Peer-Assisted Learning Strategies (PALs): A Literature Review

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ABSTRACT

This research review examines Peer-Assisted Learning Strategies (PALS) and their influence on academic achievement across a variety of educational environments. PALS is a structured teaching strategy in which students take turns as tutors and tutees, encouraging active participation, peer interaction, and collaborative knowledge production. The study summarizes empirical research and systematic analyses from 2016 onward, emphasizing PALS' efficacy in improving students' conceptual understanding, problem-solving ability, and learning outcomes in areas such as science, mathematics, and language. PALS appears to promote good classroom dynamics, encourage learners, and accommodate varied learning requirements by providing for quick feedback, organized peer mentoring, and individualized instruction. Reciprocal peer tutoring (RPT), a well-studied type of PALS, leads to considerable gains in student performance, particularly in grasping complex topics such as chemical calculations and mathematical problem solving. Systematic reviews and meta-analyses in secondary, tertiary, and medical education contexts show consistent gains in academic success, skill development, and social outcomes, stressing the relevance of tutor training, session flexibility, and systematic implementation. The paper also discusses modifications of PALS for inclusive and culturally diverse classrooms, demonstrating how careful matching, scaffolding, and monitoring may improve learning equality. Overall, PALS is an evidence-based and adaptable technique that enhances both cognitive and emotional outcomes by providing students with the academic, social, and metacognitive abilities required for success in today's educational environments.

Keywords: Peer-Assisted Learning Strategies (PALS), academic achievement, collaborative learning, science education, chemistry, mathematics, reciprocal peer tutoring

INTRODUCTION

The global landscape of science education presents a concerning scenario in which students frequently struggle to grasp complex scientific concepts, particularly in Chemistry (Verma & Roy, 2020). This problem is usually associated with a lack of interesting teaching techniques and insufficient learning resources, making it difficult for teachers to develop instructional strategies that fit the particular needs of each student (Santhanalakshmi & Naomi, 2021). This ineffective instruction can lead to students developing unfavorable impressions of the subject, which further impedes their learning (Khusnul, 2022). As a result, a cycle of disengagement and poor performance emerges, emphasizing the critical need for innovative teaching approaches and improved global educational settings capable of efficiently meeting students' diverse learning demands.

The Philippines, like many other countries, faces a significant challenge in science education. The low performance of Filipino students in the International Mathematics and Science Study (TIMSS) emphasizes the crucial need for innovative teaching methods and improved learning environments (Villena et al., 2020). This condition highlights the need for a novel teaching technique and a better learning environment, such as the peer-assisted learning strategy (PALS). Adopting PALS can be a successful strategy for improving student performance and engagement in science (Dorji & Darjay, 2022).

Peer-assisted learning techniques (PALS) have evolved as a successful approach to addressing a variety of educational difficulties. PALS includes students working in pairs or small groups to create a supportive learning environment in which they may help each other grasp subjects (Simpal, 2020). This collaborative technique may be extremely useful for learning complicated topics, particularly in science, such as the mole concept, which is

frequently challenging for learners (Santhanalakshmi and Naomi, 2021). In chemistry, the mole notion refers to the quantity of a material. Avogadro's number (6.022×10^{23}) represents the number of particles (atoms, molecules, ions, etc.) in one mole. PALS can be especially beneficial in helping students grasp this notion since it allows them to break down complex topics into smaller, more digestible chunks through interaction and discussion with peers.

Research has consistently proven that PALS has a positive impact on students' behavior and scientific learning skills, notably in the mole concept (Gegone, 2020). Working together encourages students to have a deeper understanding of the mole topic, develop their problem-solving skills, and enhance their overall learning experience (Simpal, 2020). PALS fosters a more collaborative and supportive learning environment, encouraging positive classroom interactions and empowering students to take responsibility for their own learning in the mole concept (Ginsburg-Block, Rohrberg, Lavigne, & Fantuzzo, 2018).

This article discusses the different challenges that Filipino students have in scientific education, particularly mastering complex topics like the mole concept. A significant barrier is the lack of engaging teaching methodologies, meaning that typical tactics may fail to pique students' attention or aid in deep understanding of scientific issues (Verma & Roy, 2020; Gegone, 2020). Furthermore, restricted learning resources highlight the need for effective tools to assist students comprehend the mole idea.

This article seeks to solve these difficulties by providing extensive reviews of peer-assisted learning strategies (PALS) from various sources.

LITERATURE REVIEWS ON PEER-ASSISTED LEARNING STRATEGIES (PALS)

Peer-assisted learning strategies (PALS) are defined by Santhanalakshmi and Naomi (2021) as a peer tutoring strategy that uses tailored interventions to enhance the main curriculum. Their study highlights PALS as an evidence-based strategy that is compatible with a variety of teaching modalities, allowing instructors to meet the unique requirements of their students in the classroom. This versatility is critical since classes frequently accommodate a wide range of learning styles and abilities. The authors especially advocate for PALS' benefits in science education, particularly for pupils who require more assistance, recognizing the difficulties that many students have while learning complicated scientific topics. Their experimental investigation found that PALS increased students' reading comprehension and general conceptual grasp of science, implying a favorable influence on both literacy and scientific reasoning abilities. This intervention's effectiveness can be linked to the enhanced engagement and individualized support provided through peer contact, which is sometimes lacking in traditional lecture-based education. Furthermore, the study should explain the type of PALS implementation employed (e.g., reciprocal peer tutoring, organized peer teaching) in order to facilitate replication and comparison with other studies.

Ismael and Alexander (2015) stated that peer-assisted instruction is an effective strategy for supporting struggling chemistry students. By pairing high-achieving students with their lower-performing peers, this teaching strategy fosters collaborative learning and enhances problem-solving skills. The potential of peer-assisted instruction to significantly improve learning proficiency compared to traditional teaching approaches is compelling. This assertion is strengthened by considering the social-cognitive theory of learning, which emphasizes the role of observation, imitation, and modeling in skill acquisition. High-achieving students act as models, demonstrating effective problem-solving techniques for their peers. The collaborative nature of the interaction allows for immediate feedback and clarification, addressing misconceptions in real-time. Empirical evidence demonstrating higher performance metrics in peer-assisted instruction groups would strengthen the case for its effectiveness. Such evidence might include pre- and post-test comparisons, analysis of student performance on specific problem sets, or qualitative data gathered through student interviews and observations. Ultimately, peer-assisted instruction represents a promising alternative that can elevate student outcomes in chemistry education, particularly for students who might benefit from a more interactive and supportive learning environment.

Simpal's (2020) study, performed at Esperanza National High School, looked at how visual representations and peer-assisted learning affected high school physics students' problem-solving abilities. Sixty students from the

science, technology, and engineering (STE) divisions took part. Using a pretest-posttest control group design, the study compared students exposed to visual representations and peer-assisted talks (experimental group) to those taught using traditional techniques (control group). Statistical analysis (mean, variance, t-test) found no significant difference in problem-solving abilities across groups prior to the intervention. This baseline equivalency is critical in determining the validity of the study's findings. However, the experimental group showed much bigger increases in problem-solving scores following intervention. To further understand the mechanisms underlying the observed improvement, the study should describe the exact forms of visual representations employed (for example, diagrams, graphs, and animations) as well as the structure of the peer-assisted conversations. Simpal observed that combining visual representations with peer-assisted learning significantly improved students' performance in physics problem-solving, implying a synergistic impact between visual and collaborative learning. The study might be enhanced by looking into the long-term retention of knowledge and problem-solving abilities.

Gazula et al. (2017) define peer-assisted teaching as a technique in which students switch between tutor and tutee roles. The tutor offers chemical issues, and the tutee replies both orally and in writing. Incorrect responses receive immediate feedback, including right answers, while correctness earns points. This organized exchange assures active engagement and prompt reinforcement, which aligns with operant conditioning principles. The instant feedback loop enables students to swiftly rectify mistakes, avoiding the reinforcement of faulty knowledge. The point system provides a motivating component, promoting active involvement and engagement. Gegone (2020) emphasizes the usefulness of peer-assisted education in assisting students who struggle with numerical problem-solving in chemistry, particularly in areas such as gas behavior, which requires extensive mathematical computations. He underlines the importance of peer-assisted collaboration and fast feedback systems in helping students acquire problem-solving abilities in these hard domains. This is especially important because many students have difficulty understanding the abstract nature of chemical ideas and applying mathematical principles. The research should preferably contain a full account of the peer tutors' training to guarantee uniformity and efficacy.

Villena et al. (2015) emphasize the link between peer learning techniques, such as peer-assisted tutoring, and constructivist learning theory. This theoretical framework stresses the learner's active participation in developing knowledge via experience and interaction. This is consistent with John Dewey's (1916) argument, which Khusnul (2022) cites, that education is an active, constructive process rather than a passive intake of knowledge. This viewpoint emphasizes the significance of student-centered learning settings, in which students actively engage in the learning process rather than passively receiving information. Simpal (2016) expands on this, calling for dynamic, student-centered scientific education. This emphasis on student agency highlights the need of advanced teaching strategies in chemistry education, which stress the development of students' scientific literacy, critical thinking skills, problem-solving ability, and positive attitudes toward the topic. The incorporation of peer-assisted learning complements this constructivist approach by encouraging active knowledge production through collaboration and debate.

Duran and Monereo (2018) suggest that effective chemistry training requires collaborative techniques, such as peer-assisted instruction, to help students understand verbal, mathematical, and visual representations of chemical ideas and processes. They maintained that using peer-assisted learning methodologies increases students' learning engagement. This is because collaborative learning taps into diverse learning styles and helps students to benefit from each other's abilities. They argue that collaborative learning environments enable students to read scientific literature and modify mathematical equations, especially in difficult domains such as gas dynamics. The authors should comment on the exact processes by which peer-assisted education improves comprehension of these various representations. For example, how can peer contact assist students in translating verbal descriptions, mathematical formulae, and visual diagrams?

Abdullah (2020) argues that there is no single "best" teaching style; rather, the most effective strategy focuses on student participation and peer-learning activities, acknowledging that many students struggle with traditional, teacher-centered training. To encourage active cooperation, Abdullah pushes for a move toward learner-centered teaching practices. This transformation necessitates a shift in the teacher's function, from primary knowledge distributor to facilitator of learning. Paculanan (2013) highlights the significance of collaborative contact among students in successfully recording their knowledge, abilities, and attitudes, and suggests reciprocal peer tutoring

(RPT) as a viable way for accomplishing this aim. RPT, a kind of PALS, establishes an organized framework for peer interaction, ensuring that all students have chances to teach and learn.

To develop students' representational abilities, instructors must be fluent and skilled in customizing instructional materials to their students' interests. To satisfy their students' unique requirements, teachers must be proficient at differentiating teaching. Gan and Hong (2010) revealed that peer-assisted tutoring may successfully alleviate many students' learning challenges. This research addresses the needs of 21st-century skills by proposing for instructors to serve as facilitators, using current teaching methods such as peer-assisted learning to provide students with the competences they need to thrive in the global marketplace.

Khusnul (2022) emphasizes peer-assisted teaching as an effective technique for both high and low-achieving pupils. This technique uses the abilities of high-achieving students to help their classmates, creating a collaborative learning environment in which students prompt, monitor, and assess each other's work while explaining any inaccurate replies. This reciprocal procedure benefits both the tutor and the tutee. The tutor reinforces their expertise by explaining topics to others, while the tutee receives individualized guidance and clarification. This peer-facilitation approach includes education, evaluation, feedback, and social support, allowing teachers to monitor rather than actively engage in the learning process. This allows the instructor to focus on specific student needs and give more tailored help.

Simpal (2016) stresses the importance of peer-assisted education, such as reciprocal peer tutoring (RPT), in allowing high-achieving students to coach peers who struggle with problem-solving in physics and chemistry. Gazula et al. (2017) describe the RPT framework, which involves students alternating between tutor and tutee roles, with tutors offering quick feedback and assigning points for accurate responses. Gan (2010) emphasizes RPT's usefulness in aiding students with numerical problem solving in chemistry, particularly in areas such as gas behavior that need mathematical calculation.

Peer-assisted instruction (PAI), with its cooperative learning framework (Sampson, 2012), is easily adaptable to a variety of educational settings. Its efficiency is increased when students of diverse skill levels work together; explaining topics improves individual understanding, which benefits both the tutor and the tutee. This aligns with Vygotsky's sociocultural theory, which emphasizes the importance of social contact in cognitive development. While Sood (2017) recommends matching students with similar skills, PAI's intrinsic flexibility allows for a variety of pairings. According to Golding (2016), the collaborative element of PAI increases motivation compared to solitary study, boosting higher-level thinking and idea production. This collaborative problem-solving is critical in physics and chemistry (Simpal, 2016), especially for word problems that need advanced mathematical abilities. Abdullah (2020) emphasizes PAI's importance in helping students improve their mathematics abilities, which are required for success in scientific subjects like as chemistry. The study should address the possible obstacles of matching students of dramatically different aptitude levels, as well as how these challenges might be overcome.

Peer-assisted learning techniques (PALS), based on John Fantuzzo's 1984 work, provide a collaborative learning environment in which students serve as both tutors and tutees (Abdullah, 2020). This reciprocal learning approach improves review and skill practice, which benefits both the student and the teacher. The reciprocal aspect of PALS guarantees that all students are actively involved in the learning process, both receiving and offering assistance. Students actively instruct, supervise, and evaluate each other's work in small groups (Gegone, 2020). This active participation allows students to form ideas based on their own experiences, making learning more meaningful and relevant. This is consistent with the constructivist notion of learning by doing. Gegone (2020) pushes for the application of PALS in science, specifically to improve problem-solving abilities in physics and chemistry. The research should include particular instances of PALS implementation in science classrooms, as well as the sorts of problem-solving exercises employed.

PALS' organized framework involves students working in pairs or small groups on certain academic assignments (Duran and Monereo, 2018). This systematic strategy guarantees that peer interactions are focused and fruitful. These groups, which are generally arranged based on skill levels, allow for asymmetrical interactions in which students cycle between tutor and tutee roles while working toward common goals. This organized method promotes focused teamwork and maximises learning outcomes. Differentiated instruction within the

collaborative learning framework is made possible by grouping students depending on ability level. Topping (2011) highlights that PALS assists both high- and low-achieving students, with high achievers helping their friends and all students benefiting from the collaborative process. Students actively question, monitor, and assess one another, offering explanations and comments, resulting in a helpful and engaging learning environment. Simpal (2016) emphasizes the importance of PALS in allowing high-achieving students to coach friends who struggle with problem solving in physics and chemistry.

Gazula et al. (2017) present a unique PALS implementation in which one student works as a tutor, giving chemical questions, while the other acts as a tutee, providing oral and written answers. Immediate feedback is given, and points are granted for right responses, resulting in a controlled and motivated learning environment. This systematic technique establishes a defined framework for peer interaction, ensuring that both students are active participants and get feedback. This strategy is very useful for reinforcing concepts and improving problem-solving abilities. Khusnul (2022) also underlines the importance of PALS in aiding students with numerical problem-solving, particularly in areas such as gas behavior that need mathematical computations. PALS' rapid feedback and collaborative nature make it an effective tool for learning these critical skills. The research should explore the possibility for bias in the assessment of replies and the techniques utilized to prevent this.

PALS is successful in a variety of school settings and aligns with cooperative learning ideas (Khusnul, 2022). While Sood (2017) recommends matching students with comparable abilities, the flexibility of PALS allows for a variety of pairings, resulting in a rich learning experience. However, considerable thought should be given to the possible difficulties of matching pupils with dramatically differing skills. Golding (2016) argues that the collaborative character of PALS is more motivating than individual work, encouraging higher-level thinking and idea development. This collaborative method is especially useful in topics like physics and chemistry (Simpal, 2016), where strong mathematical abilities are required for problem solving. Abdullah (2020) stresses PALS's importance in improving mathematical abilities, which are critical for scientific achievement. The study should look at how PALS may be tailored to diverse school settings and student requirements.

Effective teaching methods must result in long-term improvements in student comprehension and behavior (Henson, 2009). Simply remembering rules and procedures is insufficient; active student participation via debate and cooperation is required (Gegone, 2020). PALS enables active participation, especially in difficult areas such as gas behavior and chemical reactions. Allowing students to explain and clarify their ideas is critical for effective learning (Hagos, 2009). This is because expressing topics to others strengthens one's own knowledge. Simpal (2016) underlines the importance of current, advanced teaching in science and mathematics to fulfill the demands of a worldwide educational landscape, and PALS, as mentioned by Topping (2011), can effectively offer such lessons. The study should look at how PALS might be incorporated into existing curriculum to fulfill the needs of a worldwide educational landscape.

The primary goal of chemistry education is to foster a thorough grasp of mathematical ideas and computational skills (Khusnul, 2022). Modern teaching styles reflect this by include interactive simulations and peer-assisted training in the curriculum. Lubaton (2011) advocates for a move toward learner-centered approaches that improve student accomplishment by encouraging interactive inquiry, positive self-concept, and cooperation. PALS, as a collaborative learning technique, directly addresses these demands, resulting in a more engaging and successful learning environment for all students. The study should look at how PALS may be utilized to improve conceptual comprehension and computational abilities in chemistry.

Ginsburg-Block et al. (2018) stressed the importance of peer socialization experiences for academic motivation and achievement. They looked studied the influence of culture on academic motivation via the perspective of peer-assisted learning (PAL). They have thoroughly evaluated the theoretical and empirical foundations for assessing PAL as an intervention to boost student motivation across a range of racial, ethnic, and socioeconomic backgrounds, with a focus on peer-led strategies that stress academic content. Peer interactions facilitated by PAL approaches communicated positive messages about educational accomplishment to pupils, increasing their willingness to accept learning concepts and pursue academic tasks and goals.

Hasnani and Ismael (2020) conducted a study to improve students' reading skills using Peer-Assisted Learning Strategies (PALS). Their research was divided into four stages: planning, implementing, observing, and reflecting. The research methods employed were pretest, post-test, and observation. The data revealed that Peer-Assisted Learning Strategies were effective in enhancing students' reading abilities. The progress can be observed in the mean score of the students in cycle one, which is 23.1 and labeled as excellent, and in cycle two, which is 73.1 and classified as very good. In cycle one, seventeen students met the Minimum Completeness Criteria (MCC), whereas cycle two saw 22 students complete the MCC. As a result, the findings of this study suggest that Peer-Assisted Learning practices increase students' reading skills.

Reading becomes an extremely essential issue since it is regarded as the most common input for developing second language acquisition. In reality, learning methodologies utilized in classroom activities frequently resulted in a disparity between students with high and low competence levels. As a result, peer-assisted learning strategies (PALS) emerge as a solution to the gap. The function of peer-assisted learning approach is thought to be one of the most successful learning techniques since it allows people to communicate and collaborate more closely while also closing the gap in reading skills. As a result, the purpose of this study was to learn more about the impact of PALS in assisting students in improving their reading abilities by concentrating on fluency, pronunciation, and word recognition in comprehending texts while also evoking social engagement. This is related to case study research. The statistics were gathered through interviews with students in various grades of senior high school. Finally, the research gave descriptions of the students' attitudes on the importance of PALS in improving their reading abilities.

According to Gegone (2020), many educators nowadays are concerned about what educational techniques may be tailored to the particular requirements of pupils in order to improve their grasp of Chemistry ideas. To embrace the challenge, he performed quasi-experimental study with 84 pupils as test subjects. Mean Percentage Score (MPS), weighted mean, and t-test were used suitably to characterize and infer from the acquired data. Prior to the commencement of the experiment, the control and experimental groups exhibited similar problem-solving skills in Chemistry. Students in both groups had poor views regarding chemistry. After exposing the control group to traditional training and the experimental group to RPT instruction, students in the experimental group had significantly higher mean gain scores than students in the control group. Students in the control group maintained unfavorable views toward Chemistry, but students in the experimental group increased their positive attitudes toward Chemistry. The implementation of RPT training improved students' problem-solving skills and attitudes toward chemistry. Thus, in order to give students with the best educational learning experience possible in Chemistry, teachers should increase their usage of RPT and be innovative in using other new teaching tactics.

Dorji and Darjay (2022) investigated the effectiveness of a peer-assisted learning technique in answering sixth-grade arithmetic word problems in a normal classroom. A pre-test and post-test experimental study design was used, with 8 students in the control and experimental groups, respectively. A subject achievement exam was provided to both groups to measure the differences in their learning abilities prior to the intervention. The Peer Assisted Learning approach (PALS) was employed as an educational approach. The treatment group was trained to solve mathematical word problems using PALS, whereas the control group was taught a traditional approach. A t-test for the pre-test found no significant mean difference between the two groups, showing a homogeneous learning capacity at the outset ($p = 0.802$). However, the post-test analysis indicated a statistically significant difference between the mean scores of the experimental groups ($M = 19.2$) and the control group ($M = 10.9$) at $p = 0.00$, showing that the PALS therapy improved students' mathematical word problem solving abilities. Thus, it is desirable that PALS can aid in the development of intellectual and social abilities.

The goal of this study is to determine the efficiency of a peer-mediated instructional approach called peer aided learning strategy in helping standard IV students solve mathematics word problems in a normal classroom setting. A quasi-experimental investigation was conducted using a two-group post-test design. There were 60 individuals from two divisions of a school, with 30 randomly assigned to the treatment and control groups. The instructional technique employed was Peer Assisted Learning technique (PALS). Both groups' data were acquired using a baseline test and a post-test. A one-tailed 't' test was used to examine if there was a significant difference in base level scores between the groups and to assess the efficacy of PALS. The findings of this study demonstrated the efficacy of PALS, reaffirming that collaborative tactics such as peer-mediated teaching may

be a viable choice in inclusive mainstream schools for boosting student performance and engagement. Peer-mediated methods, such as PALS, can be used successfully to build and enhance academic and social abilities.

Guraya and Abdalla (2020) did a comprehensive review and meta-analysis of peer-assisted learning (PAL) in medical education and found that it had a good overall impact on students' academic progress and clinical abilities. Their summary revealed that, whereas PAL typically enhanced knowledge and skill outcomes, impact sizes varied depending on research design, peer tutor training, and outcome measuring methods. They found that PAL is a viable pedagogy in health professions education, but they advocated for more transparent reporting of tutor training and fidelity to enable for cross-study comparisons.

Brierley et al. (2022) conducted a systematic review and meta-analysis of randomized PAL trials in undergraduate medical education, discovering small but consistent improvements on academic results across many contexts. The authors stressed that high-quality trials are currently few, and they advocated for uniform descriptions of PAL treatments (e.g., session length, tutor selection/training, and assessment scheduling) in future syntheses to discover moderators of PAL efficacy.

Rawson and Rhodes (2022) investigated the motives and experiences of volunteer peer leaders in an online Peer-Assisted Learning (PAL) program. Their qualitative findings indicate that online PAL can maintain leader involvement through intrinsic motives (assisting peers, professional identity) and extrinsic rewards (CV/portfolio enhancements). The article emphasizes design aspects like as clear job descriptions, a manageable workload, and recognition that promote long-term online PAL programs, an increasingly important lesson for remote and integrated scientific training.

Hidayat et al. (2023) conducted a comprehensive evaluation of peer-tutoring studies in mathematics education from 2016 to 2023 and found consistent improvements in mathematical achievement, metacognitive abilities, and social outcomes. The review analyzed implementation types (same-age reciprocal tutoring, cross-age tutoring, and online peer tutoring) and discovered that organized protocols and instructor scaffolding were key success factors. Their findings are consistent with PALS concepts (scripted routines, role-taking, and quick corrective feedback) and offer empirical evidence for applying PALS to numerical themes in chemistry and physics.

Arco-Tirado et al. (2020) investigated an evidence-based peer-tutoring program for first-year university students using a randomized approach and found that tutored students performed better academically and retained more. Their findings show that organized peer tutoring, when carefully tailored to higher-education contexts (clear tutor training, supervised sessions, curriculum alignment), can increase topic understanding — an essential factor for secondary-tertiary transition programs in STEM courses.

Recent scoping and systematic reviews (e.g., Zhang et al., 2022; systematic reviews of PAL in health professions) affirm PAL's transferability across levels and topic areas, but emphasize variation in methodologies and reporting. These reviews advocate for better documentation of critical implementation features (pairing criteria, tutor selection, training intensity, session fidelity) to determine which PAL variations (reciprocal versus fixed-role, cross-ability versus same-ability pairing) work best under which conditions (Zhang & Maconochie, 2022; Brierley et al., 2022).

Work on adapting PALS for equity-focused and diverse classrooms (e.g., Thorius, 2018; Vardy, 2022) contends that PALS can help multilingual learners and children of color when lessons are culturally sensitive and pairing decisions take into account linguistic and emotional aspects. These authors emphasize teacher facilitation, culturally relevant materials, and constant monitoring to avoid unintentionally worsening success disparities – a practical point for implementing PALS in inclusive Philippine classrooms (Thorius, 2018; Vardy, 2022).

SUMMARY

This research study looked at Peer-Assisted Learning Strategies (PALS) as an educational strategy for boosting students' academic attainment, specifically in science, chemistry, mathematics, and language education. Drawing on empirical studies, quasi-experimental research, systematic reviews, and meta-analyses published mostly after

2016, the paper established PALS as a structured, evidence-based, and adaptable teaching technique based on constructivist and sociocultural learning theories. Across a wide range of educational environments, from elementary and secondary schools to tertiary and medical education, PALS consistently improved students' conceptual comprehension, problem-solving abilities, academic performance, motivation, and social interaction.

The research identified reciprocal peer tutoring (RPT) as a popular and successful kind of PALS, particularly for tackling complicated and abstract ideas like the mole concept, gas laws, and mathematics word problems. In order to maximize learning benefits, the studies examined underlined the necessity of organized role-taking, quick feedback, tutor training, and methodical implementation. Furthermore, PALS has been demonstrated to benefit inclusive and culturally diverse classrooms by encouraging cooperation, closing achievement disparities, and enhancing learner autonomy. Overall, the data demonstrates that PALS not only improves cognitive results but also promotes good classroom dynamics, learner engagement, and the development of metacognitive and social skills that are critical for 21st century learning.

CONCLUSIONS

Based on the examined research, Peer-Assisted Learning Strategies appear as a highly successful and adaptable instructional strategy capable of tackling long-standing issues in science and math education. Consistent data across different disciplines and educational levels shows that PALS dramatically increases students' academic success, problem-solving ability, and attitudes toward learning when compared to traditional, teacher-centered techniques. The reciprocal and collaborative aspect of PALS is consistent with constructivist and sociocultural theories, which emphasize learning as an active, social, and meaningful activity.

Furthermore, the research emphasizes that the effectiveness of PALS is mostly dependent on deliberate design aspects such as proper student matching, controlled interaction protocols, unambiguous tutor training, and ongoing instructor facilitation. When these features are skillfully applied, PALS improves both low-achieving and high-achieving children by reinforcing their understanding and abilities. Given its demonstrated effectiveness, adaptability, and alignment with learner-centered pedagogy, PALS is a viable and sustainable instructional strategy for improving educational outcomes, particularly in complex subject areas such as chemistry and mathematics, in both the Philippine and global education contexts.

RECOMMENDATIONS

In light of the findings of this literature review, several recommendations are proposed:

1. Teachers, particularly in science and mathematics, are urged to include Peer-Assisted Learning Strategies into their normal classroom instruction, especially when teaching complicated and abstract ideas like the mole concept, gas laws, and mathematical problem solving. Teachers should be educated in creating structured PALS sessions with clear roles, guided engagement, and quick feedback methods.
2. School administrators and curriculum designers can encourage institutional adoption of PALS by offering professional development programs focusing on peer tutoring methodology, tutor training, and classroom management tactics that assure fidelity of implementation. Allocating time and resources for collaborative learning activities is critical for successfully incorporating PALS into current curriculum.
3. Future study should look at the long-term impacts of PALS on knowledge retention, transfer of learning, and metacognitive development, as well as its influence on diverse learner profiles and topic areas. To improve cross-study comparisons, more rigorous experimental designs and uniform reporting of implementation characteristics such pairing criteria, session time, and tutor preparation are advised.
4. Researchers and practitioners should investigate culturally responsive and inclusive PALS modifications to guarantee that it supports students from a variety of language, cultural, and academic backgrounds. Continuous monitoring and reflective practice are required to avoid disparities and maximize PALS' potential as an equitable, learner-centered educational technique.

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