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Effects of Project-Based Learning on Postgraduate Students' Research Proposal Writing Skills

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Abstract: Research is considered a vital component for propelling progress and development. This study aims to investigate the effects of problem-based learning (PBL) in the teaching of research methodology and statistics courses on improving research writing skills and enhancing course achievement. It also projects an action plan model for the effective implementation of PBL in the instructional aspect. The study utilised a positivist research paradigm based on action research design using the technique of content analysis. Employing a universal rubric, 45 proposals of graduate programme students enrolled in the College of Education at Minia University in North Upper Egypt were subjected to content analysis to rate students' skills in writing research proposals before and after the delivery of the course. The students volunteered to participate in the study after they were given a synopsis of the aims and procedures. Students' achievement was assessed through a test consisting of 90 items, developed primarily for this purpose at the end of the second semester in the academic year 2018–2019. The post-content analysis revealed a significant improvement in scientific research skills, with a considerable difference between the pre- and post-achievement scores. It is imperative to consider the feasibility of using the PBL approach in teaching research methodology and statistics courses for graduate students. The study recommended the adoption of PBL in undergraduate programmes as well as in high school education.

Keywords: *Academic achievement, postgraduate students, project-based learning, research methodology, research proposal writing skills.*

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Introduction

Research is a vital driver for a nation's progress and development. Students in higher education institutions (HEIs) are required to have the necessary skills to conduct research through a scientific process. One of the methods to achieve this is to introduce graduate school students to problem-based learning (PBL) where scientific research skills are employed. When used in the instructional process, PBL can help students develop critical thinking skills during complex situations (Inocian, 2018).

The positive effects of PBL in helping university students acquire 21st century skills have been widely accepted and documented in various studies (e.g., Bell, 2010; Musa et al., 2011). These skills, including job-readiness and employability competencies, are crucial for lifelong learning and workplace requirements. PBL can be defined as a comprehensive instructional approach that engages learners in an organised and cooperative manner to examine and solve certain problems (Musa et al., 2011). PBL can propel higher education students' success and employability after they graduate.

The investigation of scientific research skills at the graduate level among students is evidently limited. The development of scientific research skills is one of the essential goals of postgraduate institutions in First World countries including the United States of America, the United Kingdom, and Australia (Timmerman et al., 2013). In developing countries like Egypt, however, low priority has been given to the improvement of research skills among university students (Khalaf, 2014, 2018, 2019). These citations nuance a bifurcated notion that Eastern nations are lagging behind compared to their Western counterparts in terms of PBL potentials in the instructional process, which needs a mitigation strategy to counter the argument that regardless of cultural landscapes, it is imperative to improve research writing skills.

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Bell (2010) stated that by implementing PBL, students in HEIs are being prepared to enhance 21st century skills such as critical thinking, communication, collaboration, and creativity, with readiness as well as a repertoire of skills that can be used successfully. These four macro skills are needed for the well-rounded development of learners, as emphasised in Inocian's quadrant model of teaching (Inocian, 2015). Moreover, PBL projects are often impressive, and have grand undertakings created and presented with 'ultimate pride and care'. In PBL, students work cooperatively to conduct research and create projects, which amplify the use of their theoretical knowledge when used collectively rather than individually (pp. 39–43). The use of PBL in graduate schools not only enhances one's self-regulation, but also promotes cooperation and collaboration, and social networks.

Akçöltekin (2016) developed a project-based training programme with scientific research skills to enhance positive attitudes towards scientific research. The study participants included 90 high school teachers. The results revealed a significant improvement in attitudes towards scientific research skills and research methodology. Additionally, a positive correlation was found between attitudes towards scientific research and project competition. No differences in gender or educational level were determined in attitudes towards scientific research. Regardless of gender orientation, an optimistic outlook is a precursor to positive change.

Parker (2010) noted that the weak state of undergraduate research methods could be attributed to the increased emphasis on breadth over depth in studies and a lack of commitment to training with research methods as well as conducting practical research projects. He added, 'there is a consistent lack of training in research skills in most undergraduate programs in the USA, Canada, and Australia. Likewise, the case exists in Egyptian universities and higher education institutions. This foregoing reality remains ontological unless HEIs continue to be steadfast in their efforts to increase their commitments to ensuring quality graduate school research, publication, and dissemination.

A study conducted by Timmerman et al. (2013) demonstrated that training programmes and research proposal experiences could optimise research skills development. Accordingly, it is imperative to encourage students to attend workshops and engage in various scientific research facets. It can be inferred from the literature that research skills can be improved and sustained with training. Accordingly, the present study seeks to enhance research writing skills using the PBL approach.

Research Objectives

The study aims to investigate the influence of PBL on the teaching of research methodology courses, improving research skills and enhancing course achievement. It also projected an action plan for the effective implementation of PBL in the instructional aspect. It sought to answer the following research questions: (1) Does a PBL approach improve postgraduate proposal writing skills? (2) Are there statistically significant differences between achievement in research methodology and statistics courses before and after PBL training? (3) What type of PBL instructional model can be designed for effective teaching?

Literature Review

The literature provides a rich background regarding the use of PBL in various disciplines of the academia. The dictionary of education defines PBL as a student-driven approach to classroom organisation in which the students themselves are responsible for investigating a question and representing their results once the project is completed. Students in PBL explore questions in their own way and create and manage their own group projects. This allows them to critically think, perform, communicate, collaborate, and create outputs that document the successful realisation of learning outcomes based on prescribed standards.

Relevant literature on research methods and research skills recommended that students should conduct research, collect and analyse data in order to support and reinforce their research skills. This recommendation interfaces the proper application of theory and practice. One of the errors committed in the instruction of research skills is the delivery of the subject being an isolated and separate course, whereas it should be more successfully integrated with other courses (Abu-Setta & Al-Ashiq, 2007; Parker, 2010). The current trend is that research is integrated with all the prescribed courses in the curriculum, instruction and assessment of higher education curricula.

Role of Students in PBL

In PBL, students attempt to satisfy their natural curiosity for knowledge using critical thinking skills in an innovative way (Inocian, 2018). It should focus on learners' skill development (Savery, 2006, as cited in Ungaretti et al., 2015). Students should prepare questions and receive guidance from their mentors and supervisors. They have the liberty to select the main elements of the project. They can engage in any type of project like (1) construction and manipulation, (2) employment, (3) problem, (4) learning, (5) aesthetics and (6) skill development (Calderon, 1998, as cited in Inocian, 2015). In graduate schools, students can engage in construction projects like miniature structure, for examples, and other outputs. If they wish to engage in employment projects, they can choose cleaning drives and nutrition campaigns in the community. If they engage in a problem-solving project, they can opt for research, advocacy work, and product innovation and modification. If they want to be part of a learning project, they can write about the historical importance

of their place or maintain an urban garden. If they are passionate about art and culture, they can engage in song recital or theatre performance. If they want to hone their expertise in skill projects, they have to play the guitar, sing and dance in cultural performances and engage in writing if they wish to become practicing researchers in the future. PBL's main objective is to enable students to think deeply, become innovative learners, achieve a better understanding of the topic that interests them, be fully involved, and solve real-world problems (Bell, 2010).

Benefits of PBL

In the British context, Boaler (1999) determined that students who learnt through PBL achieved three times higher scores in mathematics national exams than their traditional learning peers. Moreover, PBL also helps students achieve higher grades in academic achievement and improve their motivation level (Bell, 2010; Inocian et al., 2019; Tiwari et al., 2017). These benefits of PBL have been frequently asserted by many researchers; Bell (2010) described that with PBL, students learn to be autonomous, disciplined and responsible learners. They acquire and practice accountability, cooperation and sufficient self-regulation.

PBL promotes social learning through fundamental skills developed during teamwork, including activities in which students generate ideas, ask questions, participate in collective problem-solving, are involved in active listening, use effective communication, reflect with self-evaluation and participate in social interaction. As students participate in and develop these skills, it also helps them achieve mastery and proficiency, thus making PBL skills essential for future success (Bell, 2010).

PBL motivates learners to acquire and apply research methodology skills because it provides them with opportunities to apply various research skills and gain first-hand experience in realistic, contextualised real-world problem scenario (Inocian et al., 2019; Tiwari et al., 2017). Engagement in PBL enables students to explore and find new information and synthesise these details in a way that makes learning experiences more realistic, interesting and meaningful (Inocian et al., 2019; Pflaum & Bishop, 2004; Wurdinger et al., 2007). The PBL approach enables students to learn real-world application of skills and analytical thinking. Therefore, they perform well not only in standardised tests but also on project assessments. Additionally, PBL helps sustain students' interests and motivation over a period of time, increases their engagement and deepens their learning experience (Bell, 2010).

Musa et al. (2011) asserted that PBL enables students to (1) transfer theoretical knowledge to similar real-world situations and life contexts; (2) equip themselves with vital skills such as planning, discipline, organisation, teamwork, collaborative work, assuming responsibility, data collection and presenting information; (3) improve self-directedness, personal initiative, creativity and independence as it is a student-centred process. (p. 188–193); (4) help students acquire conflict resolution, decision-making and communication skills; and (5) increase students' self-confidence, critical thinking skills and desire to be productive (p. 194).

Research Proposal Writing Skills

Considering its essential role in preparing a competent researcher, both research methods and research projects are consistently required for undergraduate degrees in European countries (Parker, 2010). It is widely accepted that the purpose of the research methodology and statistics courses is that it enables students to carry out a research project. In PBL, students use a wide range of tools and resources to conduct their research. Moreover, PBL improves students' social skills and self-esteem since it depends on collaborative work (Bell, 2010). Research methodology skills can be best applied and practiced with the use of PBL. It has assisted students in gaining self-confidence and increased their knowledge on the assigned topic. Students added that being a member in a dynamic group develops their communication skills, data collection, and analytical and presentation skills (Tiwari et al., 2017).

Previous Studies

Using the cross-cultural technique, Parker (2010) examined the requirements for quantitative methods in 200 political science programmes in the United States compared with Australia, Canada, Sweden, Norway, Finland, Netherland and the United Kingdom. It was found that research skills and methodology instruction were much weaker than that stated in the previous literature. The case was similar in countries that award flexible arts degrees while European universities oblige students to receive training in research methods followed by a practice of hands-on research.

Musa et al. (2011) utilised the project-based learning approach to improve job-readiness, employability, language learning and workplace skills. Participants included 29 sophomores selected randomly. The results indicated that approximately 705 of the respondents gained work-related and 21st-century skills using the PBL approach. They were also capable of designing and implementing data collection processes using interviews and questionnaires. They managed to apply analytical and problem-solving skills, acquired leadership and teamwork skills, and learnt how to write a coherent, concise and comprehensive research report driven by their experience with a PBL approach.

Using performance-based assessment, Timmerman et al. (2013) investigated the development of research skills of 100 STEM students enrolled in master's and doctoral programmes. They sought to evaluate the progress of participants'

written research proposals through the academic year. The results indicated that participants significantly developed their research skills in certain areas, including setting the research in its proper context, appropriate use of relevant literature, phrasing testable hypotheses, correctly reporting data, and proper use of data presentation. In contrast, skills such as statistical analysis of data and reaching conclusions did not improve.

Tiwari et al. (2017) utilised PBL in teaching research methodology skills with 99 students in a medical college. The results indicated a 100% improvement in research methodology knowledge. They also demonstrated that 73.7% of the participants expressed satisfaction with and were motivated to use PBL. In addition, 76.8% believed that they could use research methodology skills in future projects, with 91% agreeing to participate in PBL projects in subsequent courses.

Khalaf (2019) examined the role of a research methodology course in college students' acquisition of research proposal writing skills from students' points of view. Participants included 100 seniors randomly selected from the College of Education at Minia University. The results indicated a limited role of research methodology courses in students' acquisition of scientific research skills. The mastery level was inferior by 75% in all dimensions, and the total score was 69.48%. The lowest dimension was 'statistical skills' (58%), followed by the dimension entitled 'results, recommendations and suggested research' (66%).

Using a randomised control trial, Schneider et al. (2022) investigated the effectiveness of the PBL approach in boosting secondary school science learning and college ambitions. The achievement was indirectly affected by participation in learning science by doing. The foregoing literature synthesises the relevance of PBL in the instructional process under which, it is an assumption that PBL can also be relevant in the context of the research methodology and statistics course as the primary intent of the paper.

The Action Plan Model of PBL Implementation

In line with the iterative cycle of the action research design, a certain model was conceptualised as its action, the PDCA model of Brydon-Miller et al. (2017). This action plan serves as the research output from the findings of the study. It highlights the contribution of the study in addressing the culture of teaching research process in graduate school education in Egypt and across the world among those who are interested in adopting the model. This Action Plan Model of PBL Implementation known as APM-PBLI begins with five processes: plan, prepare, monitor, perform and evaluate (PPMPE).

As seen in Figure 1, the APM-PBLI is seen as cyclical. The model is found at the inner circle as the heart of the instructional process. It is surrounded by five stages or processes to complete the cycle. The pointing arrows will guide users who wish to adopt this model for further utilisation or application. The processes start from planning to evaluation.

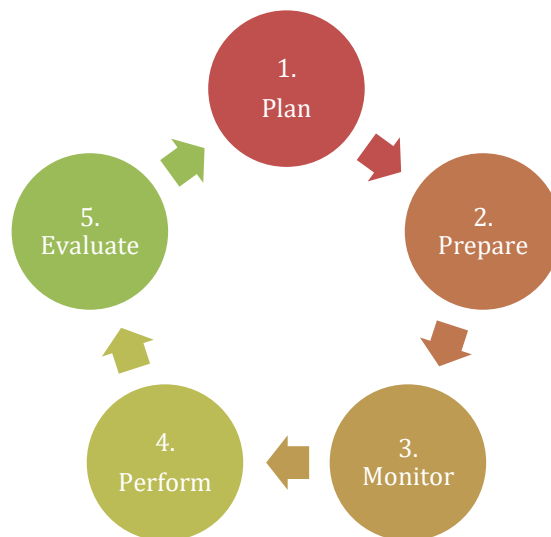


Figure 1. Action Plan Model of PBLI

How Educators Use the APM-PBLI Plan

Planning is the initial stage of the cycle, which allows professors to lay all the expected inputs like the objectives of the plan, strategies, human resources, environment, technology and measurement tools for evaluation of how PBL can be used in the actual instructional process. For instance, if the plan promotes the academic achievement of students who enrolled in the research methodology and statistics course, it should include a rationale and objectives. The activities and strategies will be planned, including the resource persons who will serve as experts. After a multi-media presentation on the writing of research proposals, the students are expected to improve their skills in writing research

proposals. Planning for evaluation tools for the planned competencies will also be required. Essentially, this first stage is the 'blue-print' of the cyclical model.

Prepare

Preparation is the second stage of the cycle where teachers implement the action plan and test its results formatively. This stage provides the actual performance of both teachers and learners to ensure the effective implementation of PBL in course offerings, as required in a specific programme of implementation offered in different educational institutions. For instance, the staging of the orientation and training of PBL implementation using multi-media presentation in the plan will be executed. It also includes orientation and workshops on how to effectively write research proposals. There is no perfect performance here because this stage serves as the initiation of the ontological and the dialectical process of instruction. This is the rehearsal stage or the 'play-performance' of the cyclical model.

Monitor

Monitoring is the third stage in the cycle using the required monitoring checklist or rubric to ensure the effective management of PBL. Actual time, resources, environment and strategies will be appropriately monitored. The checklist for monitoring can either be standardised or prepared, provided it is checked to ensure its validity and reliability. If the positive results are ascertained, then the professor will offer rewards or incentives for students' formative performance in the writing of the research proposals; and if the results are negative, finding an appropriate intervention in the PBL process will be sought to ensure the effective realisation of the plan. This stage is the 'checking-counter' of the cyclical model.

Perform

Performing refers to interventions for action based on the negative results of the monitoring process. This is where troubleshooting and modifications are needed to ensure the effective results of the realisation of PBL implementation. For instance, after the results of monitoring, the professors handling the course can ensure the quality of students' outputs related to the learning outcomes set in the course standards. This stage is the 'garnishing of the menu' of the cyclical model.

Evaluate

Evaluation is the final stage of the cycle where a standardised rubric will be used. Positive results of the evaluation will be good points for retention to ensure the sustainable effectiveness of PBL implementation. Negative results serve as a basis for future planning to address the problems and determine solutions in the next action research cycle. For instance, in the next cycle, suggestions and recommendations from professors and students will have to be integrated in the model before another cycle begins. This stage proves the iterative manner of action research design. This final stage is the 'diverging road' of the cycle.

Methodology

Research Design

The study utilised a positivist research paradigm using an action research design. Action Research Design is an iterative process described by Brydon-Miller et al. (2017), which includes the following steps: (a) to conduct a preliminary inquiry in developing an understanding of the root cause of the problem, (b) to create strategies designed in addressing the problem based on the teacher's personal experience and other secondary data, (c) to implement and observe the results of the interventions, and then (d) to reflect on the outcome and determine the next iteration of the research process that can be used in the graduate school classroom. A content analysis technique was also used to analyse each of the 45 research proposals. Content analysis transcends traditional notions of symbols, contents and intents in the investigation of the texts (Krippendorff, 2019) in each of the 45 research proposals.

Research Participants

The study was conducted in Minia University—a public university located in North Upper Egypt. The researchers selected 225 students who studied the course on research methodology and statistics and categorised them into different groups. Using PowerPoint presentations, videos and stimulated recall, the students were informed about methods to apply the theoretical concepts and gain first-hand experience in constructing a proposal and conducting the research process. All the students volunteered to participate in the study after they were given a synopsis of the aims and procedures of the course. The 225 students were grouped into different teams, and they created 45 research proposals that were selected for content analysis. Their research proposals were analysed using the universal rubric to assess scientific research writing skills.

Research Instrument/Content Analysis Rubric

The authors adopted performance-based assessment because, as Timmerman et al. (2013) stated, 'the development of research skills cannot be tested directly without performance-based assessment' (p.708). Recent findings asserted that via rubric, assessments of project-based learning are authentic (Bell, 2010). Written research proposals are considered an original source of data that clearly reflect students' skills in identifying and treating the research problems (Hackett & Rhoten, 2009). Accordingly, 45 research proposals were subjected to content analysis. The present study adopted the rubric constructed by Timmerman et al. (2013), who published a modified form of a previously validated universal rubric to assess scientific research skills and research proposal writing skills. A four-point Likert scale was used by two raters who were experts in the research methodology and statistics instruction. The scores were as follows: proficient = 3, intermediate = 2, novice = 1 and absent = 0. This rubric consisted of 10 criteria: (a) Setting the proposed research in its context; (b) Framing testable hypotheses; (c) Proper integration of relevant literature; (d) Ensuring the validity of and reliability of instruments; (e) Selection of suitable experimental design; (f) Data selection; (g) Data presentation; (h) Data analysis; (i) Reaching conclusions from the data; and (j) Alternative explanations and limitations

Data Collection

The Plan-Do-Check-Act (PDCA) model of data collection of Brydon-Miller et al. (2017) was also adopted in the process of data collection.

Plan

An investigation was conducted to evaluate the research gaps leading to the low level of academic achievement of the graduate programme students enrolled in the research methodology and statistics courses. The researcher hypothesised that there is no significant difference in the academic achievement of the research participants in the research methodology and statistics courses after the adoption of PBL. A systematic literature review was conducted on research articles published in international journals on PBL to cluster and highlight relevant literature for the conduct of the study. Existing practices in the graduate school, as regards the teaching of the research methodology and statistics were also noted.

Do and Check

The researchers selected as participants 225 graduate programme students enrolled in research methodology and statistics courses. After giving an orientation and instructions on the writing of the research proposal as a requirement of the course, they were grouped into teams. There were 45 research proposals that were analysed using a universal rubric adopted from Timmerman et al. (2013). In the adoption of PBL, the graduate school students were given orientation and training to use this in the writing of their research proposals. They were also given the post-evaluation of their performance using a 90-item test at the end of the semester in the academic year. A paired sample t-test was also used to treat the data.

Act

The results of the analysis served as the basis for the formulation of an action plan for retention of the use of PBL in the teaching of research methodology and statistics courses. In the event of some error that may affect the implementation of PBL, then another cycle is introduced for continual improvement.

Data Analysis

After the content analysis was conducted using a universal rubric, the achievement scores were generated. Students' achievement was assessed via an achievement test consisting of 90 items developed mainly for this purpose at the end of the second semester in the academic year 2018–2019. Content validity of the test was ensured through a panel of jury who work as faculty members in the college of education, Minia University. Item discrimination index of the achievement test ranged between .431 and .829. Kuder-Richardson 21 (KR21) formula was utilised to compute the reliability of the test as it is suitable for tests composed of items with binary responses. KR21 value was 0.68, indicating that the achievement test was adequately reliable. Cronbach's Alpha reliability for the rubric reached .78 indicating acceptable reliability (Tavakol & Dennick, 2011). Inter-raters' reliability was also verified through calculating correlation coefficient between the raters' assessments; and its value reached .73. Assumptions of the statistical techniques were verified before using them. Normal distribution descriptive statistics and histograms are shown in Table 1 and Figure 2. The authors evaluated the gains in students' research skills over three months through paired samples t-test and McGuigan's & Blake's gain ratio (Grigonis et al., 1970). Significant differences at the 0.01 level were reported between the mean scores of the pre- and post-content analyses.

Ethical Considerations of the Study

In order to meet the requirements for ethics in the conduct of research, the 45 student-participants were informed that their research proposals were subjected to content analysis using a universal rubric. Results of the analysis were treated with utmost confidentiality. Each of the 45 research proposals was considered to ensure anonymity using coding. The research participants will benefit from the study because the results from the analysis would improve each of their research proposals. Since the study does not involve human subjects, it was able to obtain exemption from the rigors of ethical considerations from the Ethics Review Board (ERB).

Results

This section presents the data presented on visualised tables and figures. To answer the study questions, a paired samples t-test was computed, and its results were reported in the following table. Before analysing the data, normality was checked, and the descriptive statistics are shown in Table 1.

Table 1. Descriptive Statistics for the Study Variables

	Pre-Content Analysis	Post-Content Analysis	Pre-Achievement	Post-Achievement
M	7.76	15.04	75.24	78.31
Median	8.00	15.00	76.00	77.00
Mode	8.00	15.00	77.00	75.00
SD	1.45	1.41	4.30	4.78
Skewness	-.256	.019	-.179	-.119
Kurtosis	-.554	.168	-.899	-1.05

Table 2. T-Test Results of the Pre- and Post-Content Analysis Using the Rubric (N= 45)

Criteria	Pre-content analysis		Post-content analysis		t	p	Cohen's d
	M	SD	M	SD			
Context	.89	.32	1.89	.38	-12.85	.01	0.2
Hypotheses	.82	.39	1.67	.52	-7.68	.01	0.2
Literature	.73	.45	1.64	.48	-8.01	.01	0.2
Validity/Reliability	.69	.47	1.36	.48	-6.99	.01	0.1
Experimental Design	.82	.39	1.60	.50	-7.42	.01	0.1
Data Selection	.71	.46	1.49	.51	-8.21	.01	0.2
Data Presentation	.76	.43	1.47	.50	-6.30	.01	0.1
Data Analysis	.84	.37	1.38	.49	-7.09	.01	0.1
Conclusions	.78	.42	1.31	.47	-5.42	.01	0.1
Explanations/Limitations	.71	.46	1.24	.43	-5.42	.01	0.1
Total Score	7.76	1.45	15.04	1.41	-20.22	.01	0.3

Table 2 shows that there is significant improvement in scientific research skills as found in the post-analysis. All t-test values were significant at the 0.01 level. In terms of context, the research participants have significant improvement in the formulation of the introduction and the research problem that is based on existing gaps. Likewise, there is also a significant effect in the formulation of hypothesis, specifically in positivist research paradigms. There is also a significant improvement in the review of related literature in the conduct of their research proposals. Ensuring validity and reliability in terms of instrument was also significant.

Regarding the use of experimental design in the methodology section, the research participants also exhibited great improvement. The use of research data like selection, presentation and analysis also substantially improved. Formulating the conclusion as an answer to the main problem, the explanations and limitations in the discussion of the results were also found to have improved considerably. These results can be attributed to the proper orientation of the research faculty in the writing of the research proposal as a requirement for the course in Research Methodology. Accordingly, the use of PBL has contributed to the areas of self-regulation, selection of the research topic, decision-making and the learner-oriented atmosphere in the graduate school culture of the university.

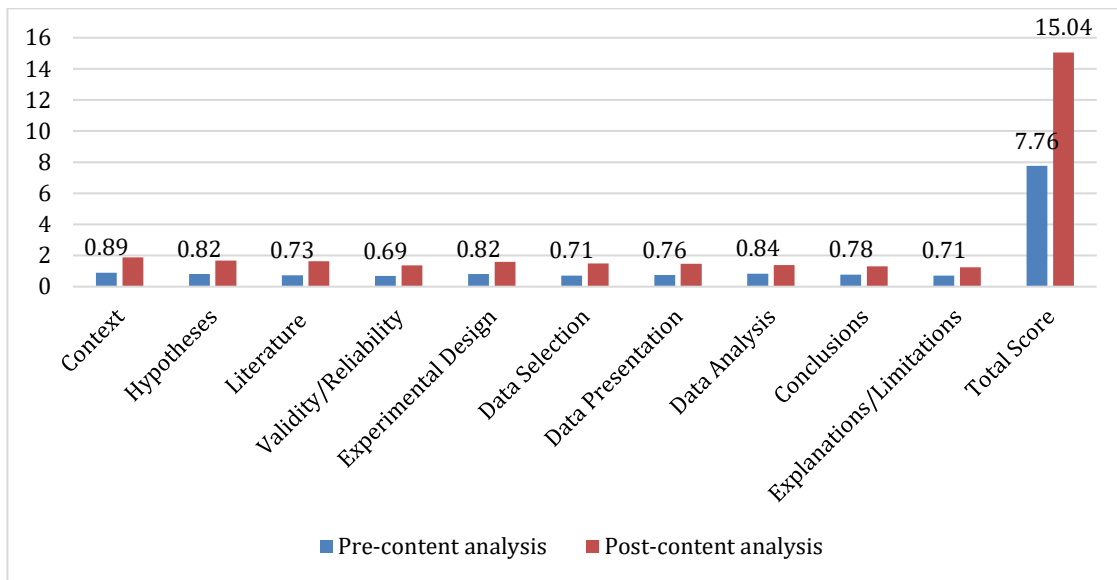


Figure 2. Differences between pre. and post content analysis

Table 3. T-Test Results for the Difference between Pre- and Post-Achievements in Research Methodology Course

	M	SD	DF	t	p	Cohen's d
Pre-achievement	75.24	4.30	44	-9.31	.000	0.713
Post-achievement	78.31	4.78				

Table 3 shows that the difference between pre- and post-achievements in the research methodology course was significant, indicating the effectiveness of the PBL training. This gain in scientific research skills may be explained by the fact that students in PBL learn how to self-monitor their progress throughout the project. In this study, over the course of three months, the research participants were trained and taught to set goals, work collaboratively, stay focused on a task, work effectively and comprehensively develop their ideas and skills. They were watching their peers' progress through the proposal preparation process and this sense of accountability towards peers had a positive impact on their motivation to complete their project.

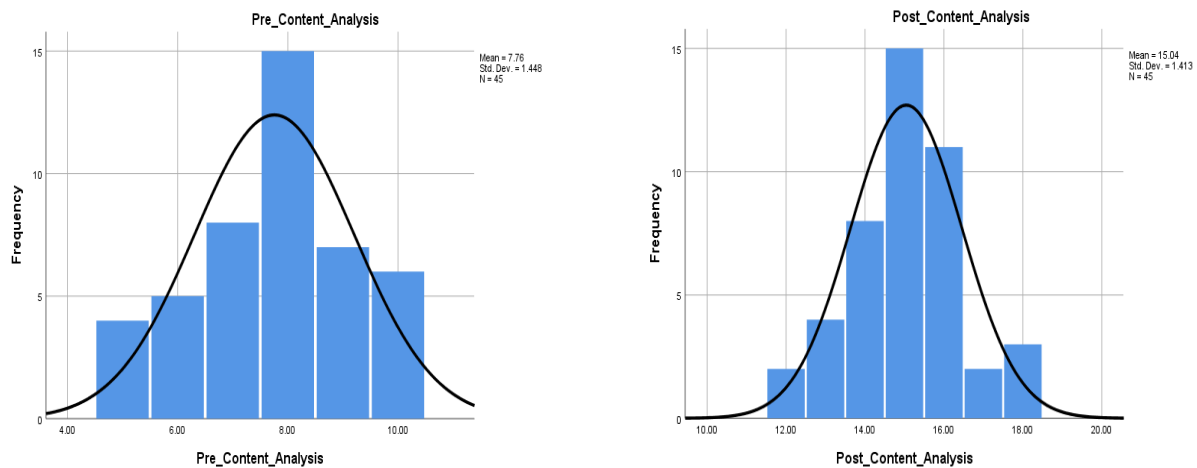


Figure 2. Normal Distribution Histograms for Pre- and Post-Content Analyses

McGuigan's & Blake's Gain Ratio

To further assess the effectiveness of the project-based learning in improving postgraduate students' research proposal writing skills, McGuigan's & Blake's gain ratio formula was utilized (Grigonis et al., 1970, p. 38). The formula is $(M2 - M1) / (P - M1) + (M2 - M1) / P$. M1= mean of pre-test, M2= mean of post-test; and P= maximum score. We used the former formula and the resultant gain ratio for the difference between the pre-test and post-test of content analysis rubric was .573 which exceeds the .5 criterion value (Grigonis et al., 1970, p. 38). This gain in research proposal writing skills demonstrate the efficacy of the project-based learning instruction as an effective tool in the acquisition of those skills.

Discussion

The main purpose of the present research was to investigate the effects of PBL approach on the acquisition and use of research proposal writing skills. In the PBL sessions, students were categorised into groups and within each group, effort labour was distributed. Members were eager to present their unique contribution in order to push the group forward; consensus on ideas, collaborative work, desire for success, deep understanding of concepts and being keen on the application of abstract concepts in a real piece of work were the main focus for the success of the PBL approach in the present study.

Each group of students has an assigned task and they cooperated with each other to improve their projects. They were content with the academic freedom during their work. From the onset of the training programme, they selected topics with mentors' help and commenced their projects from the statement of the problem by writing down references in accordance with the APA style.

PBL helped students enhance their research skills through self-confidence and scaffolded instruction, which was delivered to the participants. Students were encouraged to apply theoretical knowledge in their actual practice. Each group (consisting of five students) wrote an individual proposal and conducted their research independently. In addition to the written research project, students were allowed to deliver a brief PowerPoint presentation in which they displayed a summary of their project.

The literature predicts the fruitful consequences and long-run positive benefits of students' engagement in PBL as a means for facilitating students' acquisition of scientific research skills required for conducting research (Bell, 2010; Tiwari et al., 2017).

Students selected their own topics, and after the researchers corrected and revised them, the students began to write their proposals. Each group was encouraged to work as a team. They were directed to use all available resources as well as global databases (such as ERIC, Sage, ScienceDirect, Pro-quest, Google Scholar, etc.). Regular visits were coordinated with the university's main library, the College of Education library, and the Alexandria library branch (Knowledge Embassy) in Minia University.

Despite these limitations, the use of PBL opens a wider vista for instructional innovation with the following implications: Firstly, it has an educational implication for teachers and students to improve their current teaching practices and the school administrators to redirect and realign their management to fit in the essence of PBL implementation of their teachers in the workplace or in the classroom (Hallinger & Bridges, 2007); and specifically in the graduate programme education management (Brownell & Jameson, 2004). Secondly, it has social implications for learners to be personally and socially responsible for the tasks assigned to them (Inocian, et al., 2019; Lam, 2009; Lee et al., 2021), and that they remain proactive rather than reactive.

Thirdly, it has a psychological implication because learners are free to choose writing a research topic in accordance with their choice so that they can be happy and consequently complete the research proposals on time. It also improves the acquisition of better learning as supported by the findings of Ramli et al. (2020); the synergistic development of cognitive, affective and affective potentials (Brownell & Jameson, 2004); higher perceptions of competence like content knowledge and critical thinking (Burris & Garton, 2007; Wijnia, et al., 2011); and sustains self-esteem, interest and motivation (Bell, 2010). Fourthly, it has aesthetic implications because the students can be innovative and creative in crafting their learning outputs to achieve learning outcomes. This was confirmed by Zhou (2021) and Bell (2010) who posited that PBL has greater contribution to creativity compared to the traditional methods of teaching.

Fifthly, it has political implications for the government institution to provide budget allocation to support PBL implementation in public-school systems. It also supports policymaking as in the case of health inequity in medical practice (Cavanagh et al., 2019); the terra-political framework in the works of Jørgensen and Boje (2020). Lastly, it has a practical implication because learners will have self-regulation, self-discipline, resilience, and grit to withstand the academic challenges given in them; and to become self-directed (Distlehorst et al., 2009; Inocian, 2018; Lam, 2009; Sungur & Tekkaya, 2006). All these are affirmed by Amalya et al. (2021) that there is a significant difference in self-efficacy and learning outcomes of students using the PBL. Initially, PBL is an effective approach to learning more especially in the application of theory and practice (Hallinger & Lu, 2011); and positively affects academic achievement (Akinoğlu & Tandoğan, 2007).

Conclusion

This study was guided by the principles of project-based learning. The exposure and training of graduate programme students in the PBL approach in the teaching of research methodology and statistics courses is effective and significantly improves their skills in research writing, enhancing their academic achievement in the research process. A significant improvement in the post-content analysis indicative in the context, hypothesis, literature, validity/reliability, experimental design, data selection, data presentation, data analysis, conclusions and in explanations/limitations. With this, the prior hypothesis was accepted. The adoption of PBL in the course remains a potential factor in the improvement of the academic achievement of graduate school students taking up research

methodology and statistics courses. In academic settings, students often face academic setbacks (Khalaf, 2014; Khalaf & Abulela, 2021). Consequently, they need to cope with these difficulties, and improvement of research writing skills might lower the negative effects of those academic shortcomings. Students need to be more resilient either psychologically or academically (Khalaf, 2020; Khalaf & Al-Said, 2021) which in turn will help them get rid of their anxiety in different academic disciplines (Khalaf, 2016, 2017; Khalaf & Omara, 2022).

Recommendations

In future research, the following recommendations are suggested for considerations. First, the use of a structured interview and self-report questionnaire will be very useful to enhance a wider scope of the study. Second, future research trends could tackle the cross-cultural differences in research methodologies and statistics depending upon the fact that this course is semi-universal and is a vital requirement for the preparation of any thesis and dissertation of graduate students around the world. Third, in the light of these results, graduate college professors may direct students to employ theoretical concepts given in research methodology and statistics courses and be able to write real research proposals. Fourth, there is a need to conduct research and statistics orientations for both graduate program faculty and students to refresh their understanding about the research process more especially on the qualitative and mixed methods of research. Fifth, a training orientation is also needed on the proper adoption and utilization of PBL; that is to be participated by the graduate program professors and students as well. Sixth, the study further recommends the adoption of PBL in undergraduate programs and in high school education as we to have a strong foundation of the research process before they are enrolled in the graduate programs. High school teachers can use the action plan model to train students on how to initiate simple scientific research. Lastly, future researchers will conduct research for the effects of Action Plan Model for Problem-based Implementation (APM-PBLI) using the five stages in the cycle.

Limitations

Despite the significant findings, the study has different limitations with the use of a single instrument in data collection. Another limitation is the limited number of investigated proposals.

Authorship Contribution Statement

Both authors contributed equally to the accomplishment of this manuscript.

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