Project-Based E-Learning and Its Impact on Students' Academic Achievement in Curriculum Development Lectures

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A B S T R A K

Pada tahun terakhir ini menggunakan teknologi sangat penting dalam kegiatan pembelajaran, sehingga setiap orang harus mampu menggunakan teknologi dengan bijak. Penelitian ini bertujuan untuk mendeskripsikan potensi dampak e-learning berbasis proyek terhadap prestasi akademik mahasiswa semester empat dalam perkuliahan pengembangan kurikulum. Jenis penelitian ini yaitu kuantitatif dengan menggunakan desain penelitian eksperimen. Metode yang digunakan untuk mengumpulkan data yaitu observasi dan tes. Instrumen yang digunakan dalam mengumpulkan data yaitu lembar observasi dan soal tes. Subjek penelitian yaitu 30 mahasiswa. Data yang diperoleh pada awalnya direncanakan untuk dianalisis dengan menggunakan teknik analisis uji t sampel berkorelasi, namun karena data penelitian tidak berdistribusi normal, maka data penelitian akhirnya dianalisis menggunakan analisis statistik non parametrik. Hasil analisis data menunjukkan bahwa pertama, tidak ada siswa yang nilai posttest-nya lebih rendah dari nilai pretest. Kedua, terdapat 23 siswa yang mengalami kenaikan nilai dari pretest ke posttest. Ketiga, terdapat 6 siswa mengalami nilai yang sama dari pretest hingga posttest. Disimpulkan bahwa ada perbedaan yang signifikan prestasi akademik mahasiswa pada perkuliahan pengembangan kurikulum sebelum dan sesudah penerapan e-learning berbasis proyek.

A B S T R A C T

In recent years, using technology is very important in learning activities, so everyone must be able to use technology wisely. This study describes the potential impact of project-based e-learning on the academic achievement of fourth-semester students in curriculum development courses. This type of research is quantitative, using an experimental research design. The methods used to collect data are observation and tests. The instruments used in collecting data are observation sheets and test questions. The research subjects were 30 students. The data obtained were initially planned to be analyzed using the correlational sample t-test analysis technique. However, because the research data were not normally distributed, the research data were finally analyzed using non-parametric statistical analysis. The results of the data analysis show that first, there are no students whose posttest scores are lower than the pretest scores. Second, there were 23 students whose scores increased from the pretest to the posttest. Third, 6 students experienced identical scores from the pretest to the posttest. It was concluded that there were significant differences in student academic achievement in curriculum development courses before and after implementing project-based e-learning.

1. INTRODUCTION

The student's success or failure in schools is usually determined in terms of academic achievement. Academic achievement refers to the level of attaining academic goals projected in a specific educational process (Bulut et al., 2016; Yüksel & Geban, 2014). Academic achievement reflects the performance outcomes that indicate the extent to which a student has achieved a specific goal that were the focus of activity in educational institutions (Steinmayr et al., 2015; Suprapto et al., 2018). It is the

result of a student's interactions with his or her surroundings, specifically with the school, teachers, and peers (Bulut et al., 2016; Rabgay, 2018). Academic achievement is extremely important for teachers, as it reveals not only how well a student completed particular learning objectives, but also how well they did in extracurricular activities (Ali et al., 2013; MeenuDev, 2016; Steinmayr et al., 2015). Measuring achievement is a crucial component of the learning process since it may inform teachers of student progress toward educational objectives. Academic achievement is usually measured across examinations conducted in educational institutions to measure knowledge and skills obtained in a course and calculated in a variety of ways, such as grade point average (GPA) of a student, and the level of student satisfaction (Sakiz et al., 2021; Yüksel & Geban, 2014). Academic achievement is intimately tied to what students understand and how they can solve difficulties.

Academic achievement has been highlighted as a critical variable in learning effectiveness studies and may be broken down into numerous components, including students' qualified attainment and moral growth (Iglesias-Pradas et al., 2021; Salanova et al., 2010). Determining predicting factors influencing academic achievement is deemed essential in terms of developing guidelines that aimed at enhancing education effectiveness and efficiency. Numerous current studies have examined the relationships between learning variables and student academic achievement (Athar & Jamal, 2017; Karaçalli & Korur, 2014; Oladipupo & Ehigbochie, 2017; Rashid, 2011; Sahin et al., 2018; Siachifuwe, 2017; Zekarias et al., 2015). Despite the scientific evidence on factors affecting student learning achievement, it cannot be denied that what teachers know and what they do within and outside of the classroom play a crucial effect. What teachers know and do in the classroom includes how to employ project-based learning to improve the quality of the teaching and learning process and, in turn, to help their students do better in school.

The project-based learning is a form of the constructivist instruction strategies that encourage student to create and take charge of their own learning as they work to address the real-world challenges (Edy et al., 2019; Ergül & Kargin, 2013; Kizkapan & Bektaş, 2017). In the concept of project-based learning, students are put in an active role and are encouraged to explore a realistic problem in an area of interest without a predetermined solution. Students are encouraged to work closely with their peers and to critically evaluation their own progress (Pengyue Guo et al., 2020; Kizkapan & Bektaş, 2017; Muslim et al., 2020). Additionally, project-based learning develops other skills such as teamwork and critical thinking, which are essential for 21st-century skills. Seven key features of project-based learning as the following: first, it focuses on a substantial and open-ended question, challenge, or problem for the student to explore and answer to and/or solve (Ardianti et al., 2017; Hadiyanti et al., 2021). Second, it includes what students should know, comprehend, and be able to perform academically. Third, it is inquiry-based, stimulates intrinsic curiosity, and generates questions while helping students seek answers. Fourth, it requires 21st-century skills such as critical thinking, creativity, communication, and mutual collaboration. Fifth, it permits student voice and choice. Sixth, it provides a chance for feedback and adjustment of the plan and the project. Seventh, it requires students to present their problems, research process, and results, just as they would in the real world. Referring to these various features of project-based learning, scientific practices are regarded one of its key features as students are obliged to engage in an authentic research in which they develop their own knowledge, just like scientists do (Aksela & Haatainen, 2019; Hussin et al., 2019; Zeptyani & Wiarta, 2020).

Governments and scholars throughout the world, including Indonesia, support project-based learning (Aksela & Haatainen, 2019; Annetta et al., 2019; Hasni et al., 2016; Novak & Krajcik, 2019), as it has been shown to evidence in better academic achievement (Balemen, N. & Özer Keskin, 2018). Project-based learning enables students to observe and understand the existing correlation between scientific procedures and the real world by carrying out investigation and the open-endedness of the problems under investigations (Chen & Yang, 2019; Lely Mutakinati et al., 2018). It has shown that project-based learning improve students' critical thinking and question-posing skills and even contribute to developing students' intra and interpersonal competencies (Kaldi et al., 2011; Sasson et al., 2018).

Project-based learning is successful for teaching STEM (science, technology, engineering, and mathematics) courses because it brings theory to life and closely resembles the problem-solving skills. In recent years, computer technologies have played an increasingly important role in supporting project-based learning, which in turn has helped to encouraging student-directed scientific inquiry into problems in a real-world context (Bai, 2018; ChanLin, 2008; Schreder et al., 2013). The benefits of web-based learning for students when doing project. Without technological tools, project-based learning would be extremely different and considerably more challenging as students use the internet and an online forum for research, communication, and collaboration with those outside the classroom. The use of educational technology afford the learners greater anonymity and opportunities to practice a range of generic skills,

such as self-management, task accomplishment, and access for information (Howard et al., 2016; Shi, 2017; Zou et al., 2019).

This study focuses on revealing the impact of project-based e-learning on the fourth semester student academic achievement in curriculum development lectures. Many studies concluded that project-based learning contributed positively to student academic achievement and student attitude towards science courses (Kanter & Konstantopoulos, 2010; Selçuk, 2010; Shih et al., 2011). Related to the use of technology in project-based learning, other research found that technology-aided project-based learning was effective in enhancing student learning motivation, their capability in problem solving, and their academic achievement (Hung et al., 2012). However, we are motivated to conduct an additional study on this topic to address the call of Indonesia's Minister of Education, Culture, Research and Technology for teachers and lecturers to integrate technology-aided problem-based learning, as well as technology-aided project-based learning into their teaching and learning process. Since the empirical studies on the topic of the causal relationship between the project-based e-learning and the students' academic achievement in curriculum development lectures is still lack within the context of Indonesia's higher education institutions, this study aimed to bridge the gap by examining the causal relationship between the surveyed variables using the fourth semester students of Educational Technology Department, Ganesha University of Education, as the population and samples.

2. METHOD

This study, in its very nature, was a quantitative approach using an experimental research design. The experimental research design is a scientific approach that involves manipulating one or more independent variables in order to determine whether this generates changes in a second variable (Cherry, 2022). In experimental research design, the effect of independent variable on dependent variable is typically observed over a period of time in order to help researchers draw a logical conclusion about the causal link between the surveyed variables. We employed an experimental research design for the following reasons: while it is widely implemented in our field of expertise (education), the experimental research design is also helpful when time become a factor in establishing cause-and-effect relationships (Agung, 2017).

There are three different types of experimental research as the following: (a) pre-experimental research design, which consists of one-shot case study research design, one-group pretest-posttest research design, and static-group comparison; (b) quasi-experimental research design, which consists of non-equivalent group, discontinuity in regression, and natural experiments; and (c) true experimental research design (Tanner, 2018). Due to the absence of a control group in our study, we employed a one-shot case study as we only observed a single group on a single occasion after undergoing treatment. The study conducted during the second semester of the academic year 2021. The subject of this study consisted of thirty students from the fourth semester of the Educational Technology Department at Ganesha University of Education. Using an observation sheet, data pertaining to the use of project-based e-learning were collected, whilst data pertaining to students' academic achievement were collected from their academic records. The obtained data were initially planned to be examined using the correlated sample t-test method, but, due to that research data were not distributed normally, then the research data were finally analyzed by employed a non-parametric statistics using the Wilcoxon test.

3. RESULT AND DISCUSSION

Result

In statistical analysis, it is crucial that all parametric tests take into account the assumptions for appropriate interpretation and to ensure that the data analysis does not lead to erroneous results. For this study we employed two assumption tests, namely normality and homogeneity assumption tests. The majority of parametric tests rely on the assumption of normality. To test the assumptions of normality, we employed the Kolmogorov-Smirnov's Test. The normality of data distribution requires that the Kolmogorov-Smirnov should not be statistically significant. The results of the normality test are presented in Table 1.

Table 1. The Results Of The Normality Test

Academic Achievement	Kolmogorov-Smirnov			Decision
	Statistics	Df	Sig.	
Pretest Score	0.360	29	0.000	Abnormal
Posttest Score	0.424	29	0.000	Abnormal

Data displayed in Table 1 revealed that the Sig. value of Kolmogorov-Smirnov test for both pretest score and posttest score is .000. Since the Sig. value is lesser that .05, it inferred that the data are not normally distributed. Homogeneity test is meant to know whether the variance of data is homogenous or not. The homogeneous variance of data requires the Sig. value of Levene's statistics based on *Mean* is greater than .05. The results of the homogeneous test are presented in Table 2.

Table 2. The Results Of The Homogenous Test

Academic Achievement	Levene's Statistics	Df1	Df2	Sig.
Based on Mean	2,719	1	56	0.105
Based on Median	1,765	1	56	0.189
Based on Median and Adjusted Df	1,765	1	56,000	0.189
Based on Trimmed Mean	3,595	1	56	0.063

Data displayed in Table 2 revealed that the Sig. value of academic achievement based on *Mean* is .105. Since the Sig. value of Lavene's statistics based on *Mean* is greater than .05, it inferred that the data of academic achievement has a homogeneous variance. Based on the data displayed in Table 1 and Table 2, homogeneity assumption test was met; while the normality assumption test was not. It demonstrates that the hypothesis testing using *t-test* as it was initially planned could not be employed. Instead, we employed a non-parametric statistics using the Wilcoxon test. The results of the Wilcoxon test analysis are presented in Table 3.

Table 3. Pretest and Posttest Ranking

Academic Achievement		N	Mean Rank	Sum of Ranks
Posttest Score – Pretest Score	Negative Ranks	0 (a)	0.00	0.00
	Positive Ranks	23 (b)	12.00	276.00
	Ties	6 (c)		
	Total	29		

(a) Posttest Score < Pretest Score
(b) Posttest Score > Pretest Score
(c) Posttest Score = Pretest Score

Data displayed in Table 3 revealed that: (a) there are no students whose posttest scores are lower than pretest scores as it was indicated by the value of N in Negative Ranks is 0; (b) there are 26 students whose posttest scores are higher than pretest scores as it was indicated by the value of N in Positive Ranks is 23; and (c) there are 6 students whose posttest and pretest scores are the same as it was indicated by the value of N in Ties line is 6.

As aforementioned, we proposed a research hypothesis (Ha) to be examined in this study as follows: "There is a significant difference of the fourth semester students' academic achievement in curriculum development lectures before and after the implementation of the project-based e-learning strategy." To assess whether or not the proposed research hypothesis is accepted, we go through the results of Wilcoxon test. Based on data analysis showed that the Asymp. Sig. (2-tailed) value is .000. Since the Asymp. Sig. (2-tailed) value of .000 is lower than .05. It demonstrates that at the level of alpha (α) = .05 the research hypothesis (H_a): "There is a significant difference of the fourth semester students' academic achievement in curriculum development lectures before and after the implementation of the project-based e-learning strategy" is confirmed, while the null hypothesis (H_0): "There is no significant difference of the fourth semester students' academic achievement in curriculum development lectures before and after the implementation of the project-based e-learning strategy" is unconfirmed.

Discussion

This study aimed to disclose the impact of the project-based e-learning on the fourth semester students' academic achievement in curriculum development lectures. A project-based learning strategy usually involves several opportunities for students' learning experience (Ardianti et al., 2017; MacLeod & van der Veen, 2020; Zeptyani & Wiarta, 2020). These opportunities include the process of reflection, discussion, analysis, and evaluation of the skills that will guide future actions. In project-based learning students collect data from variety of sources, analyze their findings and produce new information (Handayani et al., 2021; Sumarmi et al., 2021; Winatha & Abubakar, 2018). Students, then, are evaluated in terms of how well they exhibit what they have learnt from their collaborative efforts.

One of the fundamental tenets of project-based learning, which has long been recognized as a part of constructivist learning, is that students actively construct their own knowledge through activity and the learning experiences created by teachers are intended to foster deep understanding rather than superficial and transitory memorization (P. Guo et al., 2020; Izati et al., 2018; L. Mutakinati et al., 2018). Giving students the opportunity to take responsibility and have a personal awareness of the project is of crucial in employing the project-based learning strategy (Chua & Islam, 2021; Cintang et al., 2018; Yustina et al., 2020). Project-based learning can promote students' learning and academic performance. In project-based learning students are required to construct and develop their own knowledge, determine how to approach a problem and select the appropriate activities to address the real-world and multidisciplinary problems (Aerts et al., 2017; Irman & Waskito, 2020; Mulcahy & Wertz, 2021).

Prior to the implementation of the posttest, the fourth semester students were exposed to the project-based e-learning strategy. As shown in Table 3 above, the results showed that the majority of students, 26 out of 30, experienced a significant improvement in their academic achievement following the implementation of the project-based e-learning strategy. This study found a significant change in academic achievement of the fourth semester students of Education Technology Department, Ganesha University of Education, since they were taking the pretest to taking the posttest in the curriculum development lectures. Our results were in line with a wide range of prior studies that back the use of project-based learning to improve students' academic achievement (Abubakar et al., 2020; Kizkapan & Bektaş, 2017). These earlier studies were constantly revealed that students taught through project-based learning regularly demonstrated higher academic achievement than that of those taught trough traditional learning model. Other benefits of using project-based learning included the following: improved teacher-student relationship, increased student enthusiasm and engagement, and increased development of the 4Cs of 21st century learning.

4. CONCLUSION

The conclusion depicted from the result of data analysis is that the students' use of the project-based e-learning resulted in a significant improvement in their academic achievement in curriculum development lectures. As the result of this study revealed a significant improvement in academic achievement after the students were exposed to the project-based e-learning strategy, this study calls for a consistent practice of the project-based learning in all subjects taught in Ganesha University of Education following the mandate of the Indonesia's Minister of Education, Culture, Research, and Technology.

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