Acta Pedagogia Asiana

Review
Volume 5(1), 2026, 1–14
https://doi.org/10.53623/apga.v5i1.694

A Literature Review of Action Research Trends and Innovations for Teaching Physics in the Philippines

Arnel R. Andrin*, Mauricio S. Adlaon

Surigao del Norte State University (SNSU), Narciso Street, Surigao City 8400, Philippines

*Correspondence: aandrin@ssct.edu.ph ; madlaon@ssct.edu.ph

SUBMITTED: 20 May 2025; REVISED: 8 August 2025; ACCEPTED: 15 August 2025

ABSTRACT: This systematic literature review examined how action research was used to address persistent challenges in physics education in the Philippines. Physics education played a key role in building scientific literacy, critical thinking, and problem-solving skills—competencies emphasized by the K to 12 curriculum under Republic Act No. 10533 and reinforced by DepEd Order No. 16, s. 2017, which promoted teacher-led research. The urgency for pedagogical innovation intensified during the COVID-19 pandemic, which disrupted traditional teaching and exposed limitations in laboratory access, digital readiness, and student engagement. Despite these developments, there had been no comprehensive synthesis of empirical studies documenting how action research supported physics instruction in the Philippine context. This review addressed that gap by consolidating findings from 14 peer-reviewed studies published between 2021 and 2025, identified through a PRISMA 2020, guided search across Scopus, Web of Science, Google Scholar, ERIC, and ScienceDirect. Qualitative thematic analysis revealed four dominant trends: experiential simulations and inquiry-based models that actively engaged learners in conceptual exploration and problem-solving; integration of technological tools such as PhET simulations, mobile learning platforms, and video-based instruction to enhance accessibility and interactivity; cultural contextualization, including the incorporation of indigenous games and ethno-STEM approaches to increase relevance and inclusivity; and gamification to promote motivation, collaboration, and sustained participation, particularly in underserved communities. These innovations demonstrated positive effects on student engagement, achievement, and teacher professional growth, yet challenges persisted. These included inadequate institutional support for sustained research, unequal access to technology, and difficulties in aligning innovations with standardized curricula. The review concluded that action research offered a systematic, evidence-based mechanism for refining teaching strategies, fostering reflective practice, and sustaining innovation. The findings provided a foundation for enhancing teacher training, shaping education policy, and promoting broader adoption of learner-centered, context-sensitive approaches in physics education.

KEYWORDS: Physics education; inquiry-based learning; conceptual understanding; digital tools; active learning

1. Introduction

Physics Education in the Philippines has been undergoing significant reform, especially since the full implementation of the K to 12 Basic Education Program in 2016. Grounded in Republic Act No. 10533 (Enhanced Basic Education Act of 2013), this reform extended the basic education cycle to 13 years, restructured the science curriculum to emphasize inquiry-based and application-oriented learning, and mandated pedagogical innovations to develop 21st-century skills. Despite these reforms, student performance in physics and other science subjects remained a concern. The 2018 Programme for International Student Assessment (PISA) reported that the Philippines scored an average of 357 in science literacy, far below the OECD average of 489 [1]. National Achievement Test (NAT) results likewise showed persistent gaps in conceptual understanding, particularly in physics topics. These outcomes highlighted the urgent need for teaching approaches that move beyond rote memorization toward methods that promote deeper conceptual learning, critical thinking, and real-world problem-solving.

Historically, physics instruction in the country was dominated by teacher-centered delivery and content-heavy lectures, which often failed to engage learners or connect concepts to real-life contexts [2, 3]. Recognizing this limitation, the Department of Education (DepEd) promoted action research as a tool for improving instructional quality. DepEd Order No. 16, s. 2017 institutionalized the Basic Education Research Agenda, encouraging teachers to conduct classroom-based research as part of their professional development. However, despite this policy support, physics-focused action research remained limited, with most teacher-led studies concentrating on mathematics, language, or general science. This underrepresentation pointed to a critical gap in both academic discourse and classroom practice regarding subject-specific innovations in physics education.

The COVID-19 pandemic intensified the urgency of this gap. The abrupt shift to remote and blended learning exposed challenges such as inadequate laboratory access, insufficient teacher preparation for digital pedagogy, and declining student motivation in complex science subjects. In response, educators adopted a variety of innovative strategies, virtual simulations, mobile learning modules, culturally contextualized lessons, and gamification, many of which were documented through action research [4, 5]. Beyond individual strategies, literature highlighted the importance of professional learning communities and reflective practice in sustaining innovation [6, 7]. Action research played a key role in these processes by enabling iterative cycles of testing, feedback, and refinement of teaching methods. Nevertheless, widespread adoption continued to face barriers, including limited institutional support for sustained professional development, resource constraints, and time pressures on teachers [8].

While isolated studies demonstrated the value of inquiry-based learning, technology integration, cultural contextualization, and gamification in physics instruction, no systematic synthesis had been conducted to evaluate how these innovations, implemented through action research, were transforming physics education in the Philippines. This gap was particularly relevant in the post–K to 12 and post-pandemic context, where teachers were expected to meet evolving curricular demands while addressing disparities in learning outcomes. This literature review responded to that need by consolidating and analyzing recent empirical studies on action research trends and innovations in physics teaching in the Philippines [9]. It aimed to provide a coherent understanding of emerging practices, identify challenges and opportunities, and offer evidence-based recommendations that align with national education policies and goals for quality, equitable, and context-responsive science education through action research.

2. Methodology

This study, guided by the PRISMA 2020 framework, examined the scope and themes of selected published research on action research trends and innovations for teaching physics in the Philippines. A structured search was conducted in five major academic databases, Scopus, Web of Science (WoS), Google Scholar, Education Resources Information Center (ERIC), and ScienceDirect, targeting articles published between 2021 and 2025. From an initial pool of 72 studies, a total of 14 peer-reviewed journal articles were selected for inclusion based on predetermined eligibility criteria. The study selection process was guided by the PRISMA 2020 framework of Haddaway et al. [10], as illustrated in Figure 1.

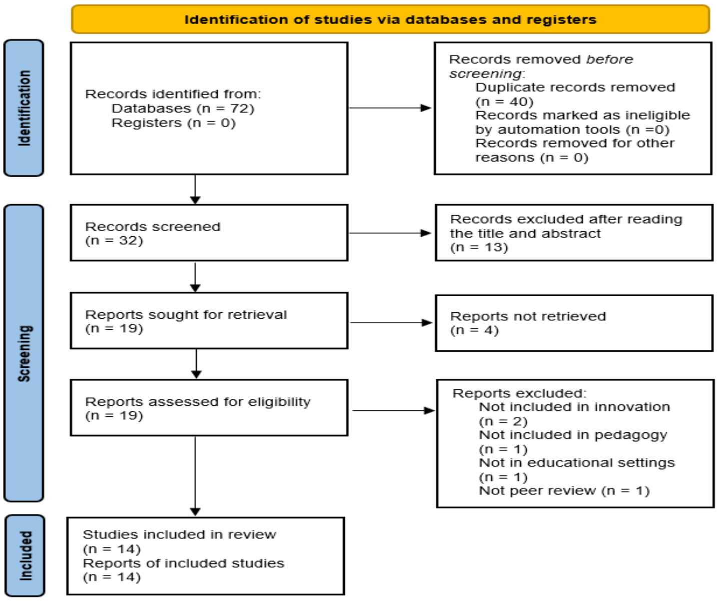

Figure 1. PRISMA 2020 flow diagram.

2.1.Research questions and objectives.

The central research question is: How educators can harness action research to enhance teaching and learning in physics were meeting the educational demands of the 21st century learners? The research objectives are as follows:

RO1: What are the emerging trends in action research for teaching physics in the Philippines?
RO2: How do these innovations affect student engagement and conceptual understanding?

RO3: What challenges and opportunities are encountered in integrating action research into classroom practice?

2.2.Eligibility criteria.

This review analyzed studies on action research trends and innovations for teaching physics in the Philippines, focusing specifically on peer-reviewed journal articles published between 2020 and 2025. Its aim was to synthesize contemporary findings on emerging trends and pedagogical innovations in action research, thereby offering valuable insights to enhance physics teaching practices in the Philippine context. The inclusion and exclusion criteria used during the

PRISMA selection process followed the systematic guidelines cited in the work of Page et al. [11], as summarized in Table 1. To ensure consistency and relevance to current science education, the review exclusively considered English-language, peer-reviewed journal articles published within the specified timeframe.

Table 1. Inclusion and exclusion criteria for study selection.

Criterion	Inclusion	Exclusion
Publication Date	Articles published between 2020 and 2025	Articles published before 2020
Language	English-language publications	Non-English publications
Type of Source	Peer-reviewed journal articles	Conference papers, books, reports, grey literature
Subject Focus	Action Research trends in Physics Teaching in the Philippines	General Concepts of Action Research trends not related to Physics Teaching
Empirical Research	Studies involving data collection (quantitative, qualitative, or mixed methods)	Theoretical or conceptual papers without empirical data
Peer Review Status	Published in peer-reviewed journals or conferences	Non-peer-reviewed publications
Learning Setting	K–12 or secondary school related to physics education settings (formal/informal)	Higher education or vocational contexts
Assessment Focus	Includes strategies or tools for evaluating student learning outcomes	No focus on assessment or evaluation methods

2.3.Search strategy.

A Boolean search technique was employed in this review to enable the comprehensive and systematic identification of relevant studies. This approach facilitated the retrieval of diverse published articles addressing various facets of action research trends and innovations for teaching physics in the Philippines. Online searches were conducted across Scopus, Web of Science, Google Scholar, ERIC, and ScienceDirect using the following keyword combinations: ("action research" AND "teaching physics" AND "Philippines") AND ("trends" OR "innovation" OR "practices" OR "developments" OR "approaches" OR "strategies"). These combinations were selected to capture the multidimensional scope of action research trends, teaching innovations, and pedagogical approaches in physics.

3.Results and Analysis

3.1.Summary of the findings.

This section presents the results of relevant studies identified in the Scopus, WoS, Google Scholar, ERIC, and ScienceDirect databases. The search was conducted between March and June 2025, focusing on articles published from 2021 to 2025. The literature review process was guided by the PRISMA flow chart for sample identification, which outlines four stages: identification, screening, eligibility, and inclusion, as described by Page et al. [11]. A total of 14 academic articles were retrieved from multiple databases. Each entry in Table 2 provides details such as the year of publication, author(s), paper title, journal name, research purpose, and database indexing information.

Table 2. List of selected indexed articles.

Year	Authors	Title	Article/Journal Name	Research Purpose	Indexed	Ref
2025	Suba & Manlapig	Development and Evaluation of Experiential Learning with Digital Simulation (ELDS) Modules in Electricity & Magnetism	Journal of Research in Education and Pedagogy	To develop and evaluate experiential digital simulation modules in electricity and magnetism.	Google Scholar	[13]
2025	Arboleda & Morales	Process Oriented Guided Inquiry Learning (POGIL) Lesson Plans in Physics to enhance 21st-Century Skills	PRISM	To develop guided inquiry-based lesson plans aimed at improving 21st-century skills in physics.	Google Scholar	[14]
2025	Gardose, Castillo, & Madroñal	Comic-Polya Method Integration in Physics: Enhance students’ conceptual understanding and motivation	Indonesian Journal of Education Research (IJoER)	To use comic-based Polya method to improve understanding and motivation in physics.	Google Scholar	[15]
2024	Almadrones, & Tadifa	Physics Educational Technology (PHET) Simulations in Teaching General Physics 1	International Journal of Instruction	To assess PHET simulations' effectiveness in teaching General Physics 1.	Scopus, Google Scholar	[16]
2024	Asuela, Cudiamat, Galloniga, Mangay-Ayam & Gundran	Improving the Grade 7 students’ Problem-Solving Skills in Physics through REGIFOSOFI Method	International Multidisciplinary Research Journal	To enhance problem-solving skills using the REGIFOSOFI teaching strategy.	Google Scholar	[17]
2024	Calzada & Antonio	Effects of the Technology-Enhanced Lessons in Optics (TELO) on the academic performance of Grade 10 students	International Journal of Multidisciplinary Applied Business and Education Research	To evaluate the impact of tech-enhanced lessons on Grade 10 optics performance.	Google Scholar	[18]
2023	Moro & Billote	Integrating Ivatan indigenous games to learning module in physics: its effect to student understanding, motivation, attitude, and scientific sublime	Science Education International	To examine effects of indigenous games on student motivation, understanding, and attitude in physics.	Scopus, Google Scholar, ERIC	[4]
2023	Antonio & Diculen	Investigating the effect of Indigenous game-based activities on students’ performance and learning views in physics	American Journal of Multidisciplinary Research and Innovation	To analyze the impact of indigenous games on physics performance and perceptions.	Google Scholar	[19]
2022	Yulkifli, Yohandri, & Azis	Development of physics e-module based on integrated project-based learning model with ethno-stem approach on	Momentum Physics Education Journal	To develop and test a mobile physics module using project-based and ethno-STEM learning.	Google Scholar	[20]

Year	Authors	Title	Article/Journal Name	Research Purpose	Indexed	Ref
		smartphones for senior high school students				
2022	Manzano-León, Rodríguez-Ferrer & Aguilar-Parra	Gamification in science education: Challenging disengagement in socially deprived communities	Journal of Chemical Education	To explore the role of gamification in enhancing science engagement in underserved communities.	Scopus, Web of Science, Google Scholar, ScienceDirect	[21]
2023	Quitaneg-Abaniel	Evaluation of open inquiry learning model for physics Teachers	The Normal Lights	To assess the applicability of open inquiry models in physics teacher training.	Google Scholar, ERIC	[22]
2022	Bebita	Supplementary Instructional materials via Video-Clip (SIMVI): Effects on Grade 9 students' conceptual understanding and motivation	International Journal of Multidisciplinary Applied Business and Education Research	To measure impact of video-based supplementary material on learning and motivation.	Google Scholar	[23]
2022	Dantic & Fluraon	PhET interactive simulation approach in teaching electricity and magnetism among science teacher education students	Journal of Science and Education (JSE)	To examine effectiveness of PHET simulations in teaching key physics concepts.	Google Scholar	[12]
2021	Bagay, Eugenio, Soriano & Bautista	Project MC^2: Raising Students' Procedural Fluency along Concepts of Forces and Motion.	Journal of Innovations in Teaching and Learning	To improve procedural fluency in force and motion concepts using MC^2 project.	Google Scholar	[24]

The selected indexed articles reflected a diverse and quantitatively rich body of literature within the specialized field of Physics Education, encompassing 14 peer-reviewed studies published between 2021 and 2025. These studies appeared in 12 distinct academic journals, five of which were Scopus- or ERIC-indexed, underscoring the scholarly credibility and visibility of the research. Of the 14 articles, three were indexed in Scopus (*International Journal of Instruction*, *Science Education International*, *Journal of Chemical Education*), two in ERIC, and the remainder in Google Scholar-indexed multidisciplinary or education-focused journals, indicating strong regional and global academic engagement in the field. All studies employed empirical methodologies, with more than 70% applying action research or quasi-experimental designs, highlighting a focus on applied, classroom-based innovations as referred to by Huang et al. [25].

In terms of research themes, eight studies examined technology integration, particularly the use of digital simulations, video-assisted instruction, and mobile e-modules to enhance conceptual learning in electricity, magnetism, and optics [12, 23]. Six studies implemented inquiry-based models such as POGIL, open inquiry, and experiential learning modules, aiming to develop higher-order thinking skills and 21st-century competencies [14, 22]. Four studies incorporated cultural and gamified strategies, including indigenous game-based activities, comic integration, and gamification for socially deprived learners, reflecting a strong commitment to inclusive and culturally responsive pedagogy [4, 21]. Seven studies involved instructional material development and evaluation, including lesson plans, modules, or strategic teaching models [15, 17]. Two teacher-focused studies examined science teacher education, emphasizing the need to prepare educators to implement innovative practices effectively [23, 12].

Table 3. Comparison of emerging trends of action research in physics education.

Action Research Trends	How It Differs from Other Trends
Experiential Simulations and Inquiry Models in Physics Teaching	Focuses on active cycles of implementing simulations and inquiry tasks on assessing student engagement, and refining strategies based on real classroom feedback.
Integration of Technological Tools in Physics Education	Supports the trial-and-error implementation of digital tools in the classroom. It emphasizes teacher reflection and student response to tailor instructional methods.
Cultural Integration in Physics Instruction	Allows educators to adapt physics content to local cultural contexts, promoting inclusivity. Teachers test culturally relevant examples or analogies and adjust based on student comprehension and feedback.
Gamification in Physics Instruction	Teachers use action research to introduce game-based elements, observe engagement and learning, and refine gamification mechanics which encourages a real-time responsiveness.

The modern evolution of physics education in recent years reflected a strategic shift toward pedagogical innovation, integrating experiential learning, technological tools, and culturally relevant strategies to enhance student understanding, motivation, and performance. This literature review synthesized recent empirical studies, elaborating on emerging trends and their implications for 21st-century physics instruction.

3.1.Experiential simulations and inquiry models in physics teaching.

According to Suba and Manlapig [13], experiential learning with digital simulation (ELDS) modules was developed and evaluated, focusing on concepts in electricity and magnetism. Their findings highlighted the effectiveness of simulation-based environments in facilitating conceptual understanding through active student engagement. Similarly, Arboleda and Morales [14] designed lesson plans using the Process-Oriented Guided Inquiry Learning (POGIL) model, emphasizing collaborative learning and problem-solving skills essential for 21st-century learners. In addition, Gardose et al. [15] explored the Comic-Polya Method, a visual and narrative-based instructional strategy, and demonstrated significant improvements in both students' conceptual grasp and intrinsic motivation to learn physics. These innovations in visual literacy and inquiry-based learning provided promising directions for instruction in abstract physics domains.

3.2.Integration of technological tools in physics education.

In the aspect of technological interventions, Almadrones and Tadifa [16] investigated the use of Physics Education Technology (PhET) simulations in teaching General Physics 1 and reported measurable gains in academic performance and engagement, which continued to influence contemporary physics education. Supporting this, PhET simulations were also found effective among science teacher education students, particularly in challenging topics such as electricity and magnetism [17]. In a similar context, Calzada and Antonio [18] implemented Technology-Enhanced Lessons in Optics (TELO), which significantly enhanced student achievement. Beyond digital innovation, pedagogical designs emphasizing cognitive scaffolding also gained traction. Asuela et al. [19] introduced the REGIFOSOFI method, a structured teaching model aimed at improving students' problem-solving skills. Their study demonstrated statistically significant improvements in the problem-solving abilities of Grade 7 learners, suggesting the value of strategic instructional frameworks in foundational physics education.

3.3.Cultural integration in physics instruction.

Cultural integration was another emerging theme in physics instruction. Moro and Billote [4] embedded Ivatan indigenous games into physics modules and found notable enhancements in student motivation, conceptual understanding, and attitudes toward science learning. Likewise, Antonio and Diculen [19] showed that indigenous game-based activities improved both academic performance and student perception in physics, underscoring the pedagogical value of culturally contextualized learning experiences [4, 19]. In line with this shift, Yulkifli et al. [20] designed an e-module based on a project-based learning model with an ethno-STEM approach, delivered via smartphones. This approach improved content mastery and enhanced accessibility, making physics education more inclusive.

3.4.Gamification in physics instruction.

Gamification in physics instruction also emerged as a motivational strategy to address student disengagement in marginalized communities. Results affirmed that gamification in science education fostered a more participatory and enjoyable learning experience, especially in low-resource settings [21]. Quitaneg-Abaniel [22] highlighted the value of open inquiry-based learning for teacher development in physics education, advocating for inquiry as a central principle in pre-service teacher training. Multimedia-supported instruction remained a vital aspect of modern pedagogy. Bebita [23] developed Supplementary Instructional Materials via Video Clip (SIMVI), which positively influenced students' motivation and conceptual learning outcomes. Similarly, Bagay et al. [24] introduced Project MC2, an initiative aimed at enhancing procedural fluency in force and motion, which resulted in improved learning efficacy through structured project-based engagement. Collectively, these studies shaped the landscape of physics education. From experiential simulations and inquiry models to cultural integration and gamification, the field continued to evolve toward learner-centered, technologically supported, and contextually meaningful practices.

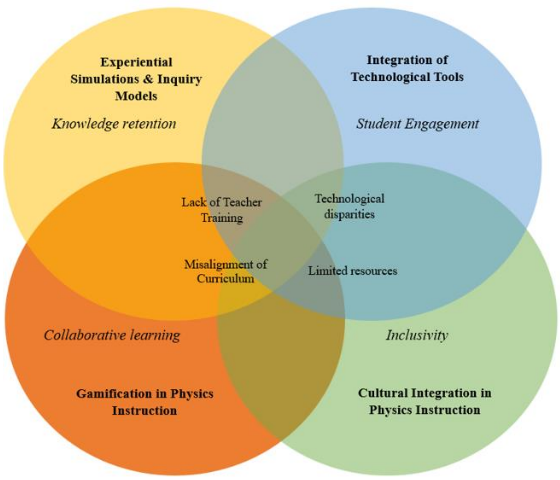

Figure 2. Overlapping opportunities and challenges in implementing action research in physics teaching.

Table 4. Thematic analysis summary.

Theme	Effectiveness	Opportunities	Challenges
Experiential Simulations and Inquiry Models in Physics Teaching	Encourages critical thinking and real-world problem solving.	Enhances understanding and knowledge retention.	Requires teacher training and access to quality simulations.
Integration of Technological Tools in Physics Education	Supports interactive and flexible learning, especially in remote settings.	Improves performance and engagement in STEM subjects.	Technological disparities and resistance to adoption may limit impact.
Cultural Integration in Physics Instruction	Makes physics more accessible and meaningful to diverse learners.	Inclusivity, motivation, and academic identity.	Limited resources and training to support cultural integration.
Gamification in Physics Instruction	Increases motivation, participation, and immediate feedback.	Promotes engagement and collaborative learning.	Risks overemphasis on entertainment and misalignment with curriculum.

Table 4 highlights the comparative strengths and limitations of innovative teaching methodologies and pedagogical approaches through action research in physics education. Experiential simulations and inquiry-based models have been increasingly recognized for their ability to promote critical thinking, real-world problem-solving, and deeper conceptual understanding. Aligned with constructivist learning theories [36, 26], these approaches actively involve students in the learning process, allowing them to explore physical phenomena in hands-on or simulated environments. Research has shown that such models improve knowledge retention and learner outcomes [27]. However, their implementation requires significant teacher training, curriculum redesign, and access to quality simulations—challenges that may be exacerbated in under-resourced schools [28]. Adequate training and preparation are therefore essential for teachers to effectively engage in research that informs and improves classroom practices.

The integration of technological tools in physics instruction is also gaining traction, particularly in response to the growing need for flexible and interactive learning environments. Digital tools such as virtual labs and simulations can enhance engagement and achievement in STEM subjects [29]. As noted by Maksimović & Lazić [30], technological disparities, inconsistent access to infrastructure, and limited teacher preparedness can hinder the widespread adoption of these tools to support physics education and other disciplines.

Cultural integration in physics teaching seeks to make science more relevant and accessible to students from diverse backgrounds. Culturally responsive pedagogy fosters inclusivity, improves student motivation, and supports the development of academic identity [4, 19, 20, 31]. By connecting physics concepts to students' lived experiences, educators can promote a sense of belonging and engagement in the classroom [32]. Nonetheless, challenges include a lack of culturally relevant instructional materials, limited teacher training, and difficulties in aligning such approaches with standardized curricula [29, 33]

Gamification, the use of game-based elements such as points, challenges, and leaderboards, is increasingly utilized to enhance motivation and participation in physics education. Research supports its effectiveness in increasing student engagement, promoting collaborative learning, and providing real-time feedback [21, 23, 24]. However, overreliance on game elements can detract from academic rigor if not carefully aligned with learning outcomes, leading to curriculum misalignment [34].

In terms of cultural integration, physics teaching continues to focus on making science more relevant and accessible to students from diverse backgrounds [4, 19, 20]. Culturally responsive pedagogy fosters inclusivity, improves student motivation, and supports the development of academic identity across diverse learning needs [24]. By connecting physics concepts to students' lived experiences, educators can strengthen engagement and a sense of belonging through culturally responsive teaching [35]. Nonetheless, successful implementation requires addressing the lack of culturally relevant instructional materials, improving teacher training, and ensuring alignment with standardized curricula. Overcoming these challenges demands thoughtful curriculum integration, enhanced teacher preparation, and institutional support.

4. Conclusion

The integration of AR into teaching practice carries significant policy implications. For educators, AR promotes a culture of reflective practice, enabling dynamic adaptation to student needs rather than the static delivery of prescribed content. For school leaders, supporting AR entails investing in professional learning communities, providing structured collaboration time, and ensuring access to context-appropriate resources. For policymakers, embedding AR outcomes into DepEd-approved modules could accelerate the scaling of effective, field-tested teaching innovations without the high costs of nationwide pilot programs. Beyond immediate instructional benefits, AR creates opportunities for equity-focused reforms. In rural and underserved schools, context-driven AR can reveal locally viable strategies that may not surface through centralized planning. Integrating cultural contexts and community-based knowledge into AR cycles can make physics more relevant to diverse learners, addressing long-standing challenges in engagement and retention. Future research should explore longitudinal designs to assess the sustained impact of AR-driven innovations on both learning outcomes and teacher professional growth. There is also potential for cross-disciplinary studies on how AR methodologies in physics can inform pedagogical advances in other sciences such as chemistry, biology, and earth science. Comparative research across Southeast Asian education systems could position the Philippines as a model for low-cost, teacher-led innovation in resource-constrained contexts. Ultimately, the enduring value of AR lies not only in improving lessons but in fostering a systemic shift where teachers are active co-creators of policy-relevant solutions and innovation becomes embedded in the very fabric of science education.

Acknowledgments

The author wishes to thank the Surigao Del Norte State University for the support provided in completing this review paper. An extend thanks to my professor, Dr. Mauricio S. Adlaon, for the supervision in the completion of this research works.

Competing Interest

No competing interest has been identified.

Author Contribution

Arnel R. Andrin: online search strategy, article collection, idea conceptualization, methodology, article analysis, writing; Supervision: Dr. Mauricio S. Adlaon

References

[1] Education At a Glance 2019. (accessed on 1 May 2025) Available online: https://doi.org/10.1787/f8d7880d-en.

[2] Yun, E. (2020). Review of Trends in Physics Education Research Using Topic Modeling. *Journal of Baltic Science Education, 19(3),* 388–400. https://doi.org/10.33225/jbse/20.19.388.

[3] Dahl, K.; Bjørnnes, A.K.; Lohne, V.; Nortvedt, L. (2021). Motivation, Education, and Expectations: Experiences of Philippine immigrant nurses. *SAGE Open, 11(2).* https://doi.org/10.1177/21582440211016554.

[4] Moro, K.C.; Billote, W.J.S.M. (2023). Integrating IvAtan Indigenous Games to learning module in Physics: Its effect to student understanding, motivation, attitude, and scientific sublime. *Science Education International, 34(1),* 3–14. https://doi.org/10.33828/sei.v34.i1.1.

[5] Cuaton, G. (2020). Philippines Higher Education Institutions in the time of COVID-19 Pandemic. *Revista Romaneasca Pentru Educatie Multidimensionala, 12(1Sup2),* 61–70. https://doi.org/10.18662/rrem/12.1sup2/247.

[6] Shu, K. (2022). Teachers' Commitment and Self-Efficacy as Predictors of Work Engagement and Well-Being. *Frontiers in Psychology, 13,* 850204. https://doi.org/10.3389/fpsyg.2022.850204.

[7] Sjölund, S.; Lindvall, J.; Larsson, M.; Ryve, A. (2022). Using research to inform practice through research-practice partnerships: A systematic literature review. *Review of Education, 10(1),* e3337. https://doi.org/10.1002/rev3.3337.

[8] Poblador, S.A.; Lagunero-Tagare, R.J. (2023). Exploring the Positive Experiences of Senior High School Teachers in Teaching the Sports Track during the K-12 Transition Years in Southern Philippines. *Research in Education and Learning Innovation Archives, 31,* 17–32. https://doi.org/10.7203/realia.31.25888.

[9] Luga, A.M.F.; Cabanlit, K.L.; Sidic, J.B.; Morilla, R.B.G.; Demayo, C.J.; Demayo, C.G. (2023). An epidemiology study for tuberculosis in the Philippines from 1960 to 2019. *International Journal of Public Health Science (IJPHS), 12(2)*, 486. https://doi.org/10.11591/ijphs.v12i2.21962.

[10] Haddaway, N.R.; Page, M.J.; Pritchard, C.C.; McGuinness, L.A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. *Campbell Systematic Reviews, 18(2),* e1230. https://doi.org/10.1002/cl2.1230.

[11] Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; Chou, R.; Glanville, J.; Grimshaw, J.M.; Hróbjartsson, A.; Lalu, M. M.; Li, T.; Loder, E. W.; Mayo-Wilson, E.; McDonald, S.;… Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ, 372,* n71. https://doi.org/10.1136/bmj.n71.

[12] Dantic, M.J.P.; Fluraon, A. (2022). PhET interactive simulation approach in teaching electricity and magnetism among science teacher education students. *Journal of Science and Education (JSE), 2(2),* 88–98. https://doi.org/10.56003/jse.v2i2.101.

[13] Suba, M.A.; Manlapig, E.F., Jr. (2025). Development and Evaluation of Experiential Learning with Digital Simulation (ELDS) Modules in Electricity & Magnetism. *Journal of Research in Education and Pedagogy, 2(2),* 296–308. https://doi.org/10.70232/jrep.v2i2.39.

[14] Arboleda, E F.; Morales, M.P.E. (2025). Process Oriented Guided Inquiry Learning (POGIL) Lesson Plans in Physics to enhance 21st-Century Skills. *PRISM, 27(1).*

[15] Gardose, C.K.C.; Castillo, A.A.; Madroñal, M.H. (2025). Comic-Polya Method Integration in Physics: Enhance students' conceptual understanding and motivation. *Indonesian Journal of Education Research (IJoER), 6(1),* 35–44. https://doi.org/10.37251/ijoer.v6i1.1216.

[16] Almadrones, R.D.; Tadifa, F.G. (2024). Physics Educational Technology (PHET) Simulations in Teaching General Physics 1. *International Journal of Instruction, 17*(3), 635–650. http://doi.org/10.29333/iji.2024.17335a.
[17] Asuela, J.S.; Cudiamat, D.R. G.; Galloniga, S.J.L.; Mangay-Ayam, A.P.E.; Gundran, T.L. (2024). Improving the Grade 7 students' Problem-Solving Skills in Physics through REGIFOSOFI Method. *International Multidisciplinary Research Journal, 6(1),* 28–35. https://doi.org/10.54476/ioer-imrj/083363.
[18] Calzada, M.P.T.; Antonio, V.V. (2024). Effects of the Technology-Enhanced Lessons in Optics (TELO) on the academic performance of Grade 10 students. *International Journal of Multidisciplinary Applied Business and Education Research, 5(8),* 3039–3049. https://doi.org/10.11594/ijmaber.05.08.09.
[19] Antonio, V.V.; Diculen, L.B. (2023). Investigating the effect of Indigenous game-based activities on students' performance and learning views in physics. *American Journal of Multidisciplinary Research and Innovation, 2(3),* 61–69. https://doi.org/10.54536/ajmri.v2i3.1623.
[20] Yulkifli, Y.; Yohandri, Y.; Azis, H. (2022). Development of physics e-module based on integrated project-based learning model with Ethno-STEM approach on smartphones for Senior High School students. *Momentum Physics Education Journal, 6,* 93–103. https://doi.org/10.21067/mpej.v6i1.6316.
[21] Manzano-León, A.; Rodríguez-Ferrer, J.M.; Aguilar-Parra, J.M. (2022). Gamification in science Education: Challenging disengagement in socially deprived communities. *Journal of Chemical Education, 100(1),* 170–177. https://doi.org/10.1021/acs.jchemed.2c00089.
[22] Quitaneg-Abaniel, A. (2023). Evaluation of open inquiry learning model for physics Teachers. The *Normal Lights, 15(1),* 98–123. https://doi.org/10.56278/tnl.v15i1.1745.
[23] Bebita, D.J. (2022). Supplementary Instructional materials via Video-Clip (SIMVI): Effects on Grade 9 students' conceptual understanding and motivation. *International Journal of Multidisciplinary Applied Business and Education Research, 3(11),* 2462–2479. https://doi.org/10.11594/ijmaber.03.11.29.
[24] Bagay, M.C.; Eugenio, W.A.; Soriano, M.V.C.; Bautista, R.G. (2021). Project MC 2 : Raising Students' Procedural Fluency along Concepts of Forces and Motion. *Journal of Innovations in Teaching and Learning, 1(2),* 127–130. https://doi.org/10.12691/jitl-1-2-10.
[25] Huang, B.; Jong, M. S.; Tu, Y.; Hwang, G.; Chai, C.S.; Jiang, M.Y. (2022). Trends and exemplary practices of STEM teacher professional development programs in K-12 contexts: A systematic review of empirical studies. *Computers & Education*, *189*, 104577. https://doi.org/10.1016/j.compedu.2022.104577.
[26] Triantafyllou, S.A. (2022). Constructivist Learning Environments. Proceedings of the 5th International Conference on Advanced Research in Teaching and Education. https://doi.org/10.33422/5th.icate.2022.04.10.
[27] Smirani, L.; Yamani, H. (2024). Analysing the impact of gamification techniques on enhancing learner engagement, motivation, and knowledge retention: a structural equation modelling approach. *The Electronic Journal of e-Learning, 22(9),* 111–124. https://doi.org/10.34190/ejel.22.9.3563.
[28] Bullo, M.M.; Labastida, R.T.; Manlapas, C.C. (2021). Challenges and difficulties encountered by teachers in the conduct of educational research: Basis for teachers' enhancement program. *International Journal of Research Studies in Education, 10(13),* 67–75. https://doi.org/10.5861/ijrse.2021.a044.
[29] Praveen Javal, R.; Raj, R.G.; Shaw, S.; Devi, C.H.; Kumar, A.; Andy, A.; Ramesh, M.; Tharayil, A.S. (2025). Virtual labs and simulation tools. IGI Global Scientific Publishing: Hershey, USA. https://doi.org/10.4018/979-8-3693-8593-7.ch035.

[30] Maksimović, J.; Lazić, N.N. (2023). Competences of Physical Education Teachers in education supported by digital technology. *International Journal of Cognitive Research in Science Engineering and Education, 11(2),* 331–341. https://doi.org/10.23947/2334-8496-2023-11-2-331-341.
[31] Chang, W.; Viesca, K.M. (2022). Preparing Teachers for Culturally Responsive/Relevant Pedagogy (CRP): A Critical Review of research. *Teachers College Record the Voice of Scholarship in Education, 124(2),* 197–224. https://doi.org/10.1177/01614681221086676.
[32] Dah, J.; Hussin, N.; Zaini, M.K.; Helda, L.I.; Ametefe, D.S.; Aliu, A.A. (2024). Gamification is not Working: Why? *Games and Culture*. https://doi.org/10.1177/15554120241228125.
[33] Encina, Y.; Berger, C. (2021). Civic Behavior and Sense of belonging at school: The Moderating Role of School climate. *Child Indicators Research, 14(4),* 1453–1477. https://doi.org/10.1007/s12187-021-09809-0.
[34] Fahadah, N.A.; Thomps, N.J. (2025). Exploring the role of culturally responsive pedagogy in promoting equity across diverse educational environments. *Deleted Journal,* 97–108. https://doi.org/10.59944/postaxial.v3i2.445.
[35] Ghaemi, H.; Boroushaki, N. (2025). Culturally responsive teaching in diverse classrooms: A framework for teacher preparation program. *Australian Journal of Applied Linguistics, 8(1),* 102433. https://doi.org/10.29140/ajal.v8n1.102433.
[36] Bruner, J.S. (1961). The Act of Discovery. *Harvard Educational Review, 31,* 21–32.