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Comparison of Biology Academic Achievement and Social Skills Between Yangon and Pyin Oo Lwin High School

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Abstract: Project-Based Learning (PBL) is increasingly recognized as an effective approach for enhancing both students' academic achievement and social skills. This study examines differences in academic achievement in biology and social skills among high school students in Yangon and Pyin Oo Lwin, Myanmar. Yangon school implemented Project-Based Learning (PBL), whereas the Pyin Oo Lwin school employed traditional teaching methods. A descriptive comparative design was adopted, involving 120 Grade 10 students, with 60 selected from Yangon and 60 from Pyin Oo Lwin. Academic achievement was measured using monthly biology test scores, while social skills were assessed via a researcher-developed questionnaire covering five indicators: positive interdependence, interaction activity, individual responsibility, interpersonal relationships, and group member interactions. An independent samples t-test revealed significantly higher biology scores in Yangon ($M = 75.80$, $SD = 5.97$) than in Pyin Oo Lwin ($M = 68.10$, $SD = 6.21$; $t = 7.01$, $df = 118$, $p < 0.01$). A Mann–Whitney U test indicated significantly stronger collaboration scores in Yangon (93.5%, $SD = 1.60$) compared to Pyin Oo Lwin (91.7%, $SD = 1.70$; $U = 577.00$, $p < 0.05$). A Pearson correlation analysis showed a statistically significant, moderate positive relationship between academic achievement and social skills ($r = 0.47$, $p < 0.001$, $r^2 = 0.22$), indicating that the two variables share only about 22% of common variance. Given the descriptive comparative design, these findings indicate that PBL implementation is associated with higher academic achievement and stronger social skills among Yangon students, rather than directly causing these outcomes. The results underscore the need for equitable access to active learning methodologies across Myanmar's diverse regional contexts.

Keywords: Academic Achievement; Biology Education; Project-Based Learning; Social Skills.

Introduction

Education plays a pivotal role in shaping students' intellectual and social capacities, equipping them with the knowledge, skills, and dispositions necessary for personal growth and societal contribution. Among the core indicators of student development in secondary education, academic achievement and social skills are particularly significant. Academic achievement reflects students' mastery of curricular content, problem-solving abilities, and cognitive proficiency [1], while social skills encompass communication, cooperation, empathy, and conflict resolution competencies essential for effective participation in diverse social environments [2]. Together, these dimensions form the foundation of holistic education, with the whole-child paradigm asserting that fostering interpersonal skills alongside academic performance produces more resilient, adaptable, and community-oriented learners [3].

Biology education, in particular, offers a compelling context in which the academic and social dimensions of learning naturally intersect. The discipline's emphasis on observation, scientific inquiry, and collaborative problem-solving engages students in discussion, peer interaction, and shared reasoning [6]. Laboratory activities and group investigations require students not only to apply cognitive skills but also to communicate effectively, negotiate ideas, and work cooperatively, thereby making Biology classrooms environments where social competencies are actively exercised alongside intellectual ones [7]. Understanding how academic achievement and social skills develop together within Biology education is, therefore, both theoretically meaningful and practically valuable. In Myanmar, the National Education Strategic Plan recognizes this integrated vision by emphasizing the incorporation of life skills and social-emotional learning into the curriculum [4].

Despite these national priorities, variations in educational resources, teaching methodologies, and socio-cultural contexts across regions may differentially influence student outcomes. Yangon, as Myanmar's largest urban centre, typically offers greater access to qualified teachers, technological resources, and extracurricular programs. Pyin Oo Lwin, though recognized for its quality schools, operates within a semi-urban environment characterized by distinct socio-cultural dynamics and differing resource availability. These regional differences raise important questions about whether students in the two contexts differ in both their academic performance and their social skill development in Biology.

Comparative studies examining academic achievement and social competencies across different regions of Myanmar, particularly within the context of Biology education, remain limited [5]. This gap in the literature justifies the present investigation, which seeks to provide empirical evidence on regional differences and

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contribute to more contextually informed approaches to teaching and learning in Myanmar's secondary schools.

While most previous research in Myanmar has focused on educational development in urban schools, relatively little attention has been paid to the educational conditions in semi-urban schools. To address this gap, the present study examines regional educational differences by comparing teaching practices, student learning behaviours, collaborative learning, and academic achievement across urban and semi-urban schools. By identifying the educational gaps between these two contexts, the study provides evidence to support the development of context-specific strategies to improve educational quality in semi-urban schools, rather than assuming that educational approaches effective in urban schools can be applied directly to other settings.

Research Methods

Research Design

A descriptive comparative research design was adopted to observe and compare differences in academic achievement and social skills. This design enabled a systematic comparison of outcomes between students in Yangon who were exposed to Project-Based Learning (PBL) and those in Pyin Oo Lwin who received traditional instruction.

Research Site

The study was conducted at two secondary schools located approximately 660 kilometres apart. The Yangon school had implemented PBL over the past five years, while the Pyin Oo Lwin school continued to rely on traditional teaching methods. Both schools maintained similar administrative frameworks, discipline policies, and academic calendars.

Participants

The sample consisted of 120 Grade 10 students: 60 from Yangon (30 from Class 10A and 30 from Class 10B) and 60 from Pyin Oo Lwin (30 from Class 10A and 30 from Class 10B). A cluster convenience sampling technique was employed because the study was conducted using intact classroom groups. Two Grade 10 classes were selected by the researcher from each school, based on accessibility and the study's objectives. Administrative approval to conduct the research in the selected classes was obtained from the respective headmasters prior to data collection. All participants were enrolled in the same grade level, followed the same national Biology curriculum, and were of comparable age, supporting a reasonable degree of comparability between the two groups. However, schools and classes were selected through convenience sampling rather than random sampling; the findings may not be fully representative of all secondary schools in Myanmar. Therefore, the results should be interpreted with caution, and future studies involving more schools and probability sampling methods are recommended to improve the generalizability of the findings.

Instruments

Academic achievement was measured using the monthly Biology examination scores provided by the teachers. The monthly examination had a total of 50 marks, lasted 60 minutes, and consisted of 30 multiple-choice questions, 5 short-answer questions, and 2 structured questions. Social skills were assessed using a researcher-developed questionnaire adapted from validated Social-Emotional Learning (SEL) scales, covering five indicators (Table 1), with responses on a 5-point Likert scale (1 = Never to 5 = Always). Scores were classified as shown in Table 2. Because the adapted items were not independently piloted with this study's sample prior to data collection, an internal consistency estimate (e.g., Cronbach's alpha) specific to this administration is not available; this limitation is discussed further below.

Table 1. Indicators of Social Skills

No	Indicator
1	Positive Interdependence
2	Interaction Activity
3	Individual Responsibility
4	Interpersonal Relationships
5	Group Member Interactions

Table 2. Category for Achievement of Social Skills

No	Category (Score Range)
1	Very High (81–100%)
2	High (61–80%)
3	Moderate (41–60%)
4	Low (21–40%)
5	Very Low (0–20%)

Data Analysis

An independent-samples t-test was used to compare Biology test scores across schools. Since social skills data were not normally distributed, a Mann-Whitney U test was used. The Pearson product-moment correlation was used to examine the relationship between academic achievement and social skills.

Results and Discussion

Yangon students achieved higher performance in Biology, demonstrated slightly stronger collaborative social skills, and showed a moderate positive association between academic achievement and collaboration compared with Pyin Oo Lwin students. Biology achievement differed significantly between the two schools, with Yangon students obtaining higher average scores, while both groups demonstrated very high levels of collaborative engagement. In addition, academic achievement and collaboration skills were moderately and positively correlated, suggesting that stronger collaborative engagement may be associated with better academic outcomes. These findings support previous studies indicating that cooperative and project-based learning environments can promote academic achievement, teamwork, communication, and shared responsibility among students [6–8].

Academic Achievement

Yangon students achieved significantly higher Biology scores than Pyin Oo Lwin students. The monthly mean Biology score of Yangon School (M = 75.80, SD = 5.97) exceeded that of Pyin Oo Lwin School (M = 68.10, SD = 6.21). An independent samples t-test indicated that this difference was statistically significant, $t(118) = 7.01$, $p < .01$, with a 95% confidence interval for the mean difference ranging from 5.50 to 9.90 points. The standardized effect size was large (Cohen's $d = 1.28$, 95% CI [0.87, 1.66]), indicating that the difference was substantial in practical as well as statistical terms. This finding is consistent with previous studies demonstrating the academic benefits of project-based learning (PBL) [6, 7].

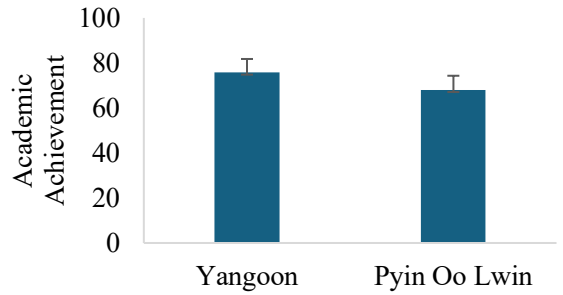

Figure 1. Comparison of Monthly Biology Test Scores Between Yangon and Pyin Oo Lwin Schools

Social Skills

Both Yangon and Pyin Oo Lwin students demonstrated very high levels of collaborative social skills, although Yangon students showed slightly stronger engagement. Across all five collaborative indicators, most responses were concentrated in the “Often” and “Always” categories. Overall collaboration scores were 93.5% (SD = 1.60) for Yangon and 91.7% (SD = 1.70) for Pyin Oo Lwin. These percentages were calculated by dividing the observed total social skills score by the maximum possible total score and multiplying by 100**.** The Mann–Whitney U test revealed a statistically significant difference between the groups (U = 577.00, p < 0.05). The rank-biserial correlation indicated a large effect size (***r*** = 0.68), suggesting that the observed difference was not only statistically significant but also practically meaningful. These findings are consistent with studies indicating that PBL environments enhance teamwork, communication, and cooperative participation [8].

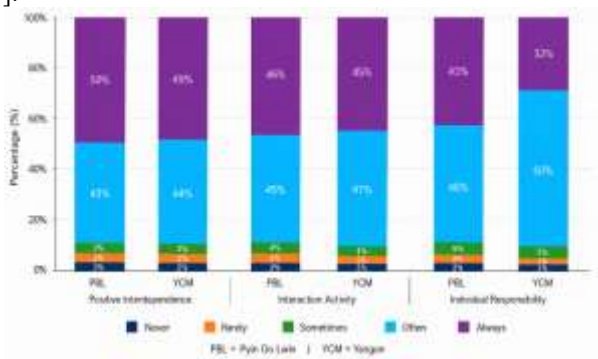

Figure 2. Comparison of Collaboration Skill Indicators between Pyin Oo Lwin and Yangon Schools

Figure 2 presents response distributions for Positive Interdependence, Interaction Activity, and Individual Responsibility across both schools. Across all three indicators, the findings consistently reveal that most respondents in both locations reported "Often" and "Always" with similar frequency, collectively accounting for approximately 90% or more of total responses, while low-frequency responses such as "Never," "Rarely," and "Sometimes" remained virtually negligible. With respect to Positive Interdependence and Interaction Activity, both Pyin Oo Lwin and Yangon exhibited broadly comparable distributions, reflecting consistently high levels of mutual dependence and active engagement in collaborative learning tasks. However, for Individual Responsibility, a marginally higher proportion of "Sometimes" responses was observed than in the preceding two indicators, suggesting slightly more diverse perceptions of personal accountability within collaborative settings. Notably, across all three indicators, Yangon showed a marginally higher proportion of "Always" responses than Pyin Oo Lwin, indicating a stronger tendency toward full engagement among Yangon participants. Overall, Yangon exhibited a marginally stronger inclination toward the highest frequency category across the indicators examined.

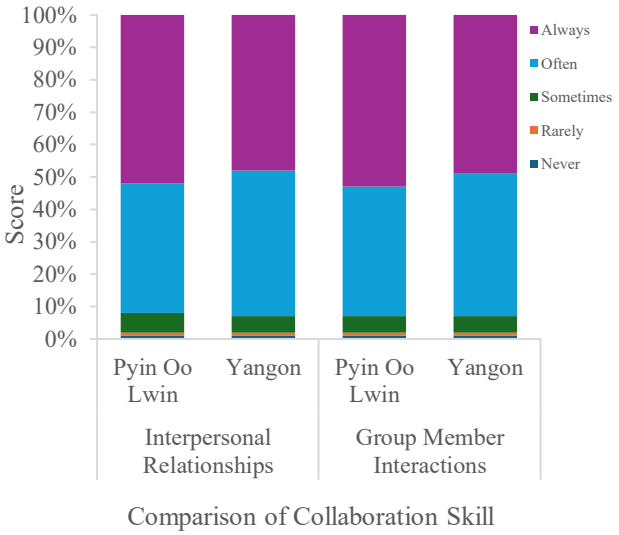

Figure 3. Comparison of Collaboration Skill Indicators between Pyin Oo Lwin and Yangon Schools

The data in Figure 3 presents response distributions for Interpersonal Relationships and Group Member Interactions. Both indicators show similarly high engagement across schools, with the combined “Often” and “Always” categories accounting for over 90% of responses in both Pyin Oo Lwin and Yangon. The distributions are broadly comparable, though Yangon again showed a marginally stronger concentration in the “Always” category, consistent with the pattern observed in Figure 3.1.

Correlation Between Achievement and Social Skills

Correlation analysis was conducted across all 120 participants. The results revealed a statistically significant moderate positive correlation between Biology achievement and collaboration skill scores ($r = 0.47$, 95% CI [0.32, 0.60], $p < .001$), with a coefficient of determination (r^2) of 0.22. This indicates that approximately 22% of the variance

is shared between Biology achievement and collaboration skill scores, suggesting a meaningful association between the two variables. However, the remaining 78% of the variance reflects factors beyond the linear relationship examined in this study. The direction of the correlation further implies that students who demonstrated higher levels of academic achievement in Biology also tended to exhibit stronger interpersonal and collaborative abilities within cooperative learning environments.

Comparison of Biology Achievement Between Yangon and Pyin Oo Lwin

The significant difference in Biology scores between Yangon and Pyin Oo Lwin requires a deeper analytical interpretation that extends beyond simply identifying which group performed better. While the Yangon school's adoption of Project-Based Learning (PBL) may be associated with higher academic outcomes, it is important to acknowledge that this study employed a descriptive comparative design rather than an experimental one. Therefore, it would be methodologically inappropriate to assert that PBL directly caused the observed differences. Rather, PBL may be associated with improved academic performance through several interconnected mechanisms. First, PBL emphasises student autonomy and inquiry, which can cultivate intrinsic motivation and deeper engagement with subject matter [6]. Second, the collaborative structure of PBL requires students to articulate, negotiate, and evaluate ideas within peer groups, processes that have been shown to strengthen conceptual understanding in Biology specifically, where peer discussion of living systems, experimental results, and ecological relationships can consolidate learning more effectively than passive instruction [7]. Third, the iterative nature of project work, whereby students plan, revise, and present their findings, may reinforce metacognitive awareness in ways that traditional instruction does not.

These findings are broadly consistent with existing literature. The superior academic outcomes observed in the PBL group align with Anazifa and Djukri [6], who reported enhanced higher-order thinking skills among PBL students, and with Dawin [7], who found that active learning environments generally yield better science achievement scores. Similarly, the positive relationship between collaborative learning and social skill development corroborates Nurhadi et al. [8], who observed that PBL chemistry classes produced measurable improvements in teamwork competencies. However, a more nuanced comparison reveals that not all studies report uniformly positive PBL outcomes. Some research indicates that PBL is most effective when teachers receive adequate training and when students possess prior experience with self-directed learning, conditions that may not be uniformly present across different school contexts [19]. Furthermore, Wentzel [10] cautions that student–teacher relationships can independently moderate the effect of any instructional strategy on social outcomes, a variable not controlled for in the present study. These comparative insights suggest that while the present findings are broadly aligned with existing literature, the conditions under which PBL yields its strongest benefits remain context-dependent and merit more nuanced investigation in future research conducted within Myanmar's diverse regional educational environments.

Contextual and Theoretical Interpretation

Beyond the instructional method itself, other contextual factors must also be considered, including teachers' experience and pedagogical training, differences in school facilities, students' socioeconomic backgrounds, and parental involvement. Attributing the performance gap solely to PBL without acknowledging these confounding variables would risk overstating the findings. Bronfenbrenner's Ecological Systems Theory [11] is directly applicable here: the theory holds that student development is shaped not only by immediate classroom experiences (the microsystem) but also by the broader institutional, community, and societal environments that comprise the mesosystem and exosystem. In this study, Yangon's urban context, with its relatively greater access to digital resources, professional development opportunities for teachers, and richer extracurricular programs, functions as a systemic amplifier of active learning approaches such as PBL. Pyin Oo Lwin, in contrast, operates in a semi-urban environment where access to such resources may be more constrained, thereby limiting the conditions under which PBL can be implemented most effectively [12]. It is precisely this ecological difference, rather than teaching method alone, that the present findings reflect; a more complete interpretation must therefore account for the urban–semi-urban disparity in educational infrastructure, resource availability, and socio-cultural norms surrounding learning.

Vygotsky's concept of the Zone of Proximal Development (ZPD) [13] provides a more direct explanation for the social dimension of these findings. In the Yangon classroom, where PBL structured regular peer collaboration around Biology inquiry tasks, students consistently operated within the ZPD: working on problems slightly beyond their individual capabilities but achievable through interaction with peers and teacher guidance. This is not merely a theoretical parallel but a description of what PBL in practice produces, namely, sustained cycles of collaborative inquiry, group problem-solving, and peer feedback that simultaneously develop conceptual understanding and interpersonal competence. The Pyin Oo Lwin classroom, relying on traditional instruction, offered fewer opportunities for this kind of scaffolded peer interaction, which may partly account for the observed gap in both Biology achievement and collaborative skill scores. This Vygotskian lens thus helps explain why academic and social development appear to co-occur under PBL conditions: the same collaborative processes that consolidate biological concepts simultaneously build communicative competence, individual responsibility, and cooperative behaviour. Together, Bronfenbrenner's ecological perspective and Vygotsky's sociocultural theory provide a complementary framework for understanding how environmental context and collaborative learning processes jointly shape students' academic and social development within Biology education.

Social Skills Findings

The social skills findings warrant more critical reflection than a straightforward comparison of group means. Although both schools were classified in the "Very High" category, with Yangon and Pyin Oo Lwin recording closely comparable scores, the relatively narrow gap raises important methodological considerations. One possibility is

that the questionnaire may be subject to a ceiling effect, whereby items are insufficiently challenging to differentiate between students who are genuinely "very high" and those who are "exceptionally high" in social competence. An alternative explanation relates to instrument sensitivity, as Likert-scale questionnaires measuring social skills through self-report are inherently vulnerable to social desirability bias, whereby respondents select the most socially acceptable responses rather than ones that accurately reflect their behaviour [18]. This may be particularly relevant in school contexts where students are aware that teachers value cooperative behaviour. This concern is compounded by the fact that internal consistency reliability for the adapted instrument was not independently established for the present sample (see Instruments), which further limits confidence in the precision of the observed group difference.

To partially mitigate this concern, classroom teachers were involved in reviewing and verifying the questionnaire responses to assess their reasonableness and authenticity. While this procedural step represents a meaningful effort to enhance response validity and reduce the influence of socially desirable answering, it is important to acknowledge its inherent limitations. Teacher verification of self-report responses may itself introduce a degree of evaluative bias, as students may anticipate teacher scrutiny and adjust their responses, accordingly, thereby reinforcing rather than resolving the social desirability effect. Furthermore, teacher judgment regarding the reasonableness of student responses is necessarily subjective and may not consistently reflect the nuanced realities of individual students' collaborative behaviours. Nonetheless, this verification step does contribute a layer of cross-referencing that strengthens the overall credibility of the data collection process beyond purely unmonitored self-report.

Future studies might further address these limitations by triangulating self-report data with systematic teacher observations, peer nominations, or behavioural checklists administered independently of the classroom context, and by incorporating items specifically designed to distinguish higher levels of social skill development beyond the upper boundaries of conventional Likert-scale instruments.

Correlation Between Academic Achievement and Social Collaborative Skills

The moderate positive correlation between Biology achievement and collaborative skill scores ($r = 0.47$) is consistent with Social-Emotional Learning (SEL) theory, which holds that academic competence and social skills are interconnected dimensions of development that mutually reinforce one another [9, 10]. This association is meaningful, yet several interpretive cautions apply. Because the design is correlational rather than experimental, directionality cannot be established; the relationship may be mediated by a third variable, such as student motivation, family support, or school culture, that independently promotes both outcomes. The moderate effect size further indicates that these are distinct constructs: while they co-vary, social skills cannot be reduced to academic performance alone and require dedicated attention in educational planning and policy [9, 14]. This relationship may be particularly important in learning Biology because collaborative scientific activities often require students to explain concepts, justify their reasoning, and collectively interpret evidence. Such interactions may simultaneously strengthen conceptual understanding and social communication skills. Therefore, the association observed in this study suggests that academic achievement and collaborative competence may reinforce one another within active learning environments rather than developing independently.

Implications for Schools and Education Offices

The findings of this study carry meaningful practical implications for schools and education policymakers in Myanmar. At the school level, the superior academic and social outcomes observed in the PBL-implementing school suggest that school administrators and Biology teachers should consider adopting and systematically integrating PBL into their instructional repertoire, particularly in science subjects where inquiry-based exploration is most naturally aligned with curriculum objectives. Teacher professional development programs should be designed to equip educators with the pedagogical knowledge and facilitation skills necessary to implement PBL effectively, as the quality of implementation is likely to moderate the degree to which positive outcomes are achieved. Furthermore, schools operating in resource-constrained environments, such as those in semi-urban contexts like Pyin Oo Lwin, should be supported through targeted provision of digital learning tools, collaborative classroom infrastructure, and mentoring networks that enable teachers to implement active learning strategies under realistic local conditions.

At the level of education offices and policymakers, the findings suggest that curriculum frameworks and assessment systems should be broadened to formally recognize and assess social collaborative competencies alongside academic achievement, given the demonstrated association between the two domains. Regional education offices should consider developing context-sensitive PBL guidelines that account for the infrastructural and sociocultural differences between urban and semi-urban schools, rather than applying uniform implementation frameworks across diverse settings. Investment in systematic monitoring and evaluation mechanisms, including observation protocols and peer-assessment instruments, would further enable education authorities to track the development of social skills more accurately and to identify schools where additional support is most urgently needed.

International Comparison

Project-Based Learning (PBL) is an effective instructional approach for improving students' academic achievement in science education. Across diverse educational contexts, PBL has been associated with stronger conceptual understanding, increased engagement in learning, and enhanced higher-order cognitive development compared with conventional teacher-centred instruction [15,16]. Recent meta-analytic evidence further suggests that the educational benefits of PBL are particularly pronounced in Southeast Asian countries, where student-centred pedagogies may provide greater opportunities for active learning within traditionally lecture-based educational systems [16]. Given the similarities in educational practices across the region, these findings provide a meaningful context for interpreting the higher Biology achievement observed among students at Yangon High School.

Evidence from recent research in biology education further supports this interpretation. Project-based instructional approaches have consistently been shown to improve students' mastery of biological concepts, cognitive achievement, and scientific understanding by engaging learners in authentic investigations and inquiry-based problem solving [17–20]. Rather than emphasizing the passive acquisition of knowledge, PBL encourages students to explore biological phenomena through collaboration, critical thinking, and the application of scientific concepts to real-world contexts, thereby promoting deeper conceptual learning and more durable knowledge retention [18–20]. These learning processes are particularly important in Biology education, where understanding complex concepts often requires students to integrate theoretical knowledge with observation, investigation, and evidence-based reasoning.

Beyond academic achievement, recent studies indicate that PBL contributes to the development of broader educational competencies that support long-term learning success. Authentic project experiences have been associated with improved scientific inquiry skills, practical laboratory competencies, creativity, collaboration, communication, and higher-order thinking, all of which are recognised as essential outcomes of contemporary science education [19–25]. These complementary learning outcomes may help explain why students participating in project-based learning frequently demonstrate stronger academic performance than their peers receiving conventional instruction, as increased engagement, collaboration, and cognitive involvement create more meaningful and effective learning experiences.

Taken together, the present findings are consistent with the broader international literature demonstrating that Project-Based Learning provides educational benefits extending beyond improvements in examination performance alone. The higher Biology achievement observed among students at Yangon High School reflects patterns reported across a range of educational settings, suggesting that student-centred, inquiry-oriented instructional approaches can effectively support academic learning in secondary Biology education. Nevertheless, because the present study employed a cross-sectional comparative design rather than an experimental intervention, the observed differences should be interpreted as being associated with variations in instructional practice rather than as definitive evidence that Project-Based Learning alone caused the achievement gap between the two schools.

Conclusion

This study demonstrated significant differences in academic achievement in Biology and social collaborative skills between high school students in Yangon and Pyin Oo Lwin. Students from the Yangon school, where Project-Based Learning was implemented, achieved significantly higher Biology scores and stronger collaborative skills than students from the Pyin Oo Lwin school, which relied primarily on traditional instruction. In addition, a moderate positive correlation was identified between academic achievement and social collaborative skills, suggesting that cognitive and socio-emotional development are interconnected dimensions of student learning.

The findings further indicate that collaborative and student-centred learning environments may support both conceptual understanding and interpersonal competence within Biology education. However, the results should be interpreted in light of broader contextual factors, such as school resources, teacher preparation, and regional educational conditions. Therefore, improving educational quality in Myanmar requires not only the promotion of active learning strategies, such as Project-Based Learning, but also equitable support systems that enable schools across regions to implement these approaches effectively. Future research should employ longitudinal or experimental designs and include broader regional samples to more directly examine the mechanisms by which instructional practices influence both academic and social development.

Author's Contribution

K.P. Hlyan: Conceptualization, data collection, data analysis, writing - original draft, writing, review and editing. I. Bachtiar: Supervision, writing, review and editing. A.W. Jufri: Supervision, writing review and editing. M.R. Adawiyah: writing, review and editing.

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