Journal of Studies in Elementary Education
2025, VOL. 01, NO. 02, 49-57
https://doi.org/10.64268/jsee.v1i2.91

From Passive Classrooms to Active Engagement: Demonstration-Based Teaching and Its Role in Improving Science Learning Outcomes in Primary Education

Kasiyati[1], Bambang Ariyanto[2], Iffa Dian Santika[3]
[1,2,3] Universitas Nahdlatul Ulama lampung, Indonesia

kasiyati@gmail.com

ABSTRACT

Background: Primary science lessons can become overly teacher centered, which reduces students' opportunity to engage with concepts through observation and hands on reasoning. In this context, demonstration based teaching is expected to make science learning more concrete and to support better achievement, particularly for topics related to energy and its transformations.
Aims: This study examines whether demonstration based teaching can improve science learning outcomes while encouraging a shift toward more active classroom participation among fourth grade students.
Methods: The research used a classroom action research approach involving 16 Grade IV students and was implemented in two cycles consisting of planning, action, observation, and reflection. Data were collected through classroom observations, interviews, written tests, and documentation. Learning outcomes were evaluated using percentage based mastery criteria aligned with the minimum standard, and qualitative field notes were used to describe changes in participation during instruction.
Result: Student mastery improved consistently across phases. In the pre cycle stage, only 25 percent of students achieved mastery, increasing to 62.5 percent in Cycle I, and rising to 93.75 percent in Cycle II. Classroom observations also indicated more visible engagement during demonstrations, including greater involvement in observing phenomena, responding to questions, and explaining simple cause effect relations related to energy changes.
Conclusion: Demonstration based teaching, implemented iteratively through classroom cycles, can substantially improve primary science learning outcomes and foster more active participation during learning activities.

ARTICLE HISTORY
Submitted: October 11, 2025
Accepted: November 03, 2025
Published: December 18, 2025

KEYWORD
Classroom Action Research; Demonstration Method; Primary Education; Science Learning Outcomes; Student Engagement;

Introduction

The effectiveness of primary science education is increasingly viewed as a decisive factor in shaping students' long term scientific literacy (Deehan et al., 2024; Fortus et al., 2022), and this urgency is difficult to ignore when learning outcomes remain uneven across classrooms (Banki, 2021). At the elementary level, science is not merely a set of facts to be memorized, but a gateway to cultivating curiosity, observation, and basic reasoning. When early science learning is weak, students often carry fragile conceptual foundations into later grades, which makes subsequent learning more difficult and less meaningful.

In many primary classrooms, science instruction still tends to be dominated by explanation and recall oriented tasks (McDonald et al., 2021; Nielsen, 2021). Lessons may proceed efficiently from the teacher's perspective, yet students are frequently positioned as listeners rather than investigators (Chen et al., 2024). This pattern limits opportunities for children to test ideas, ask questions, and engage in sense making, and it can gradually normalize passivity as the default learning posture. Over time, such conditions can be reflected in low achievement and limited participation during science learning activities.

This problem becomes more evident when the topic requires students to connect concepts to observable phenomena (Anam et al., 2024; McLure et al., 2022). Science content related to energy, for example, demands that learners recognize changes, track causes and effects, and make simple explanations based on what they see (Almusaed et al., 2023; Cooper, 2023). For students at the primary level, these demands are difficult to meet if instruction relies mainly on verbal description. Without concrete experiences, students may remember terms while failing to understand the processes those terms describe.

Young learners generally learn more effectively when abstract ideas are supported by visual cues and direct observation (Harris, 2021; Molenaar, 2022). Demonstration, in this sense, can function as a bridge between explanation and experience (Honkavuo, 2021). By seeing a phenomenon unfold and discussing it with guidance, students can begin to form more stable conceptual links. This is particularly relevant in science learning, where understanding often depends on noticing patterns and interpreting events rather than recalling definitions.

Active learning frameworks consistently emphasize that students' understanding grows when they are invited to participate, not simply receive information (Howell, 2021; Lombardi & Shipley, 2021). In a primary science setting, participation can take simple forms such as predicting outcomes, describing what is observed, comparing results, and articulating explanations in everyday language (Fàbregues et al., 2023; Singh et al., 2023). These forms of engagement are realistic to implement, but they require instructional designs that intentionally create space for observation and interaction. Without such designs, active learning may remain an ideal rather than a classroom reality.

Demonstration based teaching offers a practical approach that fits the constraints of many primary classrooms (Johnson & Burns, 2023). It does not demand sophisticated laboratory facilities, yet it can make scientific ideas more tangible (Kozub et al., 2021). When demonstrations are planned carefully and followed by guided discussion, they can encourage students to focus attention, form questions, and explain what they notice. In addition, demonstrations can help teachers diagnose misconceptions early because students' responses often reveal how they are interpreting the phenomenon.

However, the use of demonstrations in classrooms is not automatically effective (Goldberg et al., 2021). If demonstrations are treated as a one way show, students may remain spectators and the lesson returns to a teacher centered format (Kramarski & Heaysman, 2021; Sukkurwalla et al., 2024). The instructional value of demonstration depends on how it is integrated into learning sequences, how students are prompted to think and respond, and how teachers refine the approach based on classroom evidence. This is why classroom based inquiry that documents both the process and the outcomes remains important.

For these reasons, studying demonstration based teaching as an intervention within authentic classroom conditions is a relevant contribution to primary science education (Georgiou & Kyza, 2023; Rehman et al., 2023). Evidence that learning outcomes improve alongside more active engagement can strengthen the case for adopting more experiential teaching routines in everyday practice (Helate et al., 2022). This study responds to that practical need by examining how demonstration based teaching can support a shift from passive learning patterns toward more active participation, while also improving students' achievement in primary science learning.

Studies on learning design increasingly underline the importance of shifting classroom practices toward more participatory forms of instruction. Ferreira & Ineson (2026) shows that learning becomes more durable when students are involved bodily and cognitively in the learning process rather than positioned as passive listeners. In a similar vein, Cheng & Qian (2025) argues that instructional effectiveness improves when teaching modes are deliberately optimized to foster interaction and reflection. Research on teaching behavior by Chen (2026) further indicates that observable instructional practices make it easier to identify how students respond to learning tasks. The value of visual and experience based instruction is also emphasized by Ding et al. (2026), who reports stronger comprehension when learners engage with demonstrative learning environments. Evidence from applied training contexts supports this view, as Cihan Erdoğan et al. (2026) documents measurable improvements in learning outcomes following structured instructional interventions. Wei (2024) adds that contextualized experiences significantly influence how learners interpret and internalize new information. In health and practice oriented education, Rose et al. (2021) and Gandhi et al. (2026) demonstrate that active engagement with learning processes leads to better understanding than information transmission alone. Zhang et al. (2026) similarly highlights the educational benefits of observable instructional media, while Chen (2026) emphasizes the role of representation and interaction in meaningful knowledge construction. Taken together, these findings provide a strong conceptual basis for examining demonstration based teaching as an active learning approach in primary science education.

Despite growing recognition of active learning as a key principle in science education, classroom practice at the primary level often lags behind this ideal. Teachers are frequently confronted with the challenge of balancing curricular demands, time constraints, and limited instructional resources. Within this context, demonstration-based teaching emerges as a realistic pedagogical option because it allows scientific ideas to be explored through direct observation without relying on sophisticated facilities. More importantly, demonstrations can serve as entry points for discussion, questioning, and guided reasoning when they are deliberately embedded into lesson sequences. However, the educational value of demonstrations is not inherent; it depends on how they are planned, enacted, and reflected upon in response to classroom dynamics. This study is grounded in the view that examining demonstration-based teaching through systematic classroom inquiry can reveal how such practices contribute to more effective and engaging science learning.

While previous research has provided strong support for active and experiential learning approaches, much of this evidence is derived from experimental studies or technologically enhanced learning environments. Comparatively little research has focused on demonstration-based instruction as a sustained classroom intervention in primary education. In addition, existing studies often emphasize learning outcomes without adequately documenting how student participation and engagement evolve during instruction. The lack of research that simultaneously captures instructional processes and learning results within authentic classroom settings limits the practical relevance of current findings for everyday teaching. This gap highlights the need for classroom-based studies that explore how demonstration-based teaching can gradually shift passive learning patterns toward more active participation while improving academic achievement.

In response to the identified rationale and research gap, this study aims to investigate the implementation of demonstration-based teaching as an instructional intervention in primary science education. The study seeks to examine changes in students' science learning outcomes and classroom engagement across iterative cycles of instruction. It is assumed that when demonstrations are integrated purposefully into science lessons and accompanied by guided interaction, students will show improved understanding and more active involvement in learning activities. Through this focus, the study intends to contribute contextualized evidence on the potential of demonstration-based teaching to enhance both engagement and achievement in primary science classrooms.

Method

Research Design

This study was designed as classroom action research focusing on instructional improvement through demonstration-based teaching. The choice of this design was driven by the need to observe learning processes directly while allowing instructional adjustments to be made in response to classroom conditions. The research followed an iterative structure in which teaching practices were continuously refined through cycles of planning, implementation, observation, and reflection. Rather than testing a static treatment, this approach enabled the researcher to examine how demonstration-based instruction functioned in real classroom situations and how it influenced learning outcomes over time. The overall procedural flow of the study is presented in Figure 1.

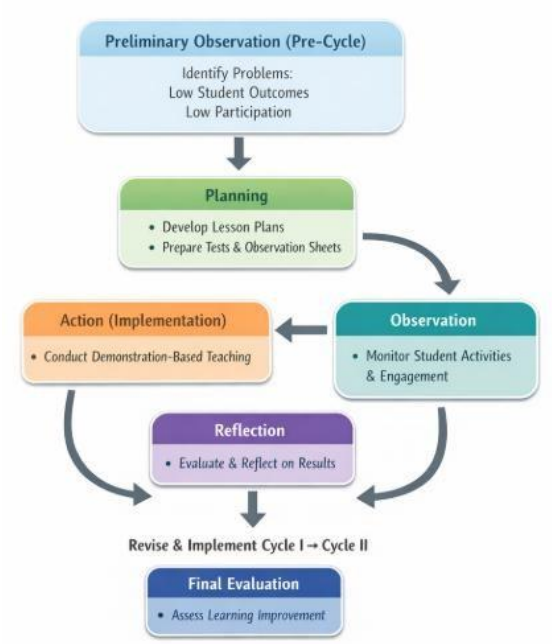

Figure 1. Flowchart of classroom action research implementing demonstration-based teaching

As shown in Figure 1, the research began with a preliminary observation phase to identify instructional challenges related to low student achievement and limited classroom participation. Based on these initial findings, instructional planning was carried out, including the preparation of lesson plans, learning materials, assessment tools, and observation guidelines. The planned instruction was then implemented using demonstration-based teaching during science lessons. Student responses and classroom interactions were systematically observed throughout the learning process. Reflection was conducted at the end of each cycle to evaluate both learning outcomes and instructional effectiveness, forming the basis for revising and continuing the intervention in the subsequent cycle.

Participant

The participants in this study consisted of 16 fourth-grade students enrolled in a primary science class. The class was selected because initial observations indicated that students experienced difficulties in understanding science concepts and showed limited engagement during lessons. All students took part in the instructional activities and assessment processes throughout the research cycles. The classroom context represented typical conditions found in primary schools, allowing the findings to reflect realistic teaching and learning situations.

Instrument

Several instruments were employed to capture both learning outcomes and classroom processes. Science achievement tests were used to measure students' understanding of the learning material before and after each instructional cycle. Classroom observation sheets were utilized to document student engagement, participation, and responses during demonstration-based learning activities. In addition, field notes and instructional documentation were collected to record contextual information related to lesson implementation and classroom dynamics. The use of multiple instruments enabled a more comprehensive description of the instructional intervention and its effects.

Data Analysis

Data analysis was conducted using both quantitative and qualitative approaches. Students' test results were analyzed descriptively by calculating the percentage of students who met the predetermined mastery criteria in each phase of the study. Changes in learning outcomes were examined across the pre-intervention stage and successive cycles. Qualitative data obtained from observations and field notes were analyzed through descriptive interpretation to identify patterns of student engagement and participation during learning activities. The integration of quantitative and qualitative findings provided a holistic understanding of how demonstration-based teaching influenced science learning in the classroom.

Results and Discussion

Results

The analysis of students' learning outcomes indicates a gradual but consistent improvement following the implementation of demonstration-based teaching. At the pre-cycle stage, most students had not yet reached the expected level of mastery, suggesting that their understanding of the science concepts was still superficial. Learning activities during this phase were largely teacher-directed, and students showed limited initiative when responding to questions or engaging with the material.

After the first instructional cycle, noticeable changes began to emerge. The number of students achieving mastery increased substantially, reflecting the initial impact of demonstration-based instruction. Observational records during this phase showed that students paid closer attention to the learning process and were more willing to respond when prompted. Although some learners still relied on guidance from the teacher, the overall classroom atmosphere became more interactive compared to the pre-cycle condition.

The second cycle produced a more pronounced improvement in learning outcomes. Almost all students met the mastery criterion, indicating that the refinement of instructional practices contributed to deeper understanding. Students were able to describe observed phenomena more clearly and demonstrated greater confidence in explaining simple scientific relationships. This suggests that repeated exposure to demonstration-based learning, combined with reflective instructional adjustments, supported both conceptual development and classroom engagement.

A detailed overview of students' science learning outcomes across instructional phases is presented in Table 1.

Table 1. Students' science learning outcomes across instructional phases

Instructional Phase	Number of Students	Students Achieving Mastery	Percentage of Mastery
Pre-Cycle	16	4	25.00%
Cycle I	16	10	62.50%
Cycle II	16	15	93.75%

Table 1 shows a steady increase in the proportion of students achieving mastery from the pre-cycle stage through Cycle II. The sharp rise observed after the first cycle indicates the immediate contribution of demonstration-based teaching, while the continued improvement in the second cycle reflects the importance of instructional refinement. Overall, the results demonstrate that demonstration-based teaching was associated with improved science learning outcomes in the primary classroom context.

Discussion

The results of this study indicate that demonstration-based teaching contributed to a gradual strengthening of students' understanding in primary science learning. The steady increase in mastery across instructional cycles suggests that students benefited from repeated exposure to observable learning experiences. Rather than memorizing abstract explanations, learners were given opportunities to see scientific processes unfold, which supported deeper comprehension. This pattern reflects the view expressed by Ferreira & Ineson (2026) that learning becomes more meaningful when students engage directly with phenomena rather than relying on verbal transmission alone.

The improvement observed in the first cycle highlights the immediate instructional value of demonstrations. When scientific concepts were introduced through visible processes, students appeared more capable of connecting explanations with concrete events. This finding is consistent with Ding et al.

(2026), who emphasizes that visual and experience-based instruction helps learners make sense of unfamiliar content, particularly in early educational stages where abstract reasoning is still developing.

The more substantial improvement in the second cycle underscores the importance of reflective instructional practice. Demonstration-based teaching became increasingly effective as the teacher refined instructional decisions based on classroom observations. This supports the argument made by Cheng & Qian (2025) that instructional effectiveness is not static but improves through iterative optimization. In this sense, the success of demonstration-based teaching lies not only in the method itself, but also in how it is continuously adjusted to students' responses.

Increased student engagement accompanied the improvement in learning outcomes, suggesting a close relationship between participation and understanding. As students became accustomed to observing and discussing demonstrations, they showed greater confidence in responding and explaining ideas. Chen (2026) notes that observable instructional practices make learning processes more visible, encouraging students to take an active role rather than remaining passive recipients of information.

Another important finding is the practicality of demonstration-based teaching in typical classroom settings. The instructional approach did not depend on advanced technology or complex materials, yet it still produced meaningful learning gains. This practical strength aligns with the findings of Cihan Erdoğan et al. (2026), who reports that well-structured instructional strategies can improve learning outcomes even in resource-limited environments.

Contextual learning also played a significant role in supporting students' understanding. Demonstrations allowed learners to interpret science concepts through familiar observations, making the content more accessible. Wei (2024) similarly emphasizes that contextualized experiences influence how learners construct meaning, particularly in foundational learning where abstract explanations alone may be insufficient.

Although much of the existing literature focuses on secondary or professional education contexts, the findings of this study resonate with research in applied learning domains. Rose et al. (2021) and Gandhi et al. (2026) both demonstrate that active engagement with learning processes leads to stronger understanding than passive instruction. The present study extends this principle to primary science education, showing that similar mechanisms operate even at early levels of schooling.

Demonstration-based teaching also created opportunities for identifying students' misconceptions. When students were asked to describe what they observed, their explanations revealed how they interpreted scientific phenomena. Zhang et al. (2026) highlights that observable instructional media can make learners' reasoning more explicit, allowing teachers to address misunderstandings before they become entrenched.

From a representational perspective, demonstrations functioned as bridges between explanation and experience. They provided concrete reference points that helped students organize and interpret information. This supports the view of Chen (2026), who argues that meaningful knowledge construction depends on the interaction between representation, interpretation, and learner engagement.

Taken together, these findings suggest that demonstration-based teaching can effectively support both cognitive and participatory aspects of learning in primary science classrooms. When implemented reflectively through classroom action research, demonstrations help shift learning away from passive routines toward more interactive and meaningful experiences. This study therefore contributes evidence that demonstration-based teaching is not merely a supplementary technique, but a viable instructional strategy for improving learning outcomes and engagement in primary science education.

Implications

The results of this study indicate that demonstration-based teaching has practical value for everyday science instruction in primary schools. Rather than functioning as a supplementary activity, demonstrations can be integrated as a central component of lesson design that helps students connect explanations with observable phenomena. This approach encourages teachers to move beyond transmission-oriented instruction toward learning environments that promote attention, interaction, and reasoning. The use of classroom action research further implies that instructional improvement is most effective when teachers systematically reflect on student responses and learning progress. These findings suggest that teacher development initiatives should emphasize reflective practice alongside pedagogical techniques. In the longer term, consistent use of demonstration-based teaching may contribute to the cultivation of more active and inquiry-oriented learning habits among primary school students.

Limitations

This study is subject to several limitations that should be considered when interpreting the findings. The research was conducted within a single classroom context involving a relatively small number of students, which limits the extent to which the results can be generalized to other settings. In addition, the focus on a specific science topic means that the effectiveness of demonstration-based teaching may vary when applied to different content areas. The classroom action research design prioritizes instructional development over experimental control, so the findings should be understood as context-dependent rather than definitive evidence of causality. These constraints highlight the need for cautious interpretation and underscore the exploratory nature of the study.

Suggestions

In light of the findings and limitations, several directions can be suggested for future research and instructional practice. Further studies could investigate the use of demonstration-based teaching across diverse science topics and grade levels to examine its consistency and adaptability. Researchers may also explore how demonstrations interact with other active learning strategies to enhance student understanding and engagement. From a practical standpoint, teachers are encouraged to design demonstrations that invite students to predict outcomes, observe carefully, and articulate explanations in their own words. Expanding future research to include larger samples or comparative approaches may provide a stronger basis for evaluating the broader impact of demonstration-based teaching in primary science education.

Conclusion

The findings of this study indicate that demonstration-based teaching has a meaningful role in supporting the improvement of primary science learning when it is implemented through reflective classroom practice. The progressive increase in student mastery across instructional phases suggests that direct observation of scientific phenomena helped learners develop clearer and more stable conceptual understanding. Beyond academic achievement, demonstration-based instruction also encouraged greater student involvement during learning activities, as students became more attentive and confident in expressing their ideas. The classroom action research framework enabled continuous adjustment of instructional strategies, ensuring that teaching practices responded to students' actual learning needs rather than remaining fixed. Taken together, these results suggest that demonstration-based teaching is not merely an instructional technique, but a practical pedagogical approach that can foster more active and meaningful science learning in primary classrooms.

Author Contributions Statement

Kasiyati was responsible for the overall research process, including conceptualizing the study, designing the classroom action research, implementing the demonstration-based teaching, collecting and analyzing the data, and writing the original draft of the manuscript. Bambang Ariyanto provided academic supervision throughout the research process, particularly in refining the research design, strengthening the theoretical framework, and critically reviewing the analysis and discussion. Iffa Dian Santika contributed to methodological guidance, validation of research instruments, and interpretation of the findings

References

Almusaed, A., Almssad, A., Yitmen, I., & Homod, R. Z. (2023). Enhancing Student Engagement: Harnessing "AIED"'s Power in Hybrid Education—A Review Analysis. *Education Sciences*, *13*(7), 632. https://doi.org/10.3390/educsci13070632

Anam, R. S., Gumilar, S., & Widodo, A. (2024). The Use of the Constructivist Teaching Sequence (CTS) to Facilitate Changes in the Visual Representations of Fifth-Grade Elementary School Students: A Case Study on Teaching Heat Convection Concepts. *International Journal of Science and Mathematics Education*, *22*(1), 73–99. https://doi.org/10.1007/s10763-023-10358-x

Banki, S. R. (2021). "Learning alone-a with Corona": Two challenges and four principles of tertiary teaching. *Journal of Research in Innovative Teaching & Learning*, *14*(1), 65–74. https://doi.org/10.1108/JRIT-12-2020-0081

Chen, Y.-C., Jordan, M., Park, J., & Starrett, E. (2024). Navigating student uncertainty for productive struggle: Establishing the importance for and distinguishing types, sources, and desirability of scientific uncertainties. *Science Education*, *108*(4), 1099–1133. https://doi.org/10.1002/sce.21864

Chen, Z. (2026). Multimodal deep learning for sports teacher behavior analysis: Design and evaluation of a personalized continuing education recommendation system. *Scientific Reports*, *16*(1). https://doi.org/10.1038/s41598-025-31341-2

Cheng, J., & Qian, J. (2025). Exploring the key factors influencing tourists' intention to use mobile AR educational applications from the perspective of structural equation modeling. *Npj Heritage Science*, *13*(1), 119. https://doi.org/10.1038/s40494-025-01575-4

Cihan Erdoğan, B., Doğan, N., & Kalle, Y. B. (2026). The impact of different training methods on the hand hygiene beliefs and practices of future home caregivers: A randomized controlled trial. *Infection, Disease and Health*, *31*(1). https://doi.org/10.1016/j.idh.2025.05.004

Cooper, G. (2023). Examining Science Education in ChatGPT: An Exploratory Study of Generative Artificial Intelligence. *Journal of Science Education and Technology*, *32*(3), 444–452. https://doi.org/10.1007/s10956-023-10039-y

Deehan, J., MacDonald, A., & Morris, C. (2024). A scoping review of interventions in primary science education. *Studies in Science Education*, *60*(1), 1–43. https://doi.org/10.1080/03057267.2022.2154997

Ding, S., Lu, T., Lv, X., Zhang, Y., Deng, R., & Huang, X. (2026). Augmented reality for enhancing educational experience in laboratory safety training. *Journal of Loss Prevention in the Process Industries*, *100*. https://doi.org/10.1016/j.jlp.2025.105848

Fàbregues, S., Sáinz, M., Romano, M. J., Escalante-Barrios, E. L., Younas, A., & López-Pérez, B.-S. (2023). Use of mixed methods research in intervention studies to increase young people's interest in STEM: A systematic methodological review. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.956300

Ferreira, J. M., & Ineson, G. (2026). Embodied learning in teacher education: Investigating student-teachers' experiences in engaging with embodied cognition theories. *Teaching and Teacher Education*, *171*. https://doi.org/10.1016/j.tate.2025.105335

Fortus, D., Lin, J., Neumann, K., & Sadler, T. D. (2022). The role of affect in science literacy for all. *International Journal of Science Education*, *44*(4), 535–555. https://doi.org/10.1080/09500693.2022.2036384

Gandhi, G., Vasthare, R., Nayak, P. P., Prabhu, A., Maini, V., & Sahana, S. (2026). Promotion of Appropriate Use of Dental Floss Among Women Undergraduate Students of South India: An Oral Health Pre–Post Study. *International Journal of Dental Hygiene*, *24*(1), 94–99. https://doi.org/10.1111/idh.70030

Georgiou, Y., & Kyza, E. A. (2023). Fostering Chemistry Students' Scientific Literacy for Responsible Citizenship through Socio-Scientific Inquiry-Based Learning (SSIBL). *Sustainability*, *15*(8), 6442. https://doi.org/10.3390/su15086442

Goldberg, P., Sümer, Ö., Stürmer, K., Wagner, W., Göllner, R., Gerjets, P., Kasneci, E., & Trautwein, U. (2021). Attentive or Not? Toward a Machine Learning Approach to Assessing Students' Visible Engagement in Classroom Instruction. *Educational Psychology Review*, *33*(1), 27–49. https://doi.org/10.1007/s10648-019-09514-z

Harris, P. L. (2021). Early Constraints on the Imagination: The Realism of Young Children. *Child Development*, *92*(2), 466–483. https://doi.org/10.1111/cdev.13487

Helate, T. H., Metaferia, T. F., & Gezahegn, T. H. (2022). English language teachers' engagement in and preference for experiential learning for professional development. *Heliyon*, *8*(10). https://doi.org/10.1016/j.heliyon.2022.e10900

Honkavuo, L. (2021). Ethics simulation in nursing education: Nursing students' experiences. *Nursing Ethics*, *28*(7–8), 1269–1281. https://doi.org/10.1177/0969733021994188

Howell, R. A. (2021). Engaging students in education for sustainable development: The benefits of active learning, reflective practices and flipped classroom pedagogies. *Journal of Cleaner Production*, *325*, 129318. https://doi.org/10.1016/j.jclepro.2021.129318

Johnson, M. L., & Burns, E. (2023). Characteristics of effective models for classroom demonstrations. *Theory Into Practice*, *62*(3), 207–218. https://doi.org/10.1080/00405841.2023.2226552

Kozub, P., Kozub, S., Lukianova, V., Borysova, L., Taraduda, D., & Kachur, T. (2021). The new concept of laboratory support for educational institutions and scientific establishments. *Archives of Materials Science and Engineering*, *Vol. 107*(nr 1). https://doi.org/10.5604/01.3001.0014.8192

Kramarski, B., & Heaysman, O. (2021). A conceptual framework and a professional development model for supporting teachers' "triple SRL–SRT processes" and promoting students' academic outcomes. *Educational Psychologist*, *56*(4), 298–311. https://doi.org/10.1080/00461520.2021.1985502

Lombardi, D., & Shipley, T. F. (2021). The Curious Construct of Active Learning. *Psychological Science in the Public Interest*, *22*(1), 8–43. https://doi.org/10.1177/1529100620973974

McDonald, C. V., Klieve, H., & Kanasa, H. (2021). Exploring Australian Preservice Primary Teachers' Attitudes Toward Teaching Science Using the Dimensions of Attitude toward Science (DAS). *Research in Science Education*, *51*(5), 1325–1348. https://doi.org/10.1007/s11165-019-09910-z

McLure, F., Won, M., & Treagust, D. F. (2022). Analysis of Students' Diagrams Explaining Scientific Phenomena. *Research in Science Education*, *52*(4), 1225–1241. https://doi.org/10.1007/s11165-021-10004-y

Molenaar, I. (2022). The concept of hybrid human-AI regulation: Exemplifying how to support young learners' self-regulated learning. *Computers and Education: Artificial Intelligence*, *3*, 100070. https://doi.org/10.1016/j.caeai.2022.100070

Nielsen, K. (2021). Peer and self-assessment practices for writing across the curriculum: Learner-differentiated effects on writing achievement. *Educational Review*, *73*(6), 753–774. https://doi.org/10.1080/00131911.2019.1695104

Rehman, N., Zhang, W., Mahmood, A., Fareed, M. Z., & Batool, S. (2023). Fostering twenty-first century skills among primary school students through math project-based learning. *Humanities and Social Sciences Communications*, *10*(1), 424. https://doi.org/10.1057/s41599-023-01914-5

Rose, H., McKinley, J., & Galloway, N. (2021). Global Englishes and language teaching: A review of pedagogical research. *Language Teaching*, *54*(2), 157–189. https://doi.org/10.1017/S0261444820000518

Singh, L., Cristia, A., Karasik, L. B., Rajendra, S. J., & Oakes, L. M. (2023). Diversity and representation in infant research: Barriers and bridges toward a globalized science of infant development. *Infancy*, *28*(4), 708–737. https://doi.org/10.1111/infa.12545

Sukkurwalla, A., Zaidi, S. J. A., Taqi, M., Waqar, Z., & Qureshi, A. (2024). Exploring medical educators' perspectives on teaching effectiveness and student learning. *BMC Medical Education*, *24*(1), 1433. https://doi.org/10.1186/s12909-024-06465-0

Wei, Z. (2024). Navigating Digital Learning Landscapes: Unveiling the Interplay Between Learning Behaviors, Digital Literacy, and Educational Outcomes. *Journal of the Knowledge Economy*, *15*(3), 10516–10546. https://doi.org/10.1007/s13132-023-01522-3

Zhang, S.-R., Yang, B.-Y., & Peng, L. (2026). Educational value assessment of YouTube surgical videos of holmium laser enucleation of the prostate. *World Journal of Urology*, *44*(1). https://doi.org/10.1007/s00345-025-06109-y