

Project-Based Learning To Promote Critical Thinking And Problem-Solving Skills Amongst Management Students

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Abstract: The primary assessment tool used in the research measured critical thinking. Moreover, the outcomes of this study have broader implications for educational practices. They emphasize the potential benefits of integrating project-based learning into curricula, especially in programs like the Optimal Investment Program, which require strong critical thinking skills. Additionally, this research highlights the importance of addressing underlying factors such as variable management, hypothesis testing, and reasoning in curriculum design to foster the growth of essential analytical skills among students. The target participants for this study were selected from various social media networks, constituting of 510 respondents from Pune. Convenience sampling, a non-probability sample methodology that chooses participants based on accessibility, was used as the sampling strategy for this study which can be advantageous for studies with limited resources or time constraints. Descriptive statistics, One way Anova and Independent sample t test were used for analysis the respondents' responses. Further exploration and implementation of project-based learning methodologies can contribute to the overall improvement of education and prepare students for success in complex, real-world situations.

Keywords: Ability, College, Methodology, Judgemental sampling, Instructor.

1. Introduction

Critical thinking skills, one component of the 4C framework, revolve around reflective thinking, focusing on the decision-making process to address existing problems (Ennis, 1996). To cultivate critical thinking skills, innovative learning methods are employed, including problem-based and project-based learning activities, collaboration training, communication training, application, the design of reality-connected student-centered learning, and more.

However, the desired expectations often do not align with reality. This is evident in people's responses to news on social media, where they hastily comment and accept information without verifying its accuracy. This phenomenon extends to the learning process, where students tend to lack critical discernment, failing to investigate information thoroughly and rushing to conclusions. This corresponds with the experiences of educators who observe students' reluctance to provide additional explanations or alternative answers to teacher-presented problems.

In addition to critical thinking, the 4C skills required for 21st-century learning also encompass creative thinking. Creative thinking in education can foster positive attitudes, stimulate discovery and exploration, and support cognitive development. Scott asserts that the future of humanity hinges on placing creativity and innovation at the forefront of the education system, encompassing problem-solving, novel thinking, generation, diverse questioning, and alternative solutions as forms of innovation and creativity.

Numerous studies have demonstrated that active participation in educational activities enhances students' comprehension and knowledge retention. Collaborative problem-solving is an inherent part of most projects, as students collaborate with peers to find solutions. Negotiating collective problem-solving strategies is a fundamental aspect of problem-based learning (PBL).

Students are encouraged to utilize various communication tools like email, text messaging, and video communication to address problems. They are also prompted to engage in genuine inquiry rather than relying solely on textbooks or websites for information. The resources are available for use, but students are expected to generate and test their ideas. Active participation and collaboration with group members are essential, and drawings serve as scaffolding technologies. Each project results in a tangible artifact, demonstrating the students' problem-solving skills. This group must reach a consensus on a solution and provide a clear explanation of both the solution and the strategy used. The learning environment for the experimental group aligns with constructionism, with the instructor serving as a facilitator, guiding students through the project steps. This approach assigns tasks that require brainstorming, investigation, and problem-solving.

1.1 Research Problem

This decline hampers the achievement of the course's objectives, despite the fact that fostering the ability of thinking is a primary aim in educational institutions. As mentioned in the research introduction, previous studies have indicated that the traditional teacher-centered teaching method, as well as project-based learning, can influence the shift towards learner-centered education.

2. Review Of Literature

Thomas (2000) posited that PBL is a model that structures education everywhere jobs, while also establishing five criteria for PBL: projects should serve as the core of the curriculum, focus on problems that challenge students with fundamental concepts, engage students in constructive exploration, be student-driven and realistic. Typically, project work contributes students a degree of autonomy in selecting their topics and necessitates them to embark on an investigative journey involving data collection, organization, and presentation.

Hirikude et al. (2017) reported that upon completing a project, students displayed a deeper understanding of interdisciplinary content, as evidenced by a comparison of students' average grades before and after project implementation. Skills like critical thinking, problem solving, and self-management were cultivated during project work, where students engaged in an extended process of inquiry, resource discovery, and application of information.

Rochmahwati (2015) advocated for the integration of critical thinking into language curriculum design, emphasizing the growing importance of processing complex information over a mere accumulation of specific details. Additionally, students have begun to challenge their critical and creative thinking within existing learning environments through the successful integration.

Bell (2010) also noted that students expressed how they worked together to overcome problems and stimulate innovation within their groups, benefiting their efforts as a whole. The instructors' belief that they were teaching their students essential 21st-century abilities—critical thinking and problem solving being two of the most important talents highlighted in the 21st century—was strengthened by the students' involvement and pleasure throughout PBL.

Morales-Mann et al. (2001) compared to other teaching strategies. A cheerful attitude and teamwork were the most often cited factors that affected performance and learning in PBL. PBL marked a change for facilitators from their previous position as "subject experts and super consultants."

Celia and colleagues (2001) conducted an investigation into students' assessments a traditional, structure-focused nursing degree program over a 4-week duration. During this period, 130 second-year students participated in problem-based learning, and the researchers received and analyzed 100 responses from an evaluative questionnaire. The paper delineates the various ways in which students perceived differences in their learning experience, self-perception as learners, and the connection between the learning process and clinical practice.

Tiwari and colleagues (2006) set out to compare the effects of problem-based learning (PBL) and traditional lecturing approaches on the development of students' critical thinking. The primary measure of interest was students' critical thinking disposition, assessed using the California Critical Thinking Disposition Inventory

(CCTDI). Additionally, individual interviews were conducted to gather students' perspectives on their learning experiences. Data collection occurred at four different time points over three years. The analysis revealed that the overall CCTDI and subscale scores for the PBL group were not significantly different from those of the lecture group at the initial time point (pretest). However, compared to lecture students, PBL students exhibited significant improvements in overall CCTDI, Truthseeking, Analyticity, and Critical Thinking Self-confidence subscale scores from the first to the second time points, and in overall CCTDI, Truthseeking, and Analyticity subscale scores from the first to the third time points, as well as in Truthseeking and Systematicity subscale scores from the first to the fourth time points.

Ernanda and colleagues (2022) investigated the impact of implementing problem-based learning within lesson study on students' critical thinking skills, specifically regarding the human respiratory system. They conducted a true experiment with a posttest-only control design, involving 273 students from a high school in Tasikmalaya, Indonesia. The results showed a significant effect of problem-based learning models on students' critical thinking skills related to the human respiratory system.

Adawiah and colleagues (2023) assessed the impact of Google Workspace-assisted particularly in an online teaching context due to the COVID-19 pandemic. This is an experimental class using Google Workspace-assisted PBL and a control class using conventional learning. The results indicated a substantial improvement in critical thinking skills for the experimental group.

Nilesh Anute, Devyani Ingale (2023), A VLE may also include features such as discussion boards, chat rooms, and video conferencing to facilitate collaboration and communication among students. While VLEs are most commonly used in higher education, they are also being used more frequently in K-12 classrooms. As the use of technology in education continues to grow, VLEs will likely become even more prevalent in schools.

Poonsawad and colleagues (2022) synthesized and the study included the development of the learning model, which consisted of preparation, learning activities, and evaluation components. Four parts of the learning activities were identified: problem-based learning, reflection of learning, interactive digital storytelling, and gamification. The research revealed that this learning model significantly improved students' problem-solving skills and was suitable for fostering desired learner achievements and skills.

Toker and colleagues (2022) conducted a study included 394 participants and identified various factors associated with the outcome variables. The findings suggested that cooperative learning processes, personality traits, spare time activities, reflective thinking on problem-solving, and knowledge of cognition played roles in influencing these outcomes. The study explored both recursive and non-recursive models to examine these relationships.

Ritonga and colleagues (2021) highlighted the lack of critical thinking skills development in 10th-grade students in Banda Aceh, particularly in the context of biology learning. Overall, these studies delve into the effectiveness of problem-based learning and related approaches in enhancing critical thinking skills, moral sensitivity, and problem-solving abilities among students in various educational contexts.

3. Objectives

- To study the demographic profile of the respondents.
- To explore the factors affecting Problem Solving Skills and Critical Thinking Skills.
- To examine the effect of Demographic Variables over Problem Solving Skills and Critical Thinking Skills.

4. Hypothesis

Ha 1 There is a significant effect of Age, Gender, Education, Type of UG Mode over Problem Solving Skills.

Ha 2 There is a significant effect of Age, Gender, Education, Type of UG Mode over Critical Thinking Skills.

5. Research Methodology

The research methodology for this study is primarily descriptive and exploratory in nature. To gather data, a questionnaire was designed, tailored to investigate specific aspects of interest. The target participants for

this study were selected from various social media networks, constituting of 510 respondents from Pune. Convenience sampling, a non-probability sample methodology that chooses participants based on accessibility, was used as the sampling strategy for this study which can be advantageous for studies with limited resources or time constraints. This approach allows for data collection from individuals readily available and willing to participate, albeit with potential limitations related to representativeness.

6. Analysis And Discussion

Table 1: Percentage Analysis for Demographic Variables

Age	No. of. respondents	Total Percentage
Below 25	476	93.3
25-30	29	5.7
Above 30	5	1.0
Total	510	100%
Gender	No. of. respondents	Total Percentage
Male	265	52
Female	245	48
Total	510	100%
Type Of Institution	No. of. respondents	Total Percentage
Government	128	25.1
Government Aided	243	47.6
Private	139	27.3
Total	510	100%
Type Of Mode Ug Completed	No. of. respondents	Total Percentage
Direct	78	15.3
Online	161	31.6
Distance Education	170	33.3
Others	101	19.8
Total	510	100%

Inference

The table 1 presents data on various demographic and educational characteristics of 510 respondents without using any headings, subheadings, bold letters, numbering, bulletins, or other formatting.

In terms of age distribution, the majority of respondents fall into the age group 25-30, comprising 5.7% of the total. Below 25 and above 30 age groups make up 95.3% and 1% of the respondents, respectively. Gender-wise, the data shows a near-even split, with 52% of respondents identifying as male and 48% as female. Regarding the type of institution attended, the highest percentage of respondents, 47.6%, attended government-aided institutions. Government institutions and private institutions account for 25.1% and 27.3% of respondents, respectively.

The data also reveals the mode of undergraduate education completion, with 33.3% of respondents completing their education through distance education, followed by online mode at 31.6%. Direct mode and other modes account for 15.3% and 19.8%, respectively.

Table 2: Percentage Analysis for Statements

Statements	SA*	%	A*	%	N*	%	DA*	%	SDA*	%
In order to find fulfilment via my career, I like evaluating the choices critically.	31	6.1	10	2	48	9.4	267	52.4	154	30.2
I evaluate the benefits and drawbacks of other people's ideas while doing an objective analysis.	24	4.7	2	0.4	61	12	254	49.8	169	33.1
I can see how concepts and methods may be applied to understanding fresh connections.	18	3.5	15	2.9	59	11.6	256	50.2	162	31.8
I take a long time to make decisions, but most of the time they are correct.	160	31.4	197	38.6	78	15.3	44	8.6	31	6.1
When I'm unexpectedly asked to think about a new project, I approach it thoroughly analytically.	137	26.9	187	36.7	78	15.3	73	14.3	35	6.9
When faced with a challenging work, a tight deadline, and new individuals, my emotions seldom cloud my judgements.	154	30.2	165	32.4	67	13.1	88	17.3	36	7.1
In doing my regular work, I can typically come up with an argument to refute dubious claims.	113	22.2	195	38.2	83	16.3	77	15.1	42	8.2
I enjoy carefully weighing and analysing a variety of recommendations while attempting to tackle a challenging problem.	131	25.7	183	35.9	82	16.1	79	15.5	35	6.9
I am typically able to investigate a new project when I am unexpectedly requested to do so in a creative and independent manner.	36	7.1	18	3.5	55	10.8	224	43.9	177	34.7

When doing my daily work, I frequently identify patterns that others would overlook when trying to solve an issue..	29	5.7	9	1.8	36	7.1	243	47.6	193	37.8
In order to find fulfilment via my profession, I frequently approach problem-solving creatively.	33	6.5	24	4.7	59	11.6	237	46.5	157	30.8

Inference

The table presents data on respondents' attitudes and tendencies in various aspects related to problem-solving and decision-making.

One notable trend in the data is that a significant percentage of respondents express a preference for critical thinking and analytical approaches. This suggests that a majority of respondents value the process of making careful distinctions when making decisions related to their work.

Another aspect worth highlighting is the tendency to objectively analyze ideas and situations. In the statement This indicates a prevailing inclination among respondents to impartially assess ideas and concepts, considering both their merits and drawbacks.

The data also reflects a balance between analytical and innovative thinking. On the other hand, in the statement a considerable 43.9% strongly agree, and 34.7% agree. This indicates that respondents exhibit both analytical and innovative thinking skills depending on the context.

Furthermore, the data shows that a substantial portion of respondents is generally cautious when making judgments. " 38.6% strongly agree, and 31.4% agree. This suggests a tendency towards thorough consideration before forming conclusions.

Overall, the data portrays a diverse range of problem-solving and decision-making styles among the respondents, with a mix of analytical, innovative, and cautious approaches, depending on the specific situation and context.

ONE WAY ANOVA

One Way ANOVA on Age and Problem Solving Skills & Critical Thinking Skills

Table 3

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Problem solving skills	Between Groups	.152	2	.076	.105	.009
	Within Groups	366.509	507	.723		
	Total	366.660	509			
Critical thinking skills	Between Groups	1.311	2	.656	.584	.558
	Within Groups	569.446	507	1.123		
	Total	570.757	509			

From the Table 3, it is evident that Age is having a significant effect over Problem Solving Skills with $P = 0.009$, however there is no effect over Critical thinking Skills.

One Way ANOVA on Education and PSS AND CTS

Table 4

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
Problem solving skills	Between Groups	1.726	2	.863	1.199	.302
	Within Groups	364.935	507	.720		
	Total	366.660	509			
Critical thinking skills	Between Groups	.805	2	.403	.358	.006
	Within Groups	569.952	507	1.124		
	Total	570.757	509			

From the Table 4, it is evident that education has a significant effect over CTS with $P = 0.006$ while having no effect over PSS.

One Way ANOVA on Type of UG Mode and Problem Solving Skills & Critical Thinking Skills

Table 5

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
Problem solving skills	Between Groups	.280	3	.093	.129	.943
	Within Groups	366.381	506	.724		
	Total	366.660	509			
Critical thinking skills	Between Groups	3.005	3	1.002	.893	.445
	Within Groups	567.752	506	1.122		
	Total	570.757	509			

From the Table 5, it is evident that Type of UG Mode has no significant effect over PSS and CTS.

INDEPENDENT SAMPLE T TEST

Problem Solving Skills and Critical Thinking Skills over Gender

Table 6

		Independent Samples Test								
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Problem solving skills	Equal variances assumed	1.723	.190	-.261	508	.794	-.020	.075	-.168	.128
	Equal variances not assumed			-.259	488.491	.795	-.020	.076	-.168	.129
Critical thinking skills	Equal variances assumed	4.872	.028	1.801	508	.072	.169	.094	-.015	.353
	Equal variances not assumed			1.807	507.974	.071	.169	.093	-.015	.352

From the Table 6, it is evident that there is no significant effect over Problem Solving Skills and Critical Thinking Skills by Gender.

Independent Sample T Test with Problem Solving Skills and Critical Thinking Skills over Father's Education

Table 7

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Problem solving skills	Equal variances assumed	8.114	.005	-2.253	508	.025	-.169	.075	-.316	-.022
	Equal variances not assumed			-2.215	433.896	.027	-.169	.076	-.319	-.019
Critical thinking skills	Equal variances assumed	7.319	.007	-1.389	508	.165	-.130	.094	-.315	.054
	Equal variances not assumed			-1.398	507.994	.163	-.130	.093	-.314	.053

From the Table 7, it is evident that there is no significant effect over Critical Thinking Skills by Father's Education, however it has an effect over Problem Solving Skills with $p = 0.027$.

Independent Sample T Test with Problem Solving Skills and Critical Thinking Skills over Mother's Education

Table 8

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Problem solving skills	Equal variances assumed	2.092	.149	.095	508	.925	.007	.076	-.141	.156
	Equal variances not assumed			.096	506.509	.924	.007	.075	-.140	.154

Critical thinking skills	Equal variances assumed	1.716	.191	.989	508	.323	.093	.094	-.092	.278
	Equal variances not assumed			.983	478.069	.326	.093	.095	-.093	.279

From the Table 8, it is evident that there is no significant effect over Problem Solving Skills and Critical Thinking Skills by Mother's Education.

7. Conclusions

These results align with prior research findings and specifically underscore the substantial and statistically significant influence of project-based learning. The study also emphasises how project-based learning significantly and statistically significantly contributes to the growth of "reasoning" skills, which include undertakings like "identifying methods and tools for data collection," "analysing data to ensure its validity," and "making decisions and evaluating problem-solving solutions."

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