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Research Article

The Role of Project-Based Learning in Helping University Students Gain Some Academic Skills and Developing Students' and Faculty Member's Attitudes Towards It

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Abstract

This study aimed at identifying the role of the project-based learning strategy in helping students at the College of Applied Studies and Community Service, Imam Abdul Rahman bin Faisal University gain some academic skills and developing students' and faculty members' attitudes towards it. Two questionnaires and one graded scale were used as tools of the current study to measure how much faculty members and students were satisfied with project-based learning and teaching and to evaluate project-based learning practices, and training materials included in the teacher's guide and students' book. The study sample included 87 students and 15 faculty members who participated in implementing this pedagogical strategy. The results of the study showed that both students and faculty members were satisfied with using the project-based learning strategy. There were also statistically significant differences between the mean scores of the pre- and post-evaluations in the graduated scale of the standards of project-based learning practice in favor of the post-application. It was concluded that project-based learning helped students gain the following academic skills: cooperation with members of their group, critical thinking, creative thinking, decision-making, and project management.

Keywords: Project-Based Learning, Academic Skills and Developing Students'.

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Introduction

Project-based learning (PBL) is a pedagogical strategy that focuses on students and adopts an experiential approach in education so that "deeper learning" could be reinforced through an active search for a solution to real-world problems (Peterson, 2012 & Pellegrino, Hilton, 2012). Cocco (2007) stated that PBL is based upon three constructive rules;

a) Acquiring knowledge is context specific.

b) Learners must be actively involved in the learning process and should accomplish their aims through social interactions.

c) Sharing understanding and knowledge.

It has been showing that there are six characteristics of PBL, including an interesting question, an emphasis on learning objectives, active involvement in instructing activities, teamwork with other members or students, using of scaffolding technologies, and formation of substantial products (Sawyer, 2005). However, the most vital aspect is the formation of products that explain authentic problems, and this also differentiates PBL from other student-focused learning activities like problem-based training (Blumenfeld et al., 19991 & Helle, and Tynjälä, 2006). Studies such as Helle and Tynjälä (2006) and Braßler (2017) showed distinctions between problem and project-based learning since problem-based learning focuses on employing already learned knowledge while PBL emphasizes creating knowledge and understanding through the active learning process and participation (Sawyer, 2005). In this way, students can accomplish their goals by testing their ideas in the way they want, which ultimately enhances their innovative capabilities.

It cannot be denied that higher education is recommended to provide an advanced and innovative learning environment to students (Crosling, Nair, and Vaithilingam, 2015). Research has suggested that enhancing students' innovative capabilities by advocating their autonomy during learning tasks is crucial (Martín, Potočnik, and Fras, 2017). However, competency shortfalls of graduates which have been referred to as "skills gaps" cannot be neglected as there is a real gap between the level of competence needed for employment and the level of graduates' competence (Male, Bush, and Chapman, 2010). The majority of identified skills gaps include teamwork, attitude, communication, leadership, and social skills (Makhathini, 2016). To fill in this gap, the approach of teaching and learning should be changed to depend more on student-centered approaches such as PBL (Sadikin, et al. (2017). Universities are highly required to identify the knowledge, skills, and attributes that they expect their graduates to have. Moreover, there is a high demand from employers that graduates must have a range of transferable skills in addition to technical knowledge Grant and Dickson (2006).

Currently, higher education has been refocusing on outcomes-based approaches that integrate technical knowledge and professional skills in the university curriculum. PBL is expected to be one of the educational approaches that can be used to develop such attributes and skills for university graduates (Jollands, 2013). By using self-reports, graduates could recognize the benefits of undertaking PBL to build up projects, master time management and communication skills, and develop confidence and systems thinking (Jollands, Jolly, and Molyneaux (2012).

Statement of Problem

Although many studies have been conducted to highlight how PBL settings have been harnessed for learning, comparatively a few studies have explored teachers' and students' satisfaction while implementing PBL. It is claimed that there is a skill gap between what is expected from graduates at the College of Applied Studies and Community Service and their real output competence. A range of transferable skills and technical knowledge needs to be developed using more student-centered approaches, so the current research study was based on a case study to identify the degree of satisfaction of both students and faculty members with the use of PBL strategy in the process of learning and teaching at the College of Applied Studies and Community Service.

Significance of the Study

There is no coherent, research-based understanding of the best predictors of student and teacher satisfaction. Therefore, this cross-sectional study aims to measure the satisfaction of students and faculty members with using the PBL strategy. Moreover, this study aims to assess students' learning outcomes regarding the PBL by employing a rubric-based assessment method.

Questions of the Study

This study is expected to find the answer to the following four research questions;
1. How much are the College of Applied Studies and Community Service students satisfied are with learning by using the project-based learning strategy?
2. How much are the College of Applied Studies and Community Service faculty members satisfied with teaching by using the project-based learning strategy?
3. How far is the project-based learning initiative effective in achieving the standards of implementing the PBL strategy?
4. What are the skills that students acquired from learning according to the project-based learning strategy?

Hypothesis of the Study

1. Students' satisfaction with using project-based learning strategies in studying their undergraduate courses is positive.
2. Faculty members' satisfaction with the use of project-based learning strategy in teaching their undergraduate courses is positive.
3. There are statistically significant differences between the two means of pre and post assessment in the rubric of criteria for practicing project-based learning in favor of post-assessment
4. Students could acquire several skills when learned according to the project-based learning strategy.

Literature review

There are several studies published in various fields of education measuring outcomes of PBL (Rodríguez and et al. (2015) & Li (2018). PBL practices in the field of aerospace engineering Rodríguez et al. (2015) highlighted that PBL fostered students' motivation and improved their grades as well. They concluded that PBL practices developed good technical skills and improved students' core competencies. Further, it was indicated that PBL demanded more dedication from instructors than the conventional teaching approach. Similarly, Sienko, Sarvestani, and Grafman (2013) applied project, service, and experiential-based learning methods to engineering students and found out that they had a positive effect on students' learning. Shahiwala (2017) conducted a study regarding the development of entrepreneurial skills among pharmacy students through the PBL approach and concluded that PBL facilitated the understanding of management models. On the other hand understanding of undergraduate students of chemistry through PML in an IT environment was enhanced in another study conducted by Barak and Dori (2005). Li (2018) investigated PBL implementation with a special emphasis on the learning outcomes of students and their attitudes regarding PBL. The key conclusions were that the PBL offered superior learning outcomes through developing communication, creative thinking, interdisciplinary learning, knowledge retention, problem-solving as well as self-directed learning.

A recently published study conducted by Susanti, Retnaningdyah, and Trisusana (2020) explored students' perceptions towards the application of PBL in learning English as a Foreign Language. The results of that study showed that teachers had a positive experience in implementing PBL as it was found to be a useful approach. In addition, students stated that PBL was a useful method to learn English as revealed in their positive feedback. Habók and Nagy (2016) explored teachers' perceptions regarding PBL and traditional teaching methods. Results revealed that the PBL approach was favored by instructors. Lasauskiene and Rauduvaite (2015) found out that teachers had positive opinions regarding the implementation of PBL since it formed an effective educational environment for professional self-accomplishment and nonstop development. Frank, Lavy, and Elat (2003) carried out an investigatory study to explore the perceptions and attitudes of freshmen engineering students towards using PBL in learning their course. Students built their knowledge and understanding by way of active learning as well as through communication with instructors, team members, experts in the field, and other students. In the students' opinion, PBL was useful to enhance their technical capabilities and their insights and also boosted motivation to study.

Pereira, Barreto, and Pazeti (2017) described the experience of PBL among students of industrial engineering. The acquiescence of the use of PBL was enormous, but some challenges were identified such as increasing peer assessment, enlarging the team, and improving

instruments for collection and analysis of data. Gülbahar and Tinmaz (2006) conducted a case study to implement PBL through utilizing e-portfolio assessment. They found out that PBL was an applicable way of learning. Another study conducted by Hashim and Din (2009) explored the usefulness of implementing PBL and identified potential gaps for improvement. It was revealed that the technical features were achievable, however `it was challenging to perceive the competency of average students.

A recent study made by Cronin and Caria (2019) revealed that PBL activity could produce appreciably encouraging results. Collaboration between course supervisors and instructors promoted an environment in which teamwork and sharing of knowledge and ideas could flourish. Response from the satisfaction survey used in their study signified that student were fascinated by contributing to such kinds of projects, especially when support and guidance are available. Anita et al (2018) investigated the impact of PBL on enhancing creativity as well as the effectiveness of using rubrics-based evaluation in assessment. The data collected proved that PBL enhanced creativity, and rubrics-based evaluation guaranteed the quantitative determination of creativity. They also noticed that the rubrics-based assessment was quite accepted by the students and the type of assessment used was effective in terms of clarity of outcomes and emphasis of the task. It could be stated that rubric-based assessments widened the prospect of evaluating qualitative outcomes such as ethics, team collaboration, and interaction and provided students with a clear picture of what the expectations would be regarding a specific project and how they should be encountered (Bresciani, Zelna, and Anderson, 2004). From the teacher's viewpoint time consumed in creating a rubric may be extensive, but once rubrics are completed the scoring process will be simple. The more specific the rubric is, the less the necessity for spontaneous written feedback for each student's work will be. In such cases, students can receive an enlightening response even though it is offered with fewer written comments that are customized for their work (Allen and Tanner, 2006).

Research Methodology

Sample of The Study

The project-based learning initiative study was carried out at the College of Applied Studies and Community Service at Imam Abdul Rahman bin Faisal University in the Kingdom of Saudi Arabia. The approach adopted in the current study was applied to seven courses offered by seven study programs in the second semester of the academic year (2019-2020). The sample of this study included 15 faculty members and 87 students.

Tools of the Study

Different tools were used in this current study including the following;
1. Two five Likert scale questionnaires were used in the current study;
a) a questionnaire to measure students' satisfaction towards project-based learning, and
b) a questionnaire to identify the faculty members' satisfaction with using the strategy of project-based learning.
The two questionnaires were mainly designed to identify the satisfaction of the faculty members and students with teaching and learning by using the strategy of project-based learning and highlight the list of skills that students acquired by using this strategy in teaching and learning.
2. A PBL Standards Rubric Scale to assess the practices of project-based learning
3. Training materials for the introductory workshops were prepared for the faculty members and students of the initiative.

Validity and Reliability of the Questionnaires

The initial forms of the two questionnaires were prepared and distributed to a group of referees specialized in curricula and teaching methods to ensure face, content, construct, and criterion validity. Some referees suggested rewording, omitting, and changing some items. A pilot study was conducted on some students and faculty members other than the group who participated in the study to ensure reliability. The final version of the two questionnaires included 15 items reflecting the most important project-based learning gains. The responses of the study's sample were calculated according to the following table:

Table 1
Calculation of the questionnaire's responses.

Type of Items	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Positive	5	4	3	2	1
Negative	1	2	3	4	5

Since both questionnaires contain 15 items, the maximum result is (75) degrees and the lower one is (15) degrees.

PBL Standards Rubric Scale

A scale of five axes, weak (1), acceptable (2), Good (3), Very Good (4), Excellent (5), for the criteria of evaluating the project-based learning practices/projects was also prepared to measure performance indicators that reflect the college pre and post PBL's application.

Validity and Reliability of The Scale

The initial form of the scale was distributed to a group of experts specialized in curricula and teaching methods and shared with the faculty members involved in implementing the PBL initiative. This was made to make all required modifications in the light of their suggestions. Some jury members recommended deleting, adding, and adjusting some items whereas others proposed rewording some items to be more specific and easier to measure. To measure the internal consistency of the scale, the Cronbach Alpha between three faculty members of the same course in the College of Applied Studies and Community Service was calculated, using the Cooper equation (Cooper, J., 1974, P175) as shown in the following table:

Table 2
Calculating the Cronbach alpha

Pre PBL's Cronbach Alpha	Post-PBL's Cronbach alpha	Average Cronbach alpha
93%	91%	92%

Table (2) highlighted that the average Cronbach alpha is 92%, which meant that the scale was satisfactory with good internal consistency, and it could be used in the current research.
The scale in its final form included twelve standards reached after verifying its accuracy, reliability, and assuring its applicability in measuring the extent to which project-based learning standards could be achieved in the current research.

Workshop Materials

The training materials for the introductory workshops were prepared for the faculty members and students of the initiative. They were shared with the members of the initial advisory committee to judge them, ensure their suitability, and modify them if required. The training materials. They were also shared with instructors to be used as a guide for them when teaching according to the project-based learning strategy, and a guide for the student in learning according to the project-based learning strategy.

Study procedures

The current study followed the upcoming steps:

- A theoretical review of literature, studies, and previous experiences regarding project-based learning was made.
- Introductory and training materials, forms, and procedural plan required to implement the initiative were prepared.
- A contract between the University vice Presidency for Academic Affairs and the College of Applied Studies and Community Service was signed to indicate its interest to implement the initiative
- Advisory committees at the vice deanship of academic affairs and executive committees of

the College of Applied Studies and Community Service were formed.
• Introductory meetings with the executive committees and heads of departments in the college were arranged.
• Decisions that would be taken into consideration during the implementation of the initiative in the college were made.
• A pre-application testing of the scale was conducted to assess the previous practices of project-based learning.
• The descriptions of the selected courses were modified to cope with the initiative so that a certain degree could be assigned to students' projects by the end of the implementation of the initiative. This might ensure the continuity of using the suggested learning strategy in the college after the end of the initiative
• A set of workshops were arranged to improve the capacity of the team working on the initiative
• Introductory meetings were made with groups of the male and female students as well as coordinators about implementing project-based learning
• Implementation of the initiative's procedural plan in its three phases: planning, implementation, and evaluation were set off.
• Students' projects inside class were presented.
• A post-application of the scale was made to measure the extent to which the project-based learning standards were achieved in the college.
• The results of applying the initiative were discussed in the college.

Research Results

Concerning the answer to the first question; "how much the College of Applied Studies and Community Service students were satisfied with learning according to the project-based learning strategy", the answer was reflected in the following statistical hypothesis: "Students' satisfaction with using project-based learning strategy in studying their undergraduate courses was positive." A questionnaire consisting of 15 items was used to measure the extent of students' satisfaction with the use of project-based learning strategy in the study of their university courses. Table (3) shows descriptive statistical analysis of students' responses to the questionnaire items, where the average ranged between (2.31) and (4.32), and the results showed convergence in the standard deviation for the answers to each item of the questionnaire, where the standard deviation ranged between (0.80) and (0.36).

Table 3
Descriptive statistics of students' responses to the questionnaire

Standard Deviation	Average	Descriptive Statistics	Standard Deviation	Average	Descriptive Statistics
0.67	3.47	Q9	0.74	3.87	Q1
0.64	4.13	Q10	0.63	3.54	Q2
0.47	3.94	Q11	0.42	3.55	Q3
0.65	4.18	Q12	0.68	3.48	Q4
0.80	2.31	Q13	0.42	3.85	Q5
0.55	4.32	Q14	0.70	3.14	Q6
0.36	3.41	Q15	0.54	3.71	Q7
			0.54	3.16	Q8

The results showed convergence in the standard deviation for the answers to each item of the questionnaire, where the standard deviation ranged between (0.80) and (0.36).
Table (4) presented a non-parametric statistical analysis to calculate the statistical significance for each item of the questionnaire to measure the satisfaction of male and female students with learning by using this strategy. The significance of the Chi-square test for one group showed that there were significant differences in favor of learning with this strategy. The level of significance was less than (0.05), so there were significant differences in favor of project-based learning in all (15) items, so the first hypothesis was accepted.

Table 4
The Significance level of the Chi-square test for each of the students' questionnaire items:

Significance level	Freedom	Chi-square value	Question number	Significance level	Freedom	Chi-square value	Question number
0.00	2	26.9	Q9	0.00	2	37.5	Q1
0.00	2	35.2	Q10	0.00	2	27.8	Q2
0.00	2	24	Q11	0.00	2	30.9	Q3
0.00	2	22.7	Q12	0.00	2	34.3	Q4
0.00	2	27.5	Q13	0.00	2	46.7	Q5
0.032	2	30.6	Q14	0.00	2	29.6	Q6
0.022	2	29.3	Q15	0.00	2	20.4	Q7
				0.00	2	37.5	Q8

Regarding the second question, "how much the faculty members of the College of Applied Studies and Community Service were satisfied with teaching by using the project-based learning strategy", the answer was reflected in the following statistical hypothesis: "The satisfaction of faculty members towards the use of project-based learning strategy in teaching their undergraduate courses was positive."

A questionnaire comprising 15 items was used to measure the satisfaction of faculty members with the use of project-based learning strategy in teaching. Table (5) showed a descriptive statistical analysis of faculty members' responses to the questionnaire items. The average ranged between (3.43) and (4.84), and that showed convergence in the standard deviation for the answers to each item of the questionnaire, where the standard deviation ranged between (0.90) and (0.33).

Table 5.
Descriptive statistics of faculty members' responses to the questionnaire

standard deviation	Average	Descriptive statistics	standard deviation	Average	Descriptive statistics
0.62	4.43	Q9	0.33	4.79	Q1
0.49	4.71	Q10	0.42	4.86	Q2
0.62	4.79	Q11	0.56	4.64	Q3
0.78	3.43	Q12	0.55	4.71	Q4
0.70	4.64	Q13	0.44	4.64	Q5
0.80	4.57	Q14	0.70	4.71	Q6
0.90	4.64	Q15	0.54	4.71	Q7
			0.50	4.71	Q8

Table (6) presented a non-parametric statistical analysis used to calculate the statistical significance for each item of the questionnaire. It was used to measure the degree of satisfaction of faculty members with teaching by this strategy. Using the Chi-square test for one group showed that there were significant differences in favor of teaching with this strategy. The level of significance was less than (0.05), so there were significant differences in favor of project-based learning in terms of the 15 items. It can be stated that the second hypothesis was accepted.

As for the third question related to the role of the project-based learning initiative in achieving the standards of implementing PBL strategy, the answer was reflected in the third hypothesis, which states that: "there were statistically significant differences between the two means of pre and post assessment in the rubric of criteria for practicing project-based learning in favor of post-assessment". The significance of differences between the pre-and post-mean scores in the rubric of project-based learning practice criteria was calculated using the T-test. (Table 6) showed the results of the pre-and post-application of each of the criteria for the rubric:

Table 6
Results of pre-and post-application of the rubric of project-based learning criteria.

No.	Criteria	Assessment	
		pre	post
1.	The suitability of student projects with learning outcomes	2	3.8

No.	Criteria	Assessment	
		pre	post
2.	Project planning	3	4.7
3.	Training the course professor on implementing a project-based learning strategy	2.6	4.1
4.	Training the student on project-based learning	2	3.8
5.	Educational supervision: follow-up, support	2.7	4.1
6.	Productivity	2.3	3.9
7.	Independence	2.6	4.3
8.	Originality	3.3	4.1
9.	Monitor the student's skills gained during project work	2	4.3
10.	Diversity of project design	1.9	3
11.	projects presentations	2.1	3.3
12.	Project evaluation mechanisms	2.9	4.6
13.	Total \ 60	29.2	48.1

For more illustration, the following table was made to show the average score differences, standard deviation, calculated T at 0.05 significance level.

Table 7

Results of the "T" test for the average differences between the pre- and post-assessment in the rubric of project-based learning standards

Application	Average score	standard deviation	Calculated T	Significance level
Pre	29.2	4.382	40.492	Significant at (0.05) level
Post	48.1	7.852		

The previous table showed clearly that the value of "T" for the differences between the average levels of post-assessment in the rubric of the standards of practicing project-based learning has reached (48.1), which is a significant value at the level of (0.05). This means that there were differences in the standards of practice of project-based learning In favor of post-implementation, and it refers to the effect of teaching using a project-based learning strategy, the third hypothesis was accepted.

Regarding the fourth question related to the skills students gained from learning according to the project-based learning strategy, it was expressed by the fourth interrogative hypothesis that states: "students could gain several skills when learned to accord to the project-based learning strategy. To verify this hypothesis, the average rating of both students and faculty members was calculated for the questionnaire items related to the extent of students' acquisition of each skill, as shown in the following table.

It was clearly stated that the previous table that each of the five academic skills got a high evaluation score, confirming its achievement and acquisition because of learning with a project-based learning strategy. Evaluation ranges between the lowest degree which is (1) and the highest degree (5). As for the average evaluation of the two research groups of students and faculty members, all of them were above (3.5) degrees. To find out the rate at which students and faculty agree that students gain these skills, the Pearson Correlation factor was used to calculate the agreement factor which reached (0.875), which is a prime factor of agreement. This makes us unanimously sure that students could gain these academic skills with the help of their instructors who asked them to do educational projects that they carried out during their learning of project-based learning strategy.

Table 9.

Average of both students and faculty members of the questionnaire that asks about the extent of students' acquisition of each skill.

s	Skill	Students' assessment of skill acquisition	Faculty members' assessment of skill acquisition
1	Project-based learning helped students gain collaborating skill	3.87	4.71
2	Project-based learning helped students gain critical thinking skill	3.54	4.64
3	Project-based learning helped students gain creative thinking skill	3.55	4.71
4	Project-based learning helped students gain decision-making skill	3.85	4.71
5	Project-based learning helped students gain project management skill	3.51	4.43
	Average	3.65	4.64

Conclusion

It can be concluded that the project-based learning initiative was effective in improving the quality of teaching at the College of Applied Studies and Community Service as it helped achieve the criteria planned for. The results obtained were consistent with the study of Anitha (2018), Shahiwala (2017), and Rodríguez (2015); however, the current study was different from all other previous studies in terms of achieving the criteria of applying project-based learning at the university level as none of the previous studies used a project-based learning strategy to achieve the standards of this type of learning for university students. This can be explained in the light of the following points.

• Providing an opportunity for students to learn from working on projects that gave them a chance to experience the diversity of ideas suggested in each group work. Every participant did his best to provide an opportunity to exchange ideas and views on how to solve problems through the outputs of each completed project.

• Motivating students to learn to make them more positive in the educational situation, and more enthusiastic to know the results of his learning, and the level of his progress. This was made through providing regular feedback to raise students' self-confidence, and through the positive reinforcement of his peers in the group.

• Active positive interactions among students while working on educational projects where the project-based learning strategy was mainly based upon investigation, searching for knowledge, and developing solutions to all problems posed by the course professor. Discussion with peers and receiving feedback from them also provided an opportunity for students to think and express opinions, agree, or disagree, and provide justifications for that. This had an important role in developing the skills of project-based learning implementation.

• Providing an opportunity for students to be more responsible for their learning. They acquired the ability of thinking providing evidence for their opinions, analyzing the situation presented to them, and expressing their opinion on it. This helped achieve the criteria for practicing this type of learning.

• Providing students with the opportunity to search for information in various sources and organizing their presentation in front of their colleagues in the group. This developed students' independence in thinking and created a sense of self-confidence, which leads to smooth, rapid, and accurate performance.

As for the results achieved through statistical analysis using the Chi-square for the questionnaire items of students and faculty members, it was quite clear that there was a statistical significance in all items of the two questionnaires, and this indicates that students and faculty members were

satisfied with learning and studying in such new environments, despite the resistance and lack of conviction at the first time from some students and some faculty members. After training and implementation, students and their teachers put their hand on the importance of this strategy, and they wished to apply it more broadly in all the courses they are studying. However, the main obstacle was represented in the lack of their knowledge and training to work according to this strategy. Teachers were not upset and had a positive attitude towards this strategy despite the reduction of their role as this strategy focuses more on the student and his interaction with his peers.

As for the skills acquired by students, the results showed that several academic skills were acquired by students such as cooperation, critical thinking, creative thinking, project management, and decision-making. This may be because the student-based learning strategy provided them with chances and environments that were not available in traditional teaching. The current study helped students face real-life problems with broad minds based upon a wide understanding of concepts, effective communication with others, personal and social skills, using critical thinking skills. These results were consistent with the results obtained by (Pereira MAC, 2017), (Gülbahar Y, 2006), (Hashim R, 2009), (Cronin M, 2019), (Anitha D, 2018), (Bresciani MJ, 2004).

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