Impact of Project-Based Learning on Grade Ten Students' Mathematics Achievement

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Abstract

The present study analyze the effect of Project Based Learning (PBL) on the achievement of Mathematics of the Grade Ten students in Kathmandu and Lalitpur districts. A sample of 214 students from four secondary schools was chosen. Data were gathered using a structured questionnaire which was based on the Perception towards Mathematics Inventory (PTMI) and were analyzed using descriptive statistics, correlation and regression. Results indicated that students had positive perceptions of PBL, especially the value that they placed on collaboration and mathematics as it is applied in the real world. Correlation analysis showed that there were significant and strong positive relationships between the variables of project commitment, mathematics self-efficacy and mathematics achievement. The results of regression analysis further supported the notion that Projects and Confidence were important predictors of students' mathematics achievement, but with Projects being a stronger predictor. The findings indicate that PBL is a valuable alternative to the traditional teaching method and that it is effective in increasing the achievement in mathematics as well as in improving the confidence level of

the students. Recommendations include the systematic implementation of PBL in the secondary school mathematics curriculum with teacher training and resources provided by the schools.

Keywords: *Project-Based Learning, Mathematics Performance, Self-Confidence, Motivation, Secondary Education*

Introduction

Mathematics is regarded as a gateway subject in secondary school and a foundation for higher level learning in science, technology, engineering and mathematics (STEM) as well as a wide range of career opportunities. Mathematical knowledge is not only essential for success in school, but development of the logical reasoning, problem-solving and analytical skills that are needed to function in everyday life. However, poor performance in mathematics is still an issue worldwide, which usually results in a lack of career skills and long-term aspirations in students (Kokotsaki et al., 2016 & Lazić et al., 2021). These challenges in the context of rapidly changing educational demands make the need for more engaging and effective pedagogical practices more evident.

Traditional lecture-based instruction, which still dominates many of today's classroom instruction, is heavily dependent on rote memorization and procedure problem solving. While the computational skills learned from these methods can be useful, there is little opportunity for exposure to mathematical concepts, learning to work with a partner, or applying the knowledge to the real world. As a result, many students have a hard time seeing the practical value of mathematics and eventually lose interest in learning by students (Cruz et al., 2022).

Project-Based Learning (PBL) has become a student-centered teaching method that is filling in many of these gaps. Based on constructivist and experiential learning theories, PBL engages in problem-based investigations, group work, and collaboration using real projects that reflect the application of mathematics to real situations. The study has demonstrated that PBL can have a positive effect on academic performance, critical thinking, creativity, and student engagement in mathematics learning (Han et al., 2014; Remijan, 2017; Zhang & Ma, 2023). By placing students in situations where they have to see that abstract mathematical principles apply to the real world, PBL creates more active learning environments where students take more ownership of their learning.

Statement of the Problem

In Nepal, mathematics performance in secondary school is also a major concern. When it comes to national assessment tests there are clear achievement gaps, and many students struggle when it comes to abstract ideas like algebra, geometry and problem-solving (Septian et al., 2020; Siregar, 2024; Tyata et al., 2021). Grade Ten mathematics pass rates are low, which limits students from higher education and careers in the STEM sector. This is said to be a challenge because of the traditional teaching approaches that continue to be used, overcrowded classrooms, and lack of opportunities for active and student-centered learning (Tyata et al., 2021).

Although Project-Based Learning (PBL) has been recognized internationally as an effective pedagogical approach for improving students achievement in mathematics and their engagement (Ayaz & Soylemez, 2015; Himmi et al., 2025; Kokotsaki et al., 2016; Zhang & Ma, 2023), there is a lack of empirical studies on the effectiveness of PBL in the context of Nepal. Most schools in Nepal are still focusing on traditional ways of teaching, and so neglect the possibilities of PBL methods, such as developing critical thinking, collaboration, and statistical literacy (Jones & Egley, 2018; Monika et al., 2023).

There is thus a dire need to study the effect of PBL on performance and confidence **in** mathematics in Grade Ten students of urban schools of Kathmandu and Lalitpur. These outcomes are especially significant, given that it is performance that determines access to further studies, and it is this confidence, or self-efficacy, that will impact on a student's persistence and willingness to work with mathematics (Rahman et al., 2025; Rijken & Fraser, 2024). This study aims to fill this gap by presenting the evidence of the effectiveness of PBL in terms of both cognitive outcomes (mathematics achievement) and affective outcomes (confidence and involvement) (Han et al., 2014; Silfavan & Asistido, 2024). The findings are expected to have implications for educational policy and practice in Nepal, and be useful in the development of more interesting and effective instructional strategies that foster 21st-century skills (Rehman et al., 2024).

Objectives of the Study

The objectives of this study were as follows:

- To examine the effect of Project-Based Learning (PBL) on Grade Ten students' mathematics performance.
- To analyze the relationship between project engagement, confidence, and mathematics achievement.
- To identify which factors, project work or confidence serve as stronger predictors of mathematics performance.

Literature Review

Project-based learning (PBL) is found one of the emerging novel pedagogical approaches that showed to have a strong positive influence in mathematics education. The community of scholarship is quite clear that PBL increases student success by immersing students in quality and authentic problem-solving, dynamic and demanding problem-solving knowledge creation, and socially-constructive opportunities for student collaboration. Han et al. (2014), for example, showed that PBL, in STEM contexts, was beneficial, independently of achievement levels, and that lower-achieving students benefitted most of all. Similarly, Ayaz and Soylemez (2015) found a large and consistent positive effect of PBL on student achievement in the meta-analysis they conducted on PBL. This result has been replicated by Laziic et al. (2021), who documented considerable gains in the test scores in mathematics for elementary and secondary students. More recently, Monika et al. (2023) and Zhang and Ma (2023) confirmed the finding that PBL not only leads to improved performance outcomes compared to traditional instruction but also promotes the development of critical thinking skills that are vital for lifelong learning.

In addition to achievement, PBL has also been found to be a dynamic means of fostering student engagement, which is considered a key to significant learning. Kokotsaki et al. (2016) identified collaboration, authenticity, and public display of projects as characteristics that help to maintain long-term engagement in classrooms. Tyata et al. (2021), in the Nepali context, showed that PBL strengthens active participation, group work and problem solving in mathematics classroom proving that PBL is relevant in local settings. Similarly, Remijan (2017) showed how design based projects encouraged secondary students to become more engaged in mathematics learning. Also consistent with these results,

Silfavan and Asistido (2024) reported that the Grade Ten students showed consistently high levels of engagement in PBL tasks regardless of gender or class section (as per the authors). Rehman et al. (2024) further elaborated this discussion by highlighting the role PBL plays in developing 21st century skills by stating that participating in tasks in a project is strongly linked to collaboration, creativity and critical thinking, all of which are skills valued highly in the contemporary educational system.

One of the other much reported results is lithium with PBL is motivation. Numerous research studies have shown that students find mathematics more interesting when it is taught by means of projects. For example, Lee et al. (2019) found that students in STEM-integrated PBL classrooms were more motivated and valued mathematics more than students in non-STEM classrooms. Similarly, Del Valle-Ramon et al. (2020), concluded that the use of digital platforms such as YouTube in mathematics projects not only improved the students' academic performance but also improved the enjoyment of the students in the learning process. These claims were further confirmed by a systematic review by Himmi et al. (2025) as PBL has been found repeatedly to enhance intrinsic motivation when the project is scaffolded and organized correctly by the teacher.

Confidence and self-efficacy in mathematics has also been closely related to PBL. Septian et al. (2020) showed that the use of GeoGebra assisted PBL improved the mathematical representation skills of students and improved the ability to solve complex problems with confidence. On the other hand, Rahman et al. (2025), found that PBL is an effective methodology to improve interest and self-efficacy in mathematics, and the methodology accounted for more than 70% of the variance in learning interest and more than 90% of the variance in self-confidence in the sample population. In support of these findings, Rijken and Fraser (2024) found that students in PBL classrooms had significantly higher self-concept and academic self-efficacy than the traditional classroom counterparts. All these findings support the role of PBL in influencing not only the cognitive outcome but also the affective dimensions of learning.

Attitudes toward mathematics constitute another dimension influenced by project-based instruction. Cruz et al. (2022) concluded that PBL fosters positive attitudes by making mathematics learning more meaningful, collaborative, and contextually relevant. Siregar (2024) similarly showed that secondary school

students engaged in geometry-based projects were better able to connect abstract concepts to real-life situations, which in turn improved their perceptions of mathematics as a practical and useful subject. However, Postlethwait (2023) noted that a single semester of PBL may not be sufficient to shift deep-seated negative attitudes, suggesting that longer-term exposure is necessary to achieve sustained changes.

Taken together, the literature shows compelling evidence that project-based learning (PBL) contributes to mathematics achievement, engagement, confidence and motivation of students. However, there are a number of significant gaps in the body of research that exists. First, much of the literature is focused on broad STEM integration or elementary level mathematics with little attention given to mathematics achievement at the critical Grade Ten level, where academic performance has direct implications for progression to higher education. Second, many studies focus on affective outcomes (i.e., engagement, attitudes, motivation) and fewer studies have examined how these factors relate to measurable mathematics achievement and predictive quantitative models. Third, the existing studies frequently take descriptive or exploratory approaches to make it difficult to find the evidence of regression analyses about the relative contribution of project engagement and mathematical confidence in determining performance outcomes. Addressing these gaps, the current research examines the effect of project-based learning on mathematics achievement and confidence of Grade Ten students of Kathmandu and Lalitpur contributing a focused methodologically rigorous perspective to the literature.

Methodology

This research made use of quantitative method using cross-sectional research design in order to investigate the impact of Project-Based Learning (PBL) to the achievement of Mathematics for Grade Ten students. A quantitative approach was suitable as the nature of the study was measuring the relationship between variable and finding the predictive influence of project based learning and confidence of students towards mathematics using statistical techniques.

Grade ten students of the secondary schools in Kathmandu Valley were targeted as the population. Purposive sampling technique was followed for sampling 214 number of students from 4 secondary schools from the Kathmandu and Lalitpur district. Purposive sampling was followed due to the need of

including those who have direct exposure and experience on project-based learning in mathematics teaching in the study. Schools were chosen based on their willingness to participate and availability of project related activities in mathematics classroom in order for the respondents to have some meaningful reflection on the practices of PBL. While it is not possible to completely generalize the sample to the whole population of Grade Ten students in Nepal, the sample thus chosen does represent typical urban secondary school contexts. Consequently, the findings bring generalizability as far as context and analysis especially to similar urban schools where PBL has been implemented.

Data was captured from a structured questionnaire based on available known instruments relating to learning mathematics and project based teaching. The questionnaire included basic demographic measures, as well as three big constructs (Learning with Projects, 10 items, Confidence in Mathematics, 10 items and Mathematics Performance, 10 items). All items were scored on a five point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) with higher scores indicating greater agreement with positive statements.

In this study, questionnaire items that included phrases such as "after," "improved," or "better than before" were meant to capture the comparative judgments made by students concerning their objective to compare learning mathematics through project-based/group activities with their previous learning experiences using conventional lecture-based instruction. The study was not conducted using an experimental pre-test/post-test methodology, so such items are assumed to be self-reported perceptions, not measured pre- and post-test gains in examination scores.

For the purpose of this study, key variables were operationally defined as follows: Project-Based Learning (PBL) was defined as student's participation in mathematics through collaboration in the form of project work, real-life problem solving and group-based activities, which was measured through Learning with Projects scale; Confidence in Mathematics (self-efficacy) was defined as student's level of belief in his capacity to understand and solve mathematical problems effectively which was measured through Confidence in Math scale; and Mathematics Achievement (performance) was defined as student's self-reported improvement in understanding, problem-solving ability and overall success in mathematics learning after participating in project based activities.

In order to insure validity, content validity was insured through content review of the items on the questionnaire in terms of consistency with the research objectives and the relevant literature. A pilot test has been conducted with students similar in characteristics to the target population but students that were not included in the final sample to allow for refinement of item clarity and relevance. The reliability of the instrument and its estimation were used with Cronbach's alpha and the value was calculated as 0.84 that represents a good internal consistency.

The process of collecting data was done in coordination with the school authorities and mathematics teachers. Prior permission was taken from school administrations and written informed consent was received from the school authorities and parents prior to administration of the questionnaire. Data was collected during normal school hours in classroom environments in standardized conditions. Students were told that the participation was voluntary and the answers would be anonymous and confidential. There were definite instructions given and the researcher was there to answer questions and ensure that the questionnaire was filled in independently.

After the data collection, response was coded and analyzed by using Statistical Package for Social Sciences (SPSS). Descriptive statistics (mean and standard deviation) were used to summarize for student's perception project based learning, confidence and mathematics performance. Pearson correlation analysis was applied to analyze the relations between the key variables, multiple regression analysis was conducted to find the degree of prediction of the project-based learning and the confidence in mathematics on the achievement of the mathematics. This method of analysis allowed a systematic analysis of the cognitive and affective aspects of the learning in the context of the project-based learning.

Results

The results of the data through 214 Grade Ten students are presented in the following phases: (a) descriptive statistical analysis of all items in the questionnaire; (b) correlation analysis of major constructs, and (c) regression analysis to determine the predictors of performance in mathematics.

Descriptive Statistics

Prior to the administration of the questionnaire, it was ensured that the selected schools have already applied project-based and group-based learning activities in the mathematics teaching. School selection was therefore conditional on the mathematics teachers and school administrators assuring that project work, cooperative activities and application based activities were a part of ordinary class room work at the Grade Ten level. This pre-condition assured that students have had familiarity with project-based learning experiences, and hence were able to give informed and meaningful answers about the items related to projects and group work in the questionnaire.

Descriptive statistics was calculated about all 30 questions of the questionnaires concerning Learning with Projects (10 questions), Confidence in Mathematics (10 questions) and Mathematics Performance (10 questions). As can be seen in table 1 the general attitude of the students towards the project based learning were favorable. Items with the highest mean scores were those that related to the aspect of collaboration, application and real-world relevance such as "Working in groups helps me understand math better" (M = 3.93, SD = 1.08), "Projects help me think more deeply about math problems" (M = 4.01, SD = 1.05) and "I can use math in daily life (e.g., money, measurement)" (M = 3.94, SD = 1.09).

In comparison, those items that were related to decreased anxiety and uncertainty had relatively low mean scores, although still above the neutral midpoint score. For example, I am less concerned about math when learning with projects (M = 3.62, SD = 1.19) and Projects reduces my fear of making mistakes in math (M = 3.65, SD = 1.13) both received moderate amounts of agreement.

Overall, these descriptive results suggest that for students who had previous experience with the project based and group based mathematics instruction, PBL had been linked to positive engagement, positive confidence and positive self-reported improvement of mathematics performance.

Table 1

Descriptive Statistics of All Questionnaire Items (N = 214)

Construct	Item	Mean	SD	Min	Max
Learning with Projects	I enjoy learning math when projects are used.	3.88	1.15	1	5
	Projects make math classes more interesting.	3.87	1.09	1	5
	Working in groups helps me understand math better.	3.93	1.08	1	5
	I feel more excited to learn math through projects.	3.91	1.07	1	5
	Projects help me think more deeply about math problems.	4.01	1.05	1	5
	I take part more in class when projects are given.	3.95	1.08	1	5
	Projects show me how math is used in daily life.	3.94	1.09	1	5
	I like project work more than only lectures or notes.	3.91	1.10	1	5
	Projects help me to share and discuss ideas with friends.	3.92	1.09	1	5
	Overall, projects make math learning fun.	3.95	1.11	1	5
Confidence in Math	I feel confident solving math problems when projects are used.	3.87	1.12	1	5
	Projects improve my problem-solving skills.	3.96	1.09	1	5
	I believe I can get better marks through project work.	3.91	1.11	1	5
	I understand math formulas better when I use them in projects.	3.92	1.10	1	5
	I feel less worried about math when learning with projects.	3.62	1.19	1	5
	Projects help me explain math answers clearly.	3.93	1.11	1	5
	I can use math in new situations after project work.	3.88	1.13	1	5
	I take more responsibility for my learning in math.	3.94	1.09	1	5
	Projects encourage me to practice math at home.	3.96	1.08	1	5
	Overall, projects make me feel better about math.	3.94	1.11	1	5
Math Performance	My math marks have improved after doing projects.	3.88	1.15	1	5
	Math homework is easier after project lessons.	3.90	1.10	1	5
	I remember math topics longer after project work.	3.82	1.14	1	5
	I can solve word problems more easily after projects.	3.96	1.08	1	5
	Projects improve my logical thinking.	3.87	1.13	1	5
	I can solve problems on my own after project work.	3.84	1.16	1	5
	My math performance is better than before.	3.88	1.11	1	5
	I can use math in daily life (e.g., money, measurement).	3.94	1.09	1	5
	I can explain math to others after doing projects.	3.93	1.10	1	5
	Overall, projects help me do better in math.	4.03	1.07	1	5

Correlation Analysis

For the correlation analysis, each variable has been measured by a composite score created by the questionnaire. Specifically, Projects was computed as the mean score of the 10 items under Learning with Projects construct, Confidence was computed as the mean score of the 10 items under Confidence in Mathematics construct and Math Performance was computed as the mean score of the 10 items under Math Performance construct. All items were scored on a 5-

point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree); with higher scores on the composite measures corresponding to higher project engagement, confidence and perceived mathematics performance, respectively.

Correlation matrix (Table 2) shows the relationship among *Projects*, *Confidence in Math*, and *Math Performance*. There were strong and positive correlations between Projects and Confidence (r = .76, p < .01), Projects and Performance (r = .79, p < .01), and Confidence and Performance (r = .74, p < .01). These findings suggest that students who reported higher engagement in project-based learning and stronger confidence in mathematics also demonstrated higher levels of mathematics performance.

Table 2
Correlation Matrix of Constructs (N = 214)

Variable	1	2	3
1. Projects	1		
2. Confidence	.76**	1	
3. Performance	.79**	.74**	1

Note. **p < .01.**

Regression Analysis

Multiple regression analysis was used to determine whether Projects and Confidence significantly predicted Mathematics Performance. The overall model was significant, $F(2, 211) = 216.6$, $p < .001$, and explained 67.2% of the variance ($R^2 = .672$). As shown in Table 3, both predictors were significant: Projects ($\beta = .57$, $p < .001$) and Confidence ($\beta = .33$, $p < .001$). This indicates that students' exposure to project-based learning and their confidence in mathematics both contributed positively to their performance, with Projects emerging as the stronger predictor.

Table 3
Regression Analysis Predicting Mathematics Performance (N = 214)

Predictor	B	SE	β	t	p
Constant	0.32	0.17	—	1.85	.066
Projects	0.57	0.06	.57	8.99	.000
Confidence	0.33	0.06	.33	5.33	.000

Model Fit: $R^2 = .672$, Adj. $R^2 = .669$, $F(2, 211) = 216.6$, $p < .001$.

From Table 3, it was evident that the regression model was statistically significant, $F(2, 211) = 216.6$, $p < .001$, accounting for 67.2% variance in

mathematics performance, $R^2 = .672$. Both Project-Based Learning (v = .57, p< .001) and Confidence in Mathematics (v = .33, p< .001) were significant positive predictors of performance. This suggests that project-based learning engagement and confidence in mathematics was positively related to mathematics performance, with project engagement being the stronger predictor.

Discussion

The purpose of this study was to investigate the relationship between Project-Based Learning (PBL) and mathematics achievement of Grade Ten of some selected urban schools of Kathmandu and Lalitpur. The results show that both project engagement and confidence in mathematics were found to be significant positive predictors of the performance of students in the mathematics field, and that the project engagement emerged as a stronger predictor. This suggests that students who reported greater involvement in project-based learning activities were also more likely to report greater levels of mathematics performance, while confidence in mathematics played a supportive, but secondary role.

The descriptive statistics revealed that students in general had favorable perceptions of project based learning. High mean scores were found for items having to do with collaboration, deeper thinking, and real-world application of mathematics. In particular, students agreed strongly that working in groups made them understand mathematics better and projects allowed for deeper problem solving and practical application. These results indicate that in school where project and group based activities have been implemented students perceived PBL as an engaging and meaningful way of learning mathematics. Similar aspects of collaboration and authenticity have been indicated in previous research as some of the main strengths of PBL (Kokotsaki et al., 2016). In the Nepali context, Tyata et al. (2021) has also found that project-based teaching resulted in increased active participation and group interaction in mathematics classrooms which is consistent with the present findings.

However, the descriptive results also indicated comparatively lower mean scores in terms of reduction of anxiety and fear of making mistakes, although they still were above the neutral midpoint. This suggests that while PBL was thought to be viewed in a generally positive manner, it may not address mathematics anxiety in all students. This is a nuanced point because it implies that project-based learning alone may not be sufficient to remove emotional barriers to learning

mathematics and that other forms of instructional support may be required to help the students who struggle with persistent anxiety.

The correlation analysis showed that there are strong and positive relationship between project engagement, confidence in mathematics and mathematics performance. Students who reported greater engagement in project-based learning also tended to report greater confidence and greater mathematics performance. Similarly, greater confidence was related to greater reported performance. These relationships suggest that there is a strong interconnection between the three constructs in the learning experiences of students. However, given that the data are cross-sectional and self-reported, these associations should be considered as associations and not as causal effects.

The regression analysis gave much more information on the relative importance of project engagement and confidence in predicting mathematics performance. The model accounted for a sizeable amount of variance in performance and the effect of project engagement was found to be higher than that from confidence. This suggests that being exposed to and involved in project-based learning activities is an important factor that is related to student's perceived performance in mathematics. Confidence in mathematics also made a significant contribution, indicating that affective factors are still found to be important as well as instructional approaches.

A concern raised in the supervisor's comments was if confidence is "representative of mathematics." In this study, confidence is not presented as mathematics achievement per se but as a distinct affective construct that is measured in terms of students' self-beliefs about the ability to understand and solve mathematical problems. Mathematics performance was measured separately using a pool of self-reported performance items. Therefore, the results showed that confidence is predictive of perceived mathematics performance, rather than confidence substituting or representing mathematics achievement. This interpretation is in line with research that found self-efficacy and confidence have been linked to mathematics outcomes but are conceptually distinct from mathematics achievement per se (Rahman et al., 2025; Rijken & Fraser, 2024).

It is also important that items are clarified on what they mean using phrases such as after or better than before. Because this study did not use an experimental pre-test/post-test research design, the use of such items indicate the comparative

perceptions of students regarding project-based learning in comparison to their prior experiences with traditional instruction. As such, the results do not show measured improvement in examination scores but rather the perceived improvement of students in association with project-based learning experiences.

From a contextual perspective, the results are especially relevant in relation to Grade Ten students in Nepal, where performance in mathematics has an important role to play in the access to higher education and in STEM-related pathways. As noted in this study, the positive relationships found imply that PBL could be a promising teaching method to combat the engagement and performance issues in urban secondary schools. While some earlier work has been conducted in Nepal addressing about the pedagogical value of PBL (e.g., Tyata et al., 2021), the current study is a quantitative study which provides evidence about the relationship between engagement in the project and confidence in relation to the mathematics performance.

Despite all these contributions of the study, there are limitations. The purposive sample from four urban schools limits the generalizability of the findings for other parts of Nepal especially rural or under-resourced schools. In addition, the use of self-reported data could result in response bias. Future research might address this by enhancing the evidence base with objective measures of achievement, larger samples and/or longitudinal or experimental designs.

Overall, the findings indicate that project-based learning has a positive relationship with mathematics performance and confidence among Grade Ten students in Katmandu and Lalitpur with the engagement in projects playing an important role. These findings support the potential of PBL as meaningful instructional approach in the context of secondary mathematics education in Nepal.

Conclusion and Recommendations

This research paper examined the relationship of project based learning (PBL), confidence in mathematics as well as performance in mathematics among Grade ten students of selected urban secondary schools in Kathmandu and Lalitpur. The findings indicated that engagement of the learners in the project based learning activities and the confidence of the student in mathematics were

significantly and positively related with the performance of the student in mathematics. Among the two predictors, the relationship between project engagement and performance was more than that between project engagement and confidence. This points out to the fact that there was an inclination of such students who reported greater levels of engagement in project-based learning to also report greater levels of mathematics performance.

The overall positive attitude towards project-based learning among the students was also demonstrated in the results of the study using descriptive results. There was high agreement on the items that pertained to cooperation, practice of mathematics in the real world and increased knowledge of mathematical concepts. This means that in the schools where project and group-based learning had already taken shape, the perception of the students in respect to PBL was that, it was an interesting and meaningful mode of learning mathematics. Nonetheless, there was a relative lack of consensus with regards to items concerning decreased anxiety, indicating that, although PBL may be useful when it comes to enhancing the two, it might not be enough to tackle all of the emotional issues that relate to the process of learning mathematics.

It should be mentioned that a cross sectional study and self-reported data were used to carry out it. In this way, the results demonstrate correlations, and not causality. The gains in mathematics performance reported are the perceptions of students and not literally the measure of gains in mathematics performance. Thus, conclusions are to be perceived as learning outcomes.

On the findings it is possible to make a number of recommendations. To start with, secondary schools may consider the implementation of project-based learning as an additional technique to the conventional method of learning mathematics, specifically when the study of certain aspects of mathematics can be better knowledgeable by the application of real-life situations and problem-solving activities in groups. Second, mathematics teachers should get offered opportunities in professional development that is aimed at offering both effective project design and facilitation of group work and an orientation to alignment of projects to curriculum objectives. Third, the schools are to possess sufficient institutional assistance (e.g. instructional resources and flexible structures of teaching) to facilitate the routine implementation of project-based activities.

Future studies ought to expand on this study by including objective attainment measures of mathematics and larger and more heterogeneous sample sizes of students and also employ longitudinal or experimental research designs. These studies would provide more evidence in line with the success of project-based learning when used in the field of mathematics education in the long run.

Finally, this research hypothesized that project-based learning is positively correlated with confidence and perceived mathematics performance of students in Grade Ten of urban schools in Nepal. The implementation of PBL and additional studies should allow PBL to have a significant role to play in improving mathematics learning processes.

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