Improving Students' Learning Performance in Project-Based Learning for Visual Communication Design Education

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Abstract

Purpose: This study aims to explore the factors affecting students' learning performance in project-based learning within visual communication design education. It focuses on independent variables such as self-efficacy, student satisfaction, cognitive engagement, learning attitude, and learning motivation, with learning performance as the dependent variable. **Research design, data, and methodology:** This research uses a mixed-method approach, combining qualitative data from interviews and observations and quantitative data from online questionnaires. The Item Objective Congruence (IOC) method was used to validate the questionnaire, with data analyzed using Jamovi software for Cronbach's Alpha coefficient. T-tests and multiple linear regression analysis were adopted to test hypotheses. 15 teachers were interviewed, and 80 students were surveyed. **Results:** The findings support the five hypotheses, which are self-efficacy, student satisfaction, cognitive engagement, learning attitude, and learning motivation, which impact students' learning performance in project-based learning. Multiple regression analysis confirmed the significance of these variables. Additionally, qualitative observations provided insights into individual and instructional factors affecting student performance. **Conclusions:** The study highlights the importance of aligning instructional design with students' diverse learning styles. It suggests strategies to improve project-based learning efficiency, ultimately enhancing the quality of visual communication design education.

Keywords: Project-Based Learning, Student Learning Performance, Visual Communication Design, Educational Strategies

JEL Classification Code: I23, J28, L2

1. Introduction

The study of factors influencing students' learning performance has evolved importantly, reflecting a broader understanding of educational dynamics over recent decades. Since the 2000s, empirical research has expanded its focus to incorporate diverse methodologies-qualitative, quantitative, and mixed-methods approaches light on the multifaceted nature of learning performance (Worthington et al., 1996). Initial investigations emphasized motivation, self-regulation, and learning environments as key determinants of academic success. For instance, Pintrich and De Groot (1990) highlighted that self-regulation and motivational beliefs are critical predictors of academic performance. The 2010s further underscored the importance of contextual factors,

with researchers like Zimmerman and Schunk (2011) emphasizing self-regulated learning strategies and Hattie (2008) conducting comprehensive meta-analyses to identify impactful instructional practices. These studies collectively contribute to a nuanced understanding of how various factors influence learning outcomes.

Project-Based Learning (PBL) emerged as an education approach that featured transformation, particularly in higher education, due to its ability to enhance students' practical skills and foster innovation. This pedagogical model emphasizes integrating theoretical knowledge with hands-on experience, allowing students to face and deal with reality problems and challenges. The study asserts that PBL improves students' concrete skills but also boosts students' interest and motivation. In visual communication design

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(VCD), PBL is pivotal in bridging theoretical concepts with practical applications. This approach can guarantee that students gradually nurture critical thinking, creativity, and problem-solving skills that are fundamental for their future growth. As such, PBL's relevance and impact in VCD education are increasingly recognized, making it a critical area for research.

This study aims to determine the factors influencing students' learning performance in PBL within the field of VCD at a public university in Sichuan Province. The focus is on understanding how self-efficacy, student satisfaction, cognitive engagement, learning attitude, and learning motivation influence students' academic outcomes. Bandura (1977) proposed, self-efficacy is central to determining students' willingness to undertake and persist in challenging tasks. This study will explore how self-efficacy impacts students' engagement with PBL projects. Additionally, the role of student satisfaction in shaping their overall learning experience and performance will be examined, given its influence on motivation and effort. The research will also delve into cognitive engagement, encompassing students' mental strategies during learning and their relationship with learning outcomes. Furthermore, the study will assess how learning attitudes and motivations contribute to academic performance in PBL settings. By analyzing these factors, the research plans to cast some insights into optimizing instructional strategies and improving educational practices in VCD.

The importance of this article is attributed to its potential to enhance educational practices by offering a multifaceted conception of various factors that impact learning performance in PBL. The findings are expected to guide educators in developing effective teaching strategies that satisfy students' needs and upgrade their learning experiences. By identifying the interplay between self-efficacy, satisfaction, cognitive engagement, learning attitudes, and motivation, the study prepares to proceed more to refine educational models and improve students' overall performance and quality of learning. Ultimately, this research docks theoretical insights with practical applications, fostering a more effective and engaging learning environment in Visual Communication Design education.

2. Literature Review

2.1 Self-efficacy

Self-efficacy is a concept developed by Bandura (1977), which has been described as an individual's belief in their capability to perform a certain task or accomplish certain goals. It depends on personal experiences, social

surroundings, and cultural context and influences how people think, feel, and behave (Zulkosky, 2009). Self-efficacy relates to students' confidence in their learning abilities and recognition of opportunities and obstacles (Schunk, 1991). Unlike general confidence, which denotes a broad belief in competence, self-efficacy is a nuanced belief in one's capacity to succeed in various contexts (Bandura, 1977). Social pressure, peer relationships, and socioeconomic status can affect self-efficacy, particularly in educational settings where achievement and societal acceptance may conflict (Jungert & Rosander, 2010). Research shows that self-efficacy influences motivation, persistence, and outcomes, making it crucial for understanding achievement (Pintrich & Schunk, 2002; Zimmerman, 2000).

H1: Self-efficacy has a significant impact on learning performance.

2.2 Students' Satisfaction

Student satisfaction reflects how content students are with their learning environment, including instructional effectiveness, institutional support, and related factors. It encompasses emotional, cognitive, and behavioral aspects, covering teaching quality, school support, and personal development (Virtanen et al., 2017). Defined by Weerasinghe et al. (2017) as short-term attitudes formed from evaluating educational experiences, student satisfaction is a key indicator of school and program quality. Emotional engagement plays an important role, with research by Luo et al. (2019) showing that it positively correlates with overall satisfaction and influences cognitive engagement. Kane et al. (2008) highlight the importance of ongoing satisfaction benchmarking, though long-term analysis still needs to be explored. Luo et al. (2019) reveals that teachers' social-emotional support can importantly predict students' satisfaction with the classroom atmosphere. Understanding and improving these aspects are crucial for enhancing student motivation and commitment to learning.

H2: Students' satisfaction has a significant impact on learning performance.

2.3 Cognitive Engagement

As discussed by Nicolini (2021), cognitive engagement involves attentional engagement, where individuals pay attention to related stimuli while ignoring distractions. It reflects the ability to maintain concentration and allocate cognitive resources effectively to a task. Zhu (2006) emphasize that cognitive engagement is also tied to interest-based engagement, characterized by intrinsic motivation and curiosity. Individuals are more likely to engage with it cognitively once they find a task personally meaningful or

enjoyable.

Luo et al. (2019) highlights perceived relevance as a key aspect of cognitive engagement. This refers to how well individuals believe a task aligns with their goals, interests, or existing knowledge. When tasks are perceived as relevant, individuals tend to be attentive in processing information and problem-solving (Zhang et al., 2021).

Pratton and Hales (1986) describes cognitive engagement as active participation in learning activities, contrasting it with passive reception of information. Active engagement includes asking questions, generating ideas, making connections, and applying knowledge in new contexts. Richter and Allert (2017) expand on this by introducing critical engagement, which involves higher-order cognitive processes such as analysis, evaluation, and information integration.

McNamara and O'Hara (2005) and Helme and Clarke (2001) introduce the concept of metacognitive engagement, which involves awareness and adjustment of one's cognitive processes. This includes monitoring comprehension, planning strategies, evaluating progress, and adjusting approaches to enhance learning outcomes. Thus, cognitive engagement encompasses various levels of involvement and processes, from attentional focus to higher-order critical thinking and metacognitive regulation.

H3: Cognitive engagement has a significant impact on learning performance.

2.4 Learning Attitude

Learning attitude encompasses a person's approach, mindset, and disposition towards acquiring new knowledge or skills. It includes various attitudes, beliefs, and behaviors that affect how one engages with and improves through learning experiences (Sullivan, 1927). Research by Mager (1968) emphasizes that open-mindedness, a critical aspect of learning attitude, involves a readiness to entertain new ideas, perspectives, and information without prejudice. This openness facilitates exploration and adaptation, which is essential for effective learning (Vaughan, 2002).

Hashemian and Heidari (2013) underscore that learning attitudes are important and are shaped by individuals' perceptions of the outcomes or attributes related to behavior. These perceptions, known as behavioral beliefs, influence how individuals evaluate these outcomes. Generally, those who hold strong, positive beliefs tend to develop favorable learning attitudes. Consequently, positive learning attitudes relate to more sound performance in the educational atmosphere (Sedighi & Zarafshan, 2006).

In summary, learning attitudes play a key role in how students approach their studies and engage with new information. The ability to remain open-minded and positively perceive the consequences of learning-related behaviors can, importantly, enhance academic performance and personal growth.

H4: Learning attitude has a significant impact on learning performance.

2.5 Learning Motivation

Deci and Ryan (1985) regard motivation as the driving force behind behavior, encompassing the decision to engage in activities and the intensity of effort exerted. Their definition highlights motivation as a dynamic process influenced by intrinsic desires, external incentives, and personal goals (Espinar Redondo & Ortega Martín, 2015; Yunus & Ali, 2009). Motivation is seen as both the activation of behavior and the channeling of efforts toward specific outcomes.

Pintrich and Schunk (2002) describe student learning motivation as the processes that energize, direct, and sustain students' behavior toward learning tasks. These include self-efficacy, task value, and self-regulation (Linnenbrink & Pintrich, 2002). Skinner (1953) adds that motivation is influenced by external reinforcements, where rewards and punishments shape learning behaviors.

In Bandura's social cognitive theory, self-efficacy is emphasized. Students' motivation is affected by their beliefs in their abilities, shaped by personal achievements, observations, peer encouragement, and emotional states (Bandura, 1977; Ushioda, 1998). According to Vygotsky's sociocultural theory, the role of social interactions and cultural context is stressed, with students' motivation being influenced by educators, peers, family, and cultural values related to education (Vygotsky & Cole, 1978).

Nicholls (1984) views motivation as the psychological processes driving students toward academic goals, influenced by personal goals, attributions, and competence perceptions. Zimmerman (2000) adds that motivation is an interplay of intrinsic interests, extrinsic incentives, and self-regulatory processes influencing students' learning efforts and academic success.

H5: Learning motivation has a significant impact on learning performance.
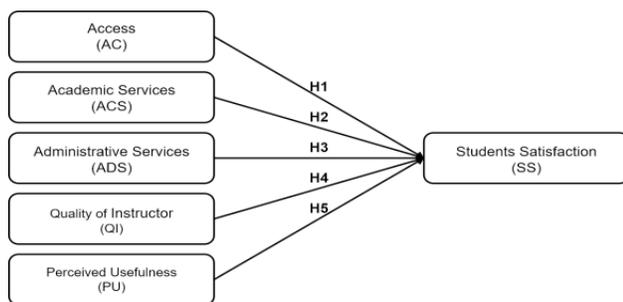
2.6 Students' Satisfaction

Students' satisfaction is influenced by various factors, including teaching quality, course content, peer interactions, and institutional support. Research indicates that positive student satisfaction correlates with enhanced academic performance and retention rates (Herrington & Herrington, 2006). Additionally, frameworks like the SERVQUAL

model are often used to assess service quality in education, highlighting dimensions such as reliability and responsiveness (Parasuraman et al., 1988). Ultimately, fostering a supportive learning environment is crucial for improving students' satisfaction levels (Astin, 1993).

3. Research Methods and Materials

3.1 Research Framework

Four theoretical frameworks from Moghavvemi et al. (2018), Yüce and Dost (2019), Raza et al. (2019) and Tseng and Chen (2020) were integrated to form the conceptual framework in this research, as presented in Figure 1.

Figure 1: Conceptual Framework

H1: Self-efficacy has a significant impact on learning performance.
H2: Students' satisfaction has a significant impact on learning performance.
H3: Cognitive engagement has a significant impact on learning performance.
H4: Learning attitude has a significant impact on learning performance.
H5: Learning motivation has a significant impact on learning performance.

3.2 Research Methodology

This study outlines its research process in several phases, starting with the Pre-Strategic Phase, where researchers identify the main objectives and research questions, seeking expert advice to refine interview outlines and questions. This study adopts a mixed-method approach, combining quantitative and qualitative research to enhance strategic intervention. Initially, qualitative data is collected through interviews and observations with 15 teachers from Leshan Normal University, focusing on aspects such as self-efficacy, satisfaction, and learning performance. The interviews help refine research design and data collection tools based on

preliminary findings.

Quantitative data is gathered via an online survey tool, with strategic intervention and reliability tested before distribution to 80 respondents. Multiple linear regression analyzes relationships between variables, and Jamovi is used to establish the study framework and hypotheses. Strategic interventions lasting 15 weeks are detailed, with monitoring and evaluation mechanisms designed to track implementation and impact through quantitative and qualitative data.

In the post-strategic phase, researchers assess intervention effectiveness, comparing pre- and post-intervention data and feedback. If outcomes fall short, further diagnoses and adjustments are made to improve intervention strategies.

3.3 Research Population, Sample Size, and Sampling Procedures

3.3.1 Research Population
In this study, the subjects are undergraduate students majoring in Visual Communication Design at Leshan Normal University in Sichuan Province. The total number of students is 80, all actively engaged in project-based learning methods as part of their coursework. From this group, a specific experimental subset of 30 students from a particular course was selected to implement the strategic intervention (strategic design). Currently, the total number of students from the three tracks - Web Design and Animation, Multimedia Design, and Folk Craft Design - is 118, 118, and 101, respectively, with a sample of 23.7%. This subset was chosen to analyze specific factors influencing their performance in project-based learning in visual communication design education. The selection criteria ensured a representative sample to provide insights into the broader student experience within the project.

3.3.2 Sample size
At the initial stage of diagnosis, the sample size for reliability testing is 15, and the sample size for multivariate constrained regression testing is 80. In the strategic stage, 30 teachers will be selected to participate in implementing the strategy. In the 'post-strategic' stage, these 30 teachers will also be re-employed.

3.3.3 Sampling Procedures
This study used sampling methods and a 5-point Likert scale questionnaire distributed online via Questionnaire Web.

Phase One: Non-probability purposive sampling selected three project-based learning courses from different grades in Visual Communication Design: Web Design and Animation, Multimedia Design, and Folk Craft Design.

Phase Two: Probability sampling through stratified random sampling targeted 336 students across these tracks. Sample sizes were determined proportionally, and students were randomly selected from each track.

Phase Three: Non-probability purposive and convenience sampling methods, including judgment and quota sampling, were used to select full-time teachers at Leshan Normal University who had taught for at least one year. The online survey tool enabled efficient data collection, overcoming traditional time and location limitations.

3.4 Research Instruments

3.4.1 Design of Questionnaire

This study designed a questionnaire to explore factors affecting students' learning performance in project-based learning. Based on influential literature, the questionnaire covered Self-efficacy, Students' Satisfaction, Cognitive Engagement, Learning Attitude, Learning Motivation, and student performance. The validation process included an Item Objective Congruence (IOC) review.

The questionnaire had three parts:

1. Demographics: Collecting basic information such as gender, age, institution, years of service, and professional title.

2. Influencing Factors: Measuring factors impacting student grades with 39 items across the specified categories.

3. Dependent Variables: Assessing student learning performance with seven questions.

3.4.2 Components of Questionnaire

The questionnaire for this study comprises three key components:

1. Demographic Information: This section collects basic data on respondents, including gender, age, institution, years of service, and professional title to ensure sample representativeness.

2. Factors Influencing Learning Performance: This part evaluates factors affecting student grades in project-based learning. It includes 39 items on Self-efficacy (10 items), Students Satisfaction (9 items), Cognitive Engagement (6 items), Learning Attitude (7 items), and Learning Motivation (7 items), rated on a scale of agreement.

3. Student Learning Performance: This component measures the dependent variable—student learning performance—through seven specific questions.

3.4.3 IOC Results

In the Item-Objective Congruence (IOC) testing, IOC values range from -1 to 1, reflecting the alignment of each item with the measurement objectives. According to Tavakol and Dennick (2011), items with IOC values above 0.50 have

a high content intervention. In this study, among 16 expert ratings for the Self-efficacy scale, 10 items fell below 0.50, and among 13 expert ratings for the Learning Performance scale, six items were below 0.50. Based on these findings, items with IOC ratings below 0.50 were excluded. Consequently, the final questionnaire retained 39 items for independent variables—Self-efficacy (10 items), Students' Satisfaction (9 items), Cognitive Engagement (6 items), Learning Attitude (7 items), and Learning Motivation (7 items)—and seven items for the dependent variable, Learning Performance.

3.4.4 Pilot survey and Pilot test results

The researchers distributed the questionnaires validated by IOC to 30 students at Leshan Normal University using an online platform. In this study, all items demonstrated Cronbach's Alpha coefficients exceeding 0.7, presenting satisfactory levels of internal consistency. Specifically, the coefficients were as follows: Self-efficacy = 0.932, Students' Satisfaction = 0.933, Cognitive Engagement = 0.912, Learning Attitude = 0.911, Learning Motivation = 0.923, and Learning Performance = 0.932. Therefore, all items in this study passed the reliability testing. Detailed test results and correlations are presented in Table 1.

Table 1: Pilot Test Result

Variables	No. of Items	Sources	Cronbach's Alpha	Strength of Association
Self-efficacy	10	Arambewela et al. (2006)	0.932	Excellent
Students' Satisfaction	9	Telford and Masson (2005)	0.933	Excellent
Cognitive Engagement	6	Abdullah (2006)	0.912	Excellent
Learning Attitude	7	Luekens et al. (2004)	0.911	Excellent
Learning Motivation	7	Abdullah (2006)	0.923	Excellent
Learning Performance	7	Ali et al. (2016)	0.932	Excellent

4. Results and Discussion

4.1 Results

4.1.1 Demographic Profile

The interviewees are all students majoring in Web Design and Animation, Multimedia Design, and Folk Craft Design at Leshan Normal University. Table 2 shows the specific basic information.

Table 2: Demographic Profile

Research Population (n=80)		Frequency	Percent
Gender	Male	26	32.5%
	Female	54	67.5%
Total		**80**	**100%**
Strategic plan participants (n=30)		Frequency	Percent
Gender	Male	15	50%
	Female	15	50%
Total		**30**	**100%**

4.1.2 Results of multiple linear regression

The researcher carried out Multiple Linear Regression. Table 3. presents the relationship between independent variables and Learning Performance, analyzed using Jamovi for multiple regression. The p-values for Self-efficacy (0.018), Students' Satisfaction (0.039), Cognitive Engagement (0.002), Learning Attitude (0.028), and Learning Motivation (0.046) are all below 0.05, indicating important effects on Learning Performance. The R-squared value of 0.986 shows that these variables expound 98.6% of the variance in Learning Performance. Standardized regression coefficients are positive for all variables, with Self-efficacy (0.438) having the highest impact and Students' Satisfaction (0.291) the lowest. Multicollinearity tests show VIF values below 5 for all variables, confirming no multicollinearity. The results support all five research hypotheses (See Table 3).

Table 3: The multiple linear regression of five independent variables on learning performance

Variables	Standardized Coefficients Beta	t	P-value	VIF	R	R Square
Self-efficacy	0.438	3.65*	0.018	2.24		
Students' Satisfaction	0.291	2.58*	0.039	1.36		
Cognitive Engagement	0.353	3.03*	0.002	2.41	0.993	0.986
Learning Attitude	0.315	2.46*	0.028	1.64		
Learning Motivation	0.376	3.62*	0.046	2.07	0.993	0.986
Dependent variable: Learning Performance						

Note: p-value <0.05*

Therefore, the multiple linear regression analysis results support the five hypotheses the researchers proposed. Thus, this study's research hypotheses are confirmed based on the results of the multiple linear regression analysis.

H6: There is a significant mean difference in self-efficacy between pre- strategic plan and post- strategic plan stages.

H7: There is a significant mean difference in students' satisfaction between pre- strategic plan and post- strategic plan stages.

H8: There is a significant mean difference in cognitive engagement between pre- strategic plan and post- strategic plan stages.

H9: There is a significant mean difference in learning attitude between pre- strategic plan and post- strategic plan stages.

H10: There is a significant mean difference in learning motivation between pre- strategic plan and post- strategic plan stages.

H11: There is a significant mean difference in learning performance between pre- strategic plan and post- strategic plan stages.

4.2 IDI Intervention Stage

The researcher planned a 16-week intervention period to enhance students' performance. During this time, specific strategies and actions were implemented to address the factors influencing learning performance identified in the study. The intervention involved structured activities, targeted support, and practical measures designed to improve key aspects such as self-efficacy, student satisfaction, cognitive engagement, learning attitude, and motivation.

Weekly progress assessments and adjustments were made to ensure the effectiveness of the intervention measures. This included monitoring student performance, gathering feedback, and refining strategies based on ongoing evaluations. It sought to develop a caring and responsive learning environment that promoted the students' academic growth and addressed their challenges. The intervention was continued until after 16 weeks, followed by full-scale evaluations of its effect on the student learning outcomes, for which improvement and the success of the intervention shall be measured using both qualitative and quantitative data. The specific Action Research Framework is below:
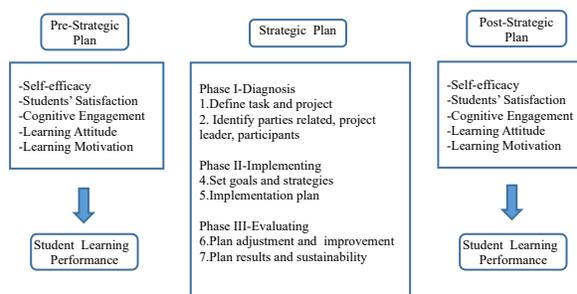
Figure 2: Strategic plan

4.3 Results Comparison between Pre-IDI and Post-IDI

The researcher performed a paired-sample t-test on six variables to assess differences between the pre-strategic and post-strategic intervention phases. This analysis sought to uncover significant changes resulting from the intervention.

The findings are summarized in the tables below, displaying the results of the paired-sample t-test for each variable.

Table 4: The multiple linear results of the four IV on DV (n=80)

	SE	SS	CE	LA	LM	LP
Before Intervention						
Mean	3.87	3.66	3J7	3.43	3.71	3.60
N	80	80	80	80	80	80
SD	0.784	0.726	0.820	0.885	0.797	0.763
After Intervention						
Mean	4.06	4,53	4.69	4.24	4,15	4.18
N	80	80	80	80	80	80
SD	0.081	0.080	0.061	0.075	0.101	0.080

Table 4 demonstrates the results of the paired-sample t-test analysis of pre-strategic intervention and post-strategic intervention comparison as follows:

The paired-sample t-test analysis revealed important improvements across all six variables from the pre-and post-strategic intervention phases.

For Self-efficacy (SE), the mean score increased from 3.87 (SD=0.784) before the intervention to 4.06 (SD=0.081) afterward, with a mean value difference of 0.19 and a p-value of less than 0.001. This indicates a statistically important enhancement in self-efficacy due to the intervention.

Similarly, student satisfaction (SS) saw a notable rise, with the mean score moving from 3.66 (SD=0.726) before the intervention to 4.53 (SD=0.080) post-intervention. The mean value difference of 0.87 and a p-value below 0.001 support an important improvement in student satisfaction following the strategic actions.

Cognitive Engagement (CE) also experienced an important boost, with the mean score increasing from 3.37 (SD=0.820) to 4.69 (SD=0.061). The substantial mean value difference of 1.32 and a p-value of less than 0.001 underscore the effectiveness of the intervention in enhancing cognitive engagement among students.

In terms of Learning Attitude (LA), the mean score improved from 3.43 (SD=0.885) pre-intervention to 4.24 (SD=0.075) post-intervention. With a mean value difference of 0.81 and a p-value under 0.001, the results demonstrate an important positive shift in students' learning attitudes due to the intervention.

Learning Motivation (LM) also showed an important increase, with the mean score rising from 3.71 (SD=0.797) to 4.15 (SD=0.101). The mean value difference of 0.44 and a p-value below 0.001 confirm that the intervention enhanced students' learning motivation.

Lastly, learning performance (LP) improved significantly, with the mean score moving from 3.60 (SD=0.763) to 4.18 (SD=0.080). The mean value difference of 0.58 and a p-value of less than 0.001 indicate a substantial improvement in students' overall learning performance following the

strategic intervention.

Overall, the paired-sample t-test results indicate that all six variables—self-efficacy, Students' Satisfaction, Cognitive Engagement, Learning Attitude, Learning Motivation, and Learning Performance—showed important mean value differences between the pre-strategic and post-strategic intervention phases. The most notable improvements were observed in Cognitive Engagement and student satisfaction, which experienced the largest increases. These findings support the effectiveness of the intervention in enhancing various aspects of student learning and performance.

5. Conclusions, Recommendations and Limitations

5.1 Conclusions & Discussions

This research is dedicated to factors affecting the student's learning performance in PBL in the context of a Visual Communication Design course at a public university in Sichuan Province. This paper's comprehensive perspective analysis of pre- and post-intervention data provides several key conclusions and insights.

Firstly, the strategic interventions importantly improved student outcomes across all measured variables: Self-efficacy, Student Satisfaction, Cognitive Engagement, Learning Attitude, Learning Motivation, and Learning Performance. The paired-sample t-test results demonstrated substantial mean value differences, with improvements in each variable being statistically important (p<0.001). These findings underscore the effectiveness of the intervention in enhancing various dimensions of student learning and performance.

The most notable improvements were observed in Cognitive Engagement and Student Satisfaction. Cognitive Engagement, the depth of students' mental involvement in learning tasks, showed the highest mean value difference (1.32). This suggests that the intervention effectively fostered deeper cognitive involvement in project-based activities. Similarly, Students' Satisfaction saw an important increase (0.87), indicating that the intervention positively impacted students' overall contentment with their learning experiences.

Self-efficacy, Learning Attitude, and Learning Motivation also exhibited important improvements, albeit to a lesser extent, compared to Cognitive Engagement and Students Satisfaction. The enhancement in Self-efficacy (mean value difference of 0.19) suggests that students felt more confident in their abilities post-intervention. Learning

Attitude and Learning Motivation improved by 0.81 and 0.44, respectively, reflecting more positive attitudes and increased motivation towards learning.

The important positive changes in Learning Performance (mean value difference of 0.58) align with the observed improvements in the other variables. This indicates that the intervention not only improved specific aspects of student engagement but also translated into better overall academic outcomes.

These results support the hypotheses that self-efficacy, student satisfaction, cognitive engagement, learning attitude, and learning motivation impact learning performance. The positive correlations between these variables and Learning Performance highlight their critical roles in enhancing student success in project-based learning environments.

By discussing these findings, targeted interventions might make a great difference in the educational experience and outcomes for the students. In particular, the improved cognitive engagement and students' satisfaction hint at the possibility of more effective learning processes and better performance. Further studies need to examine the long-term impacts such interventions could have on them and include other factors that may influence learners when studying in PBL contexts. Moreover, extending the study to other settings and disciplines would provide an expanded perspective on such dynamics and how generalizable they would be across contexts.

Ultimately, it affirms that multidimensional student engagement and satisfaction will be key to improving performance in project-based learning environments. These findings make useful contributions to the small but growing body of knowledge concerning how strategic intervention can raise educational outcomes and create a foundation for future research in this area.

5.2 Recommendations

According to the findings arising from the study on factors affecting students' learning performance in project-based learning (PBL) within visual communication design education, several targeted recommendations can be made to upgrade student results and boost the effectiveness of the PBL approach. These recommendations aim to address the identified factors—Self-efficacy, Student Satisfaction, Cognitive Engagement, Learning Attitude, Learning Motivation, and Learning Performance.

1. Enhance Self-Efficacy through Supportive Training and Feedback

Self-efficacy importantly impacts students' learning performance. To improve self-efficacy, institutions should implement targeted training programs that help students build confidence in their skills and abilities. The practical exercises and real-life application projects in the workshops and seminars that target skills development also provide experience and build confidence for the students, making them feel self-efficacious. In addition, this process of continuous feedback about their work will highlight strengths and weaknesses for the students, thereby developing a sense of capability and achievement.

2. Increase Students' Satisfaction through Improved Course Design and Support

Students' satisfaction is instrumental in understanding their entire learning process. In improving satisfaction, the basis should be course design and delivery. This means that the relevance of the curriculum has to be there; it must be engaging, and it has to meet the standards of the industry. Offering flexible learning could be a way to offer online resources, as well as hybrid learning opportunities, which would assist students with different learning needs and styles. The surveys and feedback mechanism should be developed regularly to allow students to provide their opinions concerning course content, teaching methods, and support services for continuous improvements consistent with their input.

3. Foster Cognitive Engagement with Interactive and Collaborative Learning

Cognitive engagement is critical for deep learning and understanding. Educators should incorporate more interactive and collaborative learning activities into the curriculum to foster cognitive engagement. This includes group projects, peer reviews, and interactive workshops encouraging active participation and critical thinking. Additionally, integrating technology tools such as design software and virtual collaboration platforms can enhance engagement by providing students hands-on experience and real-time feedback. Encouraging students to apply theoretical concepts to practical problems will also help maintain their interest and deepen their cognitive involvement.

4. Cultivate Positive Learning Attitudes through Motivational Strategies

A positive learning attitude is essential for student success in PBL environments. Educators should employ motivational strategies to cultivate a constructive learning attitude. This includes setting clear and achievable goals, recognizing and celebrating students' achievements, and creating a supportive classroom environment. Mentorship programs can also be beneficial, providing students with role models and guidance from experienced professionals in the field. Additionally, incorporating elements of choice and autonomy in project assignments can increase students' intrinsic motivation and investment in their learning.

5. Boost Learning Motivation with Relevant and Challenging Projects

Learning motivation can be important and influenced by the relevance and challenge of students' projects. To enhance

motivation, educators should design projects that are not only aligned with students' interests and career goals but also present appropriate levels of challenge. Projects should be designed to stimulate curiosity and creativity, encouraging students to explore new ideas and approaches. Providing opportunities for students to showcase their work in real-world contexts, such as industry exhibitions or client presentations, can further motivate them by demonstrating the practical value of their efforts.

6. Improve Learning Performance through Continuous Assessment and Support

Continuous assessment and support are vital for improving learning performance. Educators should implement regular formative assessments to supervise students' progress and provide timely feedback. This can be quizzes, presentations, or interim project reviews that facilitate the timely identification of learning gaps. Personal support through one-on-one mentoring sessions and academic advising will equally help students overcome some challenges and stay on track. Well-set performance criteria and resources for self-assessment will enable students to feel responsible for continuous improvement in their performance.

7. Strengthen Institutional Support and Resources

Institutions should ensure adequate resources and support systems to facilitate effective PBL. This includes investing in up-to-date technology, providing access to relevant materials and software, and creating conducive learning environments. In addition, educators' professional development programs can help them build their competencies to effectively teach and practice PBL and refresh them in the field. The development of partnerships with industrial professions and organizations may provide students with insight and opportunities that bridge academic learning to professional practice.

Addressing these specific aspects would enable an educational institution to offer students a more supportive and effective learning environment. At the same time, they are involved in project-based learning of visual communication design. These recommendations also address improving self-efficacy, satisfaction, cognitive engagement, learning attitude, motivation, and performance, which are the prime contributors to better educational outcomes and student achievements.

5.3 Limitations for Future Research

While this study provides valuable insights into the factors affecting students' learning performance in PBL within VCD education, it does have some limitations that need to be considered.

First, the sample was limited to students and faculty at only one public university in Sichuan Province. Thus, it could only be thoroughly represented by some students from such programs across different regions and institutions. This geographic and institutional limitation could affect the generalization of findings.

Information was self-reported using questionnaires. Such methods may have biases, such as social desirability or response bias, wherein students provide answers based on what they perceive as expected or acceptable, not necessarily their real experience. Additionally, the reliance on self-reports must account for observational or qualitative data that might offer deeper insights into students' learning behaviors.

Third, the study is cross-sectional; it captures data once, at one point in time, which cannot allow for an effective assessment of changes that might happen over longer periods or the long-term effects of strategic interventions currently being made. Longitudinal approaches provide a greater degree of insight into how factors affecting learning performance are changing over time.

Fourth, while the study employed rigorous statistical analyses, including paired-sample t-tests and regression analyses, it did not address potential confounding variables that could influence learning performance, such as external academic support, personal circumstances, or prior knowledge.

Lastly, focusing only on five independent variables (Self-efficacy, Students' Satisfaction, Cognitive Engagement, Learning Attitude, and Learning Motivation) may only encompass some relevant factors impacting learning performance. Future research could explore additional variables and employ a mixed-methods approach to gain a more holistic view of the influences on student performance in PBL environments.

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