Development of Project-Based Learning Instructional Model to Enhance Undergraduate Students' Creativity Ability

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Abstract

The present study had 3 primary objectives: 1) examine the factors affecting for undergraduate students' creativity ability, 2) confirm the appropriateness of developed project-based learning instructional model to enhance undergraduate students' creativity ability, and 3) study the results of implementing project-based learning model to enhance undergraduate students' creativity ability. The research methodology was structured into three distinct phases: Phase I: studying the internal and external factors affecting students' creativity ability gathering data through questionnaires administered to 150 undergraduate students and interviews conducted with 3 lecturers from Guangxi Normal University; Phase II: developing project-based instructional model for enhancing creativity ability based on instructional model development theory and the findings

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from Phase I, plus rigorous evaluation against four standards: utility, feasibility, propriety, and accuracy by 5 experts using an instructional model evaluation form; and Phase III: investigating the effectiveness of the developed instructional model – putting it into practice through lesson plans for experimentation. Data collection encompassed rubric scoring-based assessment of students' project work. Statistical analysis techniques such as frequency, percentage calculations, means, standard deviations, interpretation, and content analysis were employed to analyze the collected data.

The findings of this study can be summarized as follows:

1) The internal factors affecting for undergraduate students' creativity ability were physical and psychological including students' willingness to engage in learning activities and student's self-confidence, motivation and external factors were social environment, materials, teaching methods and class size.

2) Project-based learning instructional model to enhance undergraduate students' creativity ability consisted of 5 components i.e., principle and rationale, learning objectives, contents, methods of teaching and materials, and evaluation. After programme evaluation (utility, feasibility, propriety, and accuracy), such a model was 100% confirmed by 5 experts for further Implementation.

3) The result of implementing project-based learning instructional model found that, students' creativity ability will be overall improved 80% at Good level by research hypotheses.

Keywords: Project-based Learning, Fashion Design, Creativity Ability

Introduction

The 21st century heralds an era characterized by the omnipresence of information and technology, where in creativity and innovation have emerged as paramount drivers of national development and social progress. Li (2022) underscores that amidst the rapid evolution of science and technology alongside the rise of the knowledge economy, creativity stands increasingly as the foundational impetus for human advancement and societal development. The strategic importance of talent cultivation and competition amidst intensified global rivalries is articulated in the Thirteenth Five-Year Plan for the Development of China's National Education Sector, which emphasizes the imperative of nurturing innovative talents and fostering a modern education system to address multifaceted challenges and propel national development (Bulletin of the State Council of the People's Republic of China, 2017). Concurrently, the Outline of the National Medium and Long-Term Education Reform and Development Plan (2010-2020) underscores the revolutionary impact of information technology on educational progress, advocating for the prioritization of educational modernization through informatization

Central to human civilization's progress and societal advancement is creativity, recognized as a pivotal competence in the contemporary landscape (Li, 2022). Specifically, within the realm of garment design, the training paradigm for professionals aims at cultivating interdisciplinary talents proficient in garment

art aesthetics, technical skills, and market acumen, alongside fostering creativity and design prowess (Li, 2022). This emphasis on creativity echoes the imperative of adapting to the evolving demands of contemporary society, where personalized development in clothing design assumes precedence (Beghetto & Kaufman, 2014).

Numerous scholarly endeavors have underscored the efficacy of diverse pedagogical models in nurturing creativity among students. Atthachakara (2021) demonstrated the efficacy of a blended learning model incorporating creativity-based activities in enhancing students' innovative thinking. Similarly, Wittayakhom and Piriyasurawong (2020) advocated for the utilization of the STEAM model in Massive Open Online Courses, augmented by augmented reality, to foster creativity and innovation. Additionally, Cosgun and Atay (2021) highlighted the efficacy of problem-based learning in bolstering students' critical thinking and creativity. These pedagogical approaches, while varied, converge in their capacity to engender creativity among learners.

Project-based learning emerges as a compelling instructional model, characterized by its alignment with professional demands and its emphasis on practical application and skill development (Weatherby, 2007). Its integration into the curriculum of fashion design courses holds promise in enhancing students' creativity by facilitating hands-on, inquiry-based learning experiences (Weatherby, 2007). Particularly within the context of Guangxi Normal University, where students may possess limited exposure

to diverse design concepts, the project-based learning instructional model presents an opportunity to broaden their design horizons and cultivate innovation (Guangxi Normal University, 2022).

In light of the foregoing, the present study endeavors to explore the efficacy of the project-based learning instructional model in enhancing undergraduate students' creativity within the fashion design curriculum. Tailored to the unique context of Guangxi Normal University, this pedagogical intervention holds potential for enriching students' design acumen and fostering a culture of innovation. Through collaborative inquiry and practical engagement, the project-based learning model is poised to empower students to unleash their creative potential, thereby equipping them with the skills requisite for success in the dynamic landscape of fashion design.

Research Objectives

1. To examine the factors affecting undergraduate students' creativity ability at Guangxi Normal University.
2. To confirm the appropriateness of developed project-based learning instructional model to enhance undergraduate students' creativity ability at Guangxi Normal University.
3. To study the results of implementing project-based learning model to enhance undergraduate students' creativity ability at Guangxi Normal University.

Research Methods

The present study was divided into 3 phases with population and samples or key informants, research instruments, data collection and data analysis as follows.

Phase I – Exploring and analyzing the factors affecting undergraduate students' creativity ability at Guangxi Normal University

Key Informants

The informants of this phase were divided in to 2 group. Group 1 referred to the former English major students, taking "Fashion Design Course", semester 2 of academic Year 2022 from 3 majors in Guangxi Normal University – 50 students major in Fashion Design, 50 students major in Electronic Technology, and 50 students major in Primary Education. The total sum of participants were 150, more than the determining sample size (Krejcie & Morgan, 1970). It should be considered reasonable and significant. Group 2 were professional scholars/lecturers who taught "Fashion Design Course" from 3 universities in Guangxi Normal University – 1 lecturer from majoring in Fashion Design, 1 lecturer majoring in Electronic Technology, and 1 lecturer majoring in Primary Education.

Research Instruments

Five-point Likert scale questionnaire was employed to collect data from Group I informants. Its content validity was approved by the calculated Item-Objective Congruence (IOC)

values of 0.99. The questionnaire covered the items regarding internal factors and external factors i.e., improvement of one's design skills by thinking more about the problem, learning to improve problem solving skills, pride and self-confidence, instructor-assigned pre-class and post-class assignments, and active participation. An in-depth interview with IOC value of 0.97 was designed to collect data from lecturers in Group 2. It consisted of 10 questions corresponding to the internal and external factors related to problems in teaching English reading, opinions on method of instruction, development of reading and learners' learning behaviors about English reading skills

Data Collection

The duration of data collection was lasted from the 2nd of March 2023 to the 31st of March 2023. In order to collect data from Group I effectively, the informants were allowed to answer the questionnaires independently. Then they were collected back by the researcher. Each informant was labeled, marked with numbers and sorted by the researcher. As for Group II, the researcher administered the interviews to English lecturers from Guangxi Normal University. The answer record of each lecturer was labeled, coded with numbers and sorted by the researcher.

Data Analysis

Data obtained from Group I informants were quantitatively analyzed by descriptive statistics i.e., frequency, MEAN, and standard deviation along with interpretation of MEAN on ba-

sis of 5 ranges of attitude, 1.00 – 5.00, from strongly disagree to strongly agree. These 5 levels of frequency were calculated by using the formula as detailed in Table 1.

Table 1 Mean range of five levels of frequency of questionnaire for students

Mean range	Attitude Level	Interpretation
4.51-5.00	Strongly Agree	Highest degree of factors practiced
3.51-4.50	Quite Agree	High degree of factors practiced
2.51-3.50	Neutral	Moderate degree of factors practiced
1.51-2.50	Quite Disagree	Low degree of factors practiced
1.00-1.50	Strongly Disagree	Lowest degree of factors practiced

Besides, content analysis was used to analyze data collected from lecturers.

Phase II – Conforming the appropriateness of developed project-based learning instructional model to enhance undergraduate students' creativity ability at Guangxi Normal University

Key Informants

Three specialists in curriculum and instruction, particularly program evaluation were invited to evaluate the developed instructional model.

Research Instrument

A handout with details of project-based learning instructional model was provided to the specialists as to introduce the components and functions of such a model based on instructional model development theories and factor outcomes obtained from phase I. Then, instructional model evaluation form was used by the specialists to approve to quality of the model before further implementation within 4 standards i.e., utility, feasibility, propriety, and accuracy. IOC value of both instruments measure 1.00.

Data Collection

After collecting data in phase I and designing handout and instructional model evaluation form, the handout and instructional model evaluation form were submitted to all 5 specialists on 15th April 2023 and were collected by the end of the same month. The data of each specialist was labeled, coded with numbers, and sorted by the researcher.

Data Analysis

Frequency and percentage were employed to analyze dichotomy between 'Agree' and 'Disagree' among 5 specialists with 5 components of the model, namely principle/concepts, objectives, contents, methods of teaching and materials, and evaluation. The accepted component must be agreed by specialists not less than 90%.

Phase III – Studying the results of implementing project-based learning model to enhance undergraduate students' creativity ability at Guangxi Normal University

The results of implementing project-based learning model in this context of study refers to undergraduate students' creativity ability in terms of level of creativity quality. Guangxi Normal University students were studied for the achievement.

Population

The population included 150 students from 3 classes of students with different levels of proficiency – beginner, intermediate, and advanced, who enroll in Fashion Design Course at Guangxi Normal University in semester 2 academic year 2022: 50 students in class A, 50 students in class B, and 50 students in class C.

Samples

Since the present study was based on one-group pretest-posttest research design, the participants from class A were obtained through cluster random sampling. This class included student at various proficiency or achievement background – high, moderate, and low proficiency.

Research Instrument

To implement the developed instructional model, lesson plans of 5 chapters – Chapter 1 Overview of garment design; Chapter 2 Aesthetic principles of garment design; Chapter 3 Application of modeling elements of garment design; Chapter 4 Innovation in Fashion Design; and Chapter 5 Comprehensive Design of Modern Garment, was designed in line with such a model.

There are 6 steps to teach as follows.

Step 1: Determine the project tasks. Usually, teachers put forward one or several project task ideas, and then discuss with students to finally determine the goal and task of the project.

Step 2: Design a plan for the project. Students will work in groups to draft the project work plan.

Step 3: Make decisions. Students and faculty determine the final project plan and determine the detailed work steps and procedures.

Step 4: Implement the plan. Students determine the division of labor within the group and the forms of cooperation among the group members, and then follow the established work steps and procedures.

Step 5: Presentation: the students are supposed to present their final product to the whole class.

Step 6: Evaluate feedback. To discuss the quality inspection results and how to improve the shortcomings in the future, students can evaluate the work results by themselves, and then teachers can check and score them. Teachers and students can discuss and evaluate the problems in the project work, students' methods to solve problems and the characteristics of learning actions. By comparing the evaluation results of teachers and students, the reasons for the difference in results are found out.

To collect students' creativity ability data, the researcher has the participants prepare and present their fashion design final project - traditional clothing modeling in an innovative way as part of those 6 steps of referred activities.

Data Collection

1. Pretest was administered to the samples before the experiment relying on prepared lesson plans of 5 chapters.

2. Posttest was used to collected students' achievement after the experiment.

3. Within a week later, after posttest, students were asked to fill out self-assessment form. They were required to rate their attitudes about before and after learning through blended learning integrated with task-based learning.

Data Analysis

Students' creativity ability was assessed in 3 dimension 1) novelty 2) utility and 3) aesthetics by the researcher's scoring rubric. Then, students' performance was categorized according to rubric scoring criteria into their levels descriptor and assessed within the scope of individual and over all aspect of creativity.

Table 2 Criteria to evaluate of individual aspect of creativity: Novelty, Utility, and Aesthetics

Score	Grade
13- 15	Excellent
10 -12	Good
7-9	Medium
4-6	Pass
Less than 4	Poor

Table 3 Criteria to evaluate over all aspects of creativity

Score	Grade
37-45	Excellent
27-36	Good
18-26	Medium
9-17	Pass
Less than 9	Poor

The expected output after implementing the treatment referred to at least 80% students' creativity ability at good level.

Results

1) The Factors Affecting Undergraduate Students' Creativity Ability at Guangxi Normal University

1.1 Students' Attitude Survey Results

After analyzing data collected from students from 3 majors in Guangxi Normal University, the data indicated MEAN, standard deviation, interpretation, and ranks of both internal and external factors affecting English reading skills of the undergraduate students as shown in Table 2.

Table 4 Factors affecting English reading skills in overview

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
Internal factors (respondents)				
No. 1 Students understand the importance of developing creativity ability in the principles and methods of fashion design course.	4.48	0.67	High	7
No. 2 Students find that creativity ability is beneficial to them, make good choices in life. and help them spot fashion design problems.	4.56	0.57	The highest	2
No. 3 Students clearly understand the importance of enhancing their creative thinking in improving undergraduates' creativity ability in the study of "Fashion Design"course.	4.56	0.64	The highest	1
No. 4 Students believe that creative thinking is the core of learning "Fashion Design" to improve undergraduates' creativity ability.	4.46	0.81	High	8

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No. 5 Students believe that creativity ability is an important purpose of learning the "Fashion Design" course.	4.54	0.73	The highest	3
No. 6 Students can effectively prepare for the course by completing pre-class tasks and assignments.	4.24	0.8	High	14
No.7 Students actively participate in creativity activities and discussions through the lesson.	4.32	0.81	High	13
No.8 Students need teachers' assistance to help them overcome challenges and difficulties in learning Fashion Design course.	4.36	0.82	High	12

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No.9 Students believe that the teaching methods used by teachers in the course "Fashion Design " are reasonable and effective, and can improve their understanding of creativity ability.	4.38	0.69	High	11
No.10 Students believe that in the course "Fashion Design", the learning objectives of creativity abilityare clear and the difficulty is moderate.	4.33	0.88	High	13
No.11 Students believe that in the course “Fashion Design”, the lecturer can arrange the teaching steps well, and the lecturer’s teaching process is clear and definite.	4.43	0.80	High	9
No.12 Students believe that in the course of "Fashion Design", the interaction between teachers and students is necessary and meaningful, which can mprove their creativity ability.	4.54	0.72	The highest	4

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No.13 Students believe that in the course of "Fashion Design", the communication between students is necessary and meaningful, which can improve their creativity ability.	4.56	0.71	The highest	2
No.14 Students can increase their sense of accomplishment and pride in learning creativity ability by participating in creativity ability project based activities.	4.50	0.71	High	7
No.15 Students felt that teachers provided assignments and received feedback that helped them better apply creativity to real-world situations.	4.43	0.76	High	10
Total Average	**4.44**	**0.778**	**High**	

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
External factors				
No.1 The lecturer can use modern teaching methods in the teaching process instead of sticking to traditional teaching methods to improve students' creativity ability.	4.53	0.73	The highest	4
No.2 The lecturer emphasize the use of teaching skills, and are good at using modern teaching techniques in the teaching process to improve students' interest in learning creativity ability and expand students' knowledge.	4.50	0.72	High	7
No.3 The lecturer selects of teaching methods align with the characteristics of the Fashion Design course and the complexity of design tasks.	4.36	0.80	High	15

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No.4 The lecturer emphasize the importance of students' active participation in the teaching process to enhance students' creativity ability.	4.51	0.69	The highest	5
No.5 The lecturer emphasizes the interaction and cooperation between students in the teaching process of "Fashion Design".	4.47	0.76	High	8
No.6 It is important for the lecturer to objectively evaluate student performance and learning outcomes.	4.54	0.71	The highest	3
No.7 The textbook is suitable for the "Fashion Design" course and can achieve the teaching goal of improving students' creativity ability.	4.45	0.84	High	9
No.8 The textbook "Fashion Design" can arouse students' interest and help students learn creativity.	4.44	0.87	High	12

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No.9 The textbook "can expand students' Fashion Design creativity ability" is challenging and expand student's creativity ability.	4.45	0.82	High	10
No.10 The textbook "Fashion Design" can arouse students' thinking and discussion.	4.39	0.84	High	14
No.11 The textbook can be relevant or meaningful to students in their real lives.	4.45	0.81	High	11
No.12 Course materials include a combination of traditional textbooks and Mind Mapping resources to broaden students' knowledge and exposure to creativity ability techniques.	4.43	0.82	High	13
No.13 Activities in the classroom of "Fashion Design" can promote discussions and exchanges among students and promote their awareness of creativity ability.	4.55	0.72	The highest	2

Table 4 Factors affecting English reading skills in overview (Continued)

Factors	$\overline{X}$	S.D.	Interpretation	Ranking within All Factors
No.14 In the teaching of "Fashion Design", the classroom order and rules conform to the school regulations and are suitable for students' learning psychology.	4.51	0.73	The highest	6
No.15 A comfortable and relaxing clasroom environment, with appropriate class sizes and seating arrangements, facilitates students' engagement in learning activities.	4.57	0.68	The highest	1
Total Average	**4.48**	**0.77**	**High**	

Table 4 indicates that all internal factors affecting the learning achievement of the Fashion Design course are found to be at a high level overall ($\overline{X}$ = 4.44). Considering each item individually, it was found that Factor No.5 Students believe that creativity ability is an important purpose of learning the "Fashion Design" course have the highest mean ($\overline{X}$ =4.60)

and followed by Factor No13. Students believe that in the course of "Fashion Design", the communication between students is necessary and meaningful, which can improve their creativity ability have the second mean ($\overline{X}$ = 4.56), and the lowest mean is Factor No.7 Students actively participate in creativity activities and discussions through the lesson ($\overline{X}$ = 4.14).

For external factors affecting the learning achievement of the Fashion Design course in Guangxi Normal University, the overall level are found to be moderate ($\overline{X}$ = 4.48). Considering each item individually, it was found that Factor No.15 A comfortable and relaxing classroom environment, with appropriate class sizes and seating arrangements, facilitates students' engagement in learning activities has the highest mean ($\overline{X}$ = 4.57), followed by Factor No.13 Activities in the classroom of "Fashion Design" can promote discussions and exchanges among students and promote their awareness of creativity ability ($\overline{X}$ = 4.55), and the lowest mean is Factor No.3 The lecturer selects of teaching methods align with the characteristics of the Fashion Design course and the complexity of design tasks ($\overline{X}$ = 4.36).

1.2 Teachers' Interview Results

Following interviews conducted with three lecturers at Guangxi Normal University, several key factors influencing the creativity ability of undergraduate students have been identified. These factors can be categorized into internal and external influences.

Internal Factors:

Physical: The willingness of students to engage in learning activities is influenced by physiological factors, suggesting a correlation between physical well-being and academic performance.

Psychological: Students' levels of self-confidence, motivation, and drive to learn have been identified as significant determinants of learning outcomes and the enhancement of creativity within the course.

External Factors:

Social Environment: The broader social context within which students learn, encompassing the classroom climate and the utilization of project-based learning instructional models, has been found to exert a notable influence on students' creativity ability.

Materials: The selection of appropriate teaching models, course materials, and instructional methods emerges as a critical factor in enhancing students' creativity ability.

Teaching Methods: Various pedagogical approaches, including project-based teaching, blended teaching, flipped classroom techniques, and group work, are employed to bolster students' motivation and autonomy, thereby contributing to the development of their creativity.

Class Size: It is observed that a moderate class size fosters more effective teacher-student interaction and facilitates the implementation of project-based learning instructional models, thus positively impacting students' creativity ability.

Evaluation: Positive feedback from teaching evaluations and course assessments serves to encourage students and bolster their self-confidence and motivation, thereby enhancing their capacity for creative expression and learning.

In conclusion, an understanding of these internal and external factors is crucial for educators seeking to optimize the learning environment and promote creativity among undergraduate students. By addressing these factors systematically, educators can create an environment conducive to fostering the creative potential of students within the academic setting.

2) Confirming the appropriateness of developed instructional model of project-based learning instructional model to enhance undergraduate students' creativity ability at Guangxi Normal University

To serve objective 2, the collected data from 5 specialists of confirming the appropriateness of 5 components of instructional model prior to further implementation were analyzed within 4 areas of standards i.e., utility, feasibility, propriety, and accuracy, and were presented by frequency and percentage of the specialists as shown in the table below.

Table 5 Frequency and percentage of conformability of utility, feasibility, propriety, and accuracy of the instructional model components in 5 areas by specialists

Components of Instructional Model of project-based learning instructional model to enhance undergraduate students' creativity ability	Assessment							
	Utility		Feasibility		Propriety		Accuracy	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
I. Principle & Rationale	5	100	5	100	5	100	5	100
II. Objectives	5	100	5	100	5	100	5	100
III. Contents	5	100	5	100	5	100	5	100
IV. Methods of teaching & Materials	5	100	5	100	5	100	5	100
V. Evaluation	5	100	5	100	5	100	5	100

From Table 5 above, all 5 components of the instructional model of project-based learning on students' creativity were 100% confirmed to be appropriate by 5 specialists. These results confirmed the appropriateness of the developed instructional model for further implementation (≥90%). The aims of this model was to improve students' creativity skills in 3 necessary domains through 5 key components of the developed model. Also, internal and external factors were integrated with the model through instructional method. The 6 steps were designed according to project-based learning such as determining

the project task, designing plan for the project, making decision, implementing the plan, presenting project, and evaluating feedback.

3) Studying the effectiveness of the project-based learning instructional models on undergraduate students' creativity skills

Objective 3 analysis results are presented by reporting students' performance according to rubric score-based assessment criteria and satisfaction of learning creativity ability through project-based learning instructional model as specified in research method section with tables and descriptive analysis.

Table 6 Relative Developmental Score of Students' Creativity Ability Enhancement Through Project-based Learning: creativity ability over all

Development level	Frequency	Percentage
Excellent	14	28.00%
Good	26	52.00%
Medium	4	8.00%
Pass	6	12.00%
Poor	0	0.00%
Total	**50**	**100.00%**

From Table 6, the majority of students (80.00%) demonstrated good creativity ability upwards. To be more specific, 14 students (28.00%) achieved an excellent level, 26 students (52.00%) reached a good level, 4 students (8.00%) were at the medium level, and 6 students (12.00%) were at the pass level. There were no students in the poor level for creativity ability.

Overall, table 6 shows that the majority of students (80.00%) showed a significant increase in creativity ability after implementing the project-based learning instructional model. This finding is mutually consistent with the research hypothesis that students' creativity ability will increase overall by 80.00% (good level or excellent) after the implementation of the project-based learning model of instruction. Thus, we can conclude that the project-based learning instructional model is very effective in improving students' creativity ability.

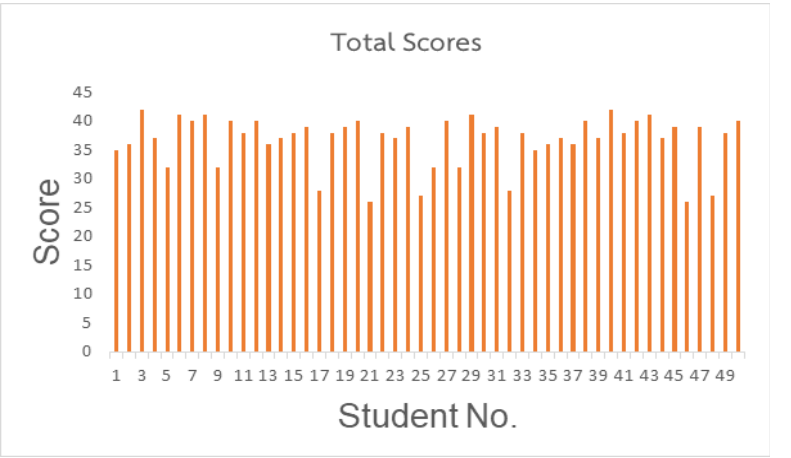

Figure 1 Students' Creativity Ability Enhancement Through Project-based Learning: creativity ability over all

Discussions

The effectiveness of project-based learning (PBL) in enhancing undergraduate students' creativity ability has been extensively documented, supported by both student feedback and academic research. Scholars such as Lai (2021) acknowledge PBL as a valuable pedagogical approach across various disciplines, particularly in the digital era. Pan (2020) outlines the process of PBL, emphasizing problem characterization, solution generation, implementation, and evaluation, which implicitly fosters students' creativity. Li (2017) highlights PBL's emphasis on constructive structuralism and the pragmatic learning concept of "learning by doing," integrating domain knowledge and technology to internalize knowledge and skills. Tang (2018) underscores PBL's role in improving communication, cooperation, creative thinking, observation, imagination, independence, and innovation skills among students. Consequently, students recognize the significance of creativity enhancement, particularly in fields like fashion design, where communication and collaboration are deemed crucial. The adoption of PBL is seen as pivotal in motivating students and improving their creativity.

Five experts unanimously confirm the appropriateness of the instructional model's components for further implementation. The confirmability of the PBL instructional model is supported by unanimous agreement across utility, feasibility, propriety, and accuracy criteria. Notably, experts unanimously endorse the principle, rationale, objectives, and components of the instructional model,

affirming their clarity, relevance, and efficacy in enhancing students' creativity ability. The pedagogical model's emphasis on student engagement, active learning, autonomy, and problem-solving skills aligns with scholarly findings and experts' assessments, further validating its effectiveness.

Analysis of student questionnaires reveals two main reasons supporting the effectiveness of PBL in enhancing creativity. Firstly, PBL encourages self-directed and hands-on learning, fostering critical thinking, exploration of ideas, and unique problem-solving approaches. Secondly, collaborative learning in PBL promotes autonomy, exploration of personal interests, and passion-driven creativity. Additionally, factors such as acquired knowledge and skills, active learning processes, and real-life application contribute significantly to enhancing students' creativity. The PBL model's effectiveness is evidenced by students' achievements and positive outcomes post-implementation.

Recommendations

The present study emphasizes the importance of project-based learning for students to develop practical skills and self-confidence, which in turn enhance problem-solving and creativity. Collaborative projects are encouraged to improve teamwork, communication, and negotiation abilities. Students are advised to take initiative and autonomy in their projects to strengthen time management, organization, and problem-solving skills, thereby fostering creativity. For lecturers, it is crucial

to provide robust support and guidance, including resources for creative pursuits, technological assistance, and project execution. Open-ended project designs should be promoted to stimulate innovative thinking and the application of knowledge to real-world challenges. Lecturers should also serve as mentors and motivators, offering a variety of project options and creating positive learning environments conducive to nurturing creativity and problem-solving skills. Additionally, they should advocate for lifelong learning through advanced technologies, innovative teaching methods, workshops, mentorship, and extracurricular creative activities. Future research should explore diverse instructional models such as cooperative learning and flipped classrooms to enhance creativity in different student populations. Longitudinal studies are necessary to evaluate the sustained impact of project-based learning on students' creativity over time. Furthermore, investigations into the influence of class size on the effectiveness of project-based learning, particularly in terms of collaboration, communication, and personalized support, are warranted.

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