was not uniformly effective. The difference in student motivation in engaging with PBL activities was one of the predictors of the effectiveness of the approach.

RQ2. Is there a significant difference in the **effectiveness** of PBL using organized library e-resources on student ILSE in both universities?

The corresponding two hypotheses are as follows.

H1. The post-test scores of University A and University B students' ILSE who were taught using PBL with library e-resources as part of the IL curricula, are higher than the pre-test scores.

(1). H_0: $\mu_{\text{post-test}} \leq \mu_{\text{pre-test}}$

(2). H_1: $\mu_{\text{post-test}} > \mu_{\text{pre-test}}$

H2. The post-test scores of University A and University B students' ILSE who were taught using PBL with library e-resources as part of the IL curricula are significantly different.

(1). H_0: $\mu_{\text{Univ. A}} = \mu_{\text{Univ. B}}$

(2). H_1: $\mu_{\text{Univ. A}} \neq \mu_{\text{Univ. B}}$

Methods

Experimental development

This was a quasi-experimental study, in which the authors developed PBL with library e-resources for the IL curriculum for LIS students. The impact on student ILSE was then analyzed by comparing the pre-implementation and post-implementation of PBL. The authors adopted the ADDIE Model to develop PBL in IL classes using library e-resources. A brief description of how the authors developed the PBL follows.

(1) Analysis: The authors summarized the literature review related to the need for and the problem of delivering teaching and learning using PBL. They collected interview data using an unstructured questionnaire relating to what teachers and students need for PBL, and what problems they met.

(2) Design: The authors categorized the issues using a thematic analysis leading to a delivery of PBL based on those needs. After that they wrote the design into the procedure both for teacher and student.

(3) Development: The authors gave the design to three experts to check the quality. The criteria used to select the experts included possession of a graduate masters in the LIS fields, minimum teaching experience of three years and familiarity with PBL and other teaching strategies. The feedback from the experts was used to refine the approach.

(4) Implementation: The authors implemented PBL for 30 LIS students, which was conducted online using Zoom.

(5) Evaluation: The students completed a short questionnaire regarding the PBL process from beginning to end and the dependent variable questionnaire. After the dependent variable data had been collected, the intervention's impact on the dependent variable was measured.

We adopted the LIS program learning plan/syllabus, and given below is the PBL designed by the authors. Table 1 shows the lesson plan of PBL with library e-resources learning activities.

The experts gave comments and evaluation for the PBL design. Based on components such as graphics, content relevancy, presentation, languages and model, three experts gave 1–10 scores and the qualitative comments for the PBL activities were designed. The average score was 8.57, and overall, the experts agreed that the PBL was good and able to enhance student ILSE.

Participants

The authors used purposive sampling in this study. The participants were LIS department students in University A and University B who took the IL class. The authors set up the G*Power application with the 0.5 effect size, 5% of error probability and 0.95 degree of confidence. The minimum number of participants recommended by the G*Power application is 45. However, we involved more than 45. A total 65 students in the two universities were involved in this experiment. Table 2 shows the participants demography.

Research design IL

The independent variable in this study is PBL in the curriculum using organized library e-resources. The dependent variable is student ILSE. Beside those variables, there is a mediator variable which is student ability in using the library e-resources. The authors also observed demographic variables including age, gender and university. The independent

Time	Graduate learning outcome	Course learning outcome	Learning materials	Assessment criteria/Indicators	Assessment methods	Learning methods	Learning activities
2 h	Graduates describe, distinguish, and apply principles of intellectual freedom and equitable access to information to LIS.	Students become confident in finding, evaluating, and using information efficiently and ethically	Definition and concept of IL.	Students should be able to describe the definition and concept of IL using library e-resources in text and verbally	Lecturer assesses student presentations	PBL using library e-resources. The students are only allowed access provided by the library. The library e-resources include • E-books • E-journals • Databases • Streaming media • Digital archives • Online research tools • E-newspapers and E-magazines • Electronic reference materials • Government documents and reports • Open access resources	The students were asked to solve the problem use the library e-resources • They were given tasks to solve the following question: Describe the definition and concept of IL using library e-resources • After the searching was finished, the students were asked to write and present a report (using presentation slides). At the end the teachers summarized the learning

Source(s): Authors' own creation

No.	Variables	Frequency	Percentage
1	Ages		
	• 19 years old or less	2	3.08
	• 20 years old	20	30.77
	• 21 years old	34	52.31
	• 22 years old	7	10.77
	• 23 years old or more	2	3.08
2	University		
	• University A	44	67.69
	• University B	21	32.31
3	Gender		
	• Male	14	21.54
	• Female	51	78.46

Source(s): Authors' own creation

Table 2.
Participants'
demography

variable was identified from the literature and implemented in the IL class. After that, the authors involved an expert to evaluate the PBL which developed.

Procedure
There were three steps of this research – the pre-implementation, during the implementation and post-implementation. In the pre-implementation step the students were asked to fill in a pre-test questionnaire in order to determine the student ILSE level compared to student ILSE developed by previous researcher (Kurbanoglu *et al.*, 2006). In the next steps, the students involved PBL using library e-resources by online learning, applying the knowledge and skills acquired to new and similar problems. The last step was post implementation. The students were asked to fill the post-test questionnaire. The post-test aims to determine the difference before and after using PBL in IL curricula use organized library e-resources on student ILSE, using the same questionnaire as for the pre-test. After the data had been gathered, the authors conducted data analysis by comparing the pre-test and post-test results using *t*-test formulae.

Research instrument
To measure the level of ILSE the authors used the Kurbanoglu scale (Kurbanoglu *et al.*, 2006), the most used ILSE scale with high score validity (Atikuzzaman and Ahmed, 2022). The questionnaire can be found in Appendix. The authors modified the questionnaire in one sub-variable that only consisted of 1 question. They added 2 questions more in the A sub-variable (define the information needed). Another modification was in the translations, from English to Bahasa Indonesia, because the participants' native language is Bahasa Indonesia. The translation was validated by the experts.

The instrument which was developed by the authors had been reviewed by three experts, with these criteria:

(1) Able to speak, write and read in Bahasa Indonesia;

(2) Full-time lecturer in library and information science (LIS) or educational sciences;

(3) Experienced in teaching and researching (minimum three years);

(4) Familiar with PBL and other teaching strategies;

(5) Have enough time to validate the instruments.

All of criteria were related to PBL with library e-resources in IL curricula and student ILSE. Three experts with 4–19 years experiences were involved to validate the research instrument. The authors used item-objective congruence (IOC) to measure the validity. Based on experts' judgment the IOC score was from 0.67 to 1.00 for all questionnaires. A total of 23 students were involved to check the reliability by filling out the questionnaires. Based on those scores, the authors examined the instrument reliability by Cronbach Alpha using SPSS. The Cronbach Alpha score was 0.959, which showed that all questionnaires were reliable. The research instrument validity and reliability scores indicated that all questionnaires were suitable to evaluate the variable.

The authors did not check the normality because the number of participants was more than 45 (higher than the G*Power recommendation). So, it was assumed that the data were normally distributed (Faul *et al.*, 2007). The pre-test scores and post-test data were homogeneous, because the significant values (respectively 0.406 and 0.136) were higher than 0.05. The data were therefore able to be analyzed by paired sample *t*-test and independent sample *t*-test.

Data analysis

RQ1 was analyzed by paired sample *t*-tests (comparison of the pre-test and post-test scores of each university).

RQ2 was analyzed by an independent sample *t*-test (comparison the gap of post-test and pre-test of each university).

Results
Difference of pre-test and post-test scores
Based on paired sample *t*-test analysis for all participant scores in Table 3 below, it can be seen that there is a significant difference in the pre-test and post-test results ($t = -4.919$, $p = 0.001 < 0.05$). Post-test scores are higher than pre-test scores (4.26 > 3.75), indicating that the PBL treatment enhanced student ILSE successfully. Based on those results, it meant that research hypothesis number 1 was accepted. To raise more comprehensive results, the authors analyzed the treatment effectiveness partially both for University A students and University B students (See Tables 5 and 6).

As shown in Table 4, the results of a paired samples *t*-test indicate that there are significant differences between the pre-test and post-test results for University A students ($t = -6.623$, $p = 0.001 < 0.05$), indicating that after the PBL treatment, University A students

	Mean (SD)			
Dimension	Pre-test	Post-test	*t*	*p*
A	3.90 (0.66)	4.43 (0.64)	−4.715	<0.001
B	3.66 (0.61)	4.30 (0.72)	−5.561	<0.001
C	3.94 (0.57)	4.35 (0.65)	−3.869	<0.001
D	3.68 (0.54)	4.24 (0.68)	−5.230	<0.001
E	3.47 (0.61)	4.12 (0.75)	−5.212	<0.001
F	3.69 (0.57)	4.14 (0.71)	−3.833	<0.001
G	3.66 (0.66)	4.19 (0.75)	−3.995	<0.001
Total	3.75 (0.50)	4.26 (0.63)	−4.919	<0.001

Note(s): $p < 0.05$, $N_{Pre-test} = 65$ and $N_{Post-test} = 65$
Source(s): Authors' own creation

Table 3.
T-test for student pre-test and post-test scores

| | Mean (SD) | | | |
Dimension	Pre-test	Post-test	*t*	*p*
A	3.89 (0.58)	4.49 (0.50)	−5.105	<0.001
B	3.67 (0.60)	4.42 (0.56)	−6.270	<0.001
C	3.90 (0.51)	4.44 (0.51)	−4.974	<0.001
D	3.58 (0.49)	4.30 (0.55)	−6.608	<0.001
E	3.43 (0.59)	4.25 (0.56)	−6.145	<0.001
F	3.64 (0.55)	4.31 (0.54)	−5.805	<0.001
G	3.57 (0.52)	4.35 (0.55)	−5.919	<0.001
Total	3.70 (0.44)	4.37 (0.48)	−6.623	<0.001

Note(s): $p < 0.05$, $N_{Pre\text{-}test} = 44$ and $N_{Post\text{-}test} = 44$
Source(s): Authors' own creation

Table 4.
T-test for university A
group in their pre-test
and post-test scores

| | Mean (SD) | | | |
Dimension	Pre-test	Post-test	*t*	*p*
A	3.98 (0.79)	4.22 (0.90)	−0.888	0.387
B	3.74 (0.61)	3.93 (0.96)	−0.747	0.465
C	4.06 (0.65)	4.04 (0.87)	0.089	0.930
D	3.91 (0.52)	3.97 (0.88)	−0.241	0.812
E	3.64 (0.56)	3.69 (1.00)	−0.223	0.826
F	3.86 (0.51)	3.68 (0.88)	0.650	0.524
G	3.92 (0.86)	3.72 (0.99)	0.666	0.514
Total	3.85 (0.60)	4.03 (0.84)	−0.779	0.445

Note(s): $p > 0.05$, $N_{Pre\text{-}test} = 21$ and $N_{Post\text{-}test} = 21$
Source(s): Authors' own creation

Table 5.
T-test for university B
group in their pre-test
and post-test scores

| | Mean (SD) | | | |
PBL Effectiveness	University A	University B	*t*	*p*
	4.37 (0.48)	4.03 (0.84)	2.091	0.02

Note(s): $p < 0.05$, $N_{Univ.\ A} = 44$ and $N_{Univ.\ B} = 21$
Source(s): Authors' own creation

Table 6.
Independent sample
T-Test for both groups
in their post-test scores

achieved a higher score of ILSE than before the PBL treatment (4.37 > 3.70). The results of a paired samples *t*-test as shown in Table 5, there were no significant differences in the pre-test and post-test results for University B students (*t* = −0.779, *p* = 0.445 > 0.05). Thus they had the same ILSE before and after the PBL treatment, even though higher scores were achieved (4.03 > 3.85).

Difference of effectiveness of treatment
The results of an independent samples *t*-test (Table 6) show that there was a significant difference in the effectiveness of PBL results between the two groups, where *t* = 2.091 and *p* = 0.02 < 0.05. It meant that the ILSE scores of students in both universities were not equal, so the research hypothesis number 2 was accepted. As shown in Table 6, the mean scores of University A students were higher than University B (4.37 > 4.03). This showed that PBL

with library e-resources was effective to enhance the ILSE of University A students, compared to University B students.

Discussions

The paired sample *t*-test results indicated that PBL with library e-resources can enhance student ILSE. The findings of RQ1 are similar with some studies that found PBL with library e-resources were effective and had a positive impact on student learning performance and student achievements (Chen and Chen, 2010; Shih *et al.*, 2011). Using PBL to teach IL might enable students to experience IL in a richer way (Diekema *et al.*, 2011). It involves the students to demonstrate their ability to identify the information they needed (Carder *et al.*, 2001). Besides improving ILSE, it also could improve student critical thinking skills (Seibert, 2021).

However, another fact was found when an independent sample *t*-test was conducted based on university origin (RQ2). The result showed that PBL with library e-resources was an effective approach for University A students, but not for students from University B. It confirmed a study conducted by Chen and Chen (2010) that found that library resources could support PBL in LIS learning. However, the PBL treatment sometimes was not effective for several students undergoing IL training. Personal motivation drove students to engage with PBL activities (Diekema *et al.*, 2011), and student motivation is the key to success in PBL (Harun *et al.*, 2012). The clarity of PBL design, including the course and learning activities for the whole semester under the collaborative learning supports is essential in maintaining student motivation. To sustainably integrate library resources into the PBL activities, it is important to support libraries to become learning organizations that can respond to changing external environments, including adapting to students' information needs (Chen *et al.*, 2011). Further research is needed to reconcile these differing findings. Other factors affecting the success of PBL using library e-resources need to be explored more in future studies.

Conclusions

PBL with library e-resources can effectively enhance student ILSE. The methods could improve ILSE for some students, especially in University A from Java Island. The authors found that University A students' ILSE scores were higher than those from University B. Besides that, the pre-test and post-test of University B students were not significantly different. It showed that the treatment was only effective for University A students, compared to those in University B. Factors affecting the success of PBL with library e-resources on student ILSE have not been identified in this study.

Limitations

(1) This study adopted self-assessment to evaluate student ILSE. The questionnaire results might be biased. The use and the development of a standardized scale for ILSE is necessary in future studies.

(2) The number of representative university students compared were not the same. The number was also relatively small in order to represent each island. Furthermore, this study only involved LIS students from two state universities. The result did not represent the whole situation of LIS students in Indonesia. There is a need to involve more LIS students from other areas and institutions in Indonesia to get a broader perspective. The representation of other types of universities is also needed.

(3) PBL was conducted for one online teaching session (two hours) only. The time to gather the whole of the PBL story was not enough. The presentation session was

limited to some students, and since not all students could participate in the presentation session because of lack of time, future studies need more time to conduct PBL, so all students have a chance to present their work.

Suggestions

(1) To apply better PBL with library e-resources, the teacher should prepare it carefully. The clear instructions in teaching and learning activities for the whole semester within a collaborative learning climate, contextualization and self-direct learning, will gain better student engagement.

(2) Based on the low score of one aspect in ILSE, "interpreting, synthesizing, and using the information", in the IL curricula, those parts need to be strengthened in both universities. Those skills are needed for students' future academic purposes and careers.

(3) PBL conducted in online mode raises many challenges. Some of them were the bad Internet connections, the lack of student attention and enthusiasm and the lack of interactions, that have the potential to interfere with the PBL activities. Teachers who will conduct PBL in online mode need more preparation to minimize the online learning challenges, by choosing an effective online meeting tool, using gamification to increase student participation, etc.

(4) A qualitative study to analyze the factors affecting the success of PBL using library e-resources is highly recommended for future studies. By understanding its factors the teacher can prepare better to achieve the success of PBL.

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Appendix

Code	Statements
A1	Define the information I need
A2	Able to understand the information characteristics
A3	I search the information with specific keywords
B4	Identify a variety of potential sources of information
B5	Limit search strategies by subject, language, and date
B6	Initiate search strategies using keywords and Boolean logic
C10	Locate information sources in the library
C11	Use library catalogues
C12	Locate resources in the library using the library catalogue
C13	Use Internet search tools (such as search engines and directories)
C14	Use different types of libraries
C7	Decide where and how to find the information I need
C8	Use different kinds of print sources (e.g., books, periodicals, encyclopaedias, and chronologies)
C9	Use electronic information sources
D15	Use many resources at the same time to conduct research
D16	Determine the authoritativeness, contemporariness and reliability of the information sources
D17	Select information most appropriate to the information need
D18	Identify points of agreement and disagreement among sources
D19	Evaluate Internet sources
E20	Synthesise newly gathered information with previous information
E21	Interpret visual information (i.e., graphs, tables, and diagrams)
F22	Write a research paper
F23	Determine the content and form the parts (introduction, conclusion) of a presentation (written, oral)
F24	Prepare a bibliography
F25	Create bibliographic records and organize the bibliography
F26	Create bibliographic records for different kinds of materials (i.e., books, articles and web pages)
F27	Make citations and use quotations within the text
F28	Choose a format (i.e., written, oral and visual) appropriate to communicate with the audience
G29	Learn from my information problem-solving experience and improve my IL skills
G30	Criticise the quality of my information-seeking process and its products

Source(s): Table courtesy of Kurbanoglu *et al.* (2006)

Table A1.
Modified the
questionnaire of
Kurbanoglu's
ILSE scale

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