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Mathematics Teachers as Designers of Learning: Exploring Design Thinking Experiences in Instructional Innovation

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Abstract

This qualitative case study examined how in-service mathematics teachers redesigned their classroom practices through design thinking as an approach to instructional innovation. Drawing on human-centered design, the study explored how teachers responded to students' learning needs, classroom contexts, and changing educational demands by developing new teaching practices. Specifically, it investigated teachers' experiences of redesigning mathematics instruction, the challenges they encountered, and the reflective practices that supported continuous improvement. Data consisted of teachers' reflective narratives and accounts of their innovation experiences, which were analyzed using qualitative content analysis. The findings showed that teachers based their instructional decisions on students' learning difficulties, including misconceptions, low engagement, language barriers, and challenges in understanding abstract mathematical concepts. They redesigned lessons by using contextualized and culturally relevant approaches, such as local materials, community-based activities, manipulatives, games, translanguaging, and hands-on learning experiences. These strategies helped make mathematics more meaningful, engaging, and accessible for students. The study also found that successful instructional innovation depended on continuous scaffolding, collaboration, active student participation, and the use of multiple learning approaches to strengthen conceptual understanding and reduce mathematics anxiety. At the same time, teachers faced challenges related to limited resources, time constraints, diverse student needs, and the additional preparation required to implement innovative lessons. Despite these challenges, they continued to improve their teaching through reflection, ongoing revision, and adaptation to their classroom contexts. The findings suggest that redesigning mathematics instruction through design thinking is an ongoing process in which teachers understand students' needs, develop and refine new instructional ideas, and adapt their practices based on classroom experiences. The study highlights the important role of teachers as reflective instructional designers and suggests that sustained innovation in mathematics education requires supportive school environments, professional collaboration, and opportunities for continuous learning and improvement.

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Introduction

Mathematics education continues to face persistent challenges related to learner engagement, conceptual understanding, mathematical anxiety, and the meaningful application of mathematical knowledge in real-life contexts (Amir & Ansari, 2026). Despite ongoing curriculum reforms and pedagogical innovations, many learners still perceive mathematics as abstract, difficult, and disconnected from their lived experiences (Organisation for Economic Co-operation and Development [OECD], 2024). These concerns are particularly evident in diverse and resource-constrained educational settings where learners encounter linguistic barriers, limited instructional resources, weak foundational numeracy skills, and minimal opportunities for experiential learning. Such realities call for instructional approaches that move beyond traditional teacher-centered delivery toward more responsive, contextualized, and learner-centered learning environments.

In contemporary educational discourse, innovation in mathematics teaching is increasingly viewed not merely as the integration of technology or novel activities, but as the intentional redesign of learning experiences grounded in learners' needs, contexts, and participation (Fernandez & Aclao, 2025). Teachers are therefore expected to function not only as content experts but also as instructional designers capable of creatively responding to classroom complexities. This evolving perspective highlights the importance of design thinking in education. Design thinking emphasizes empathy, problem identification, ideation, prototyping, testing, and continuous refinement in solving human-centered problems (Deng et al., 2026). Within mathematics education, design thinking enables teachers to examine learners' experiences, identify instructional barriers, redesign mathematical tasks, and create engaging and meaningful learning opportunities (Kannan et al., 2025).

The increasing emphasis on learner-centered and contextualized instruction has also shifted attention toward how teachers transform classroom realities into opportunities for instructional innovation. Mathematics teachers today are challenged to create inclusive environments that support conceptual understanding, participation, collaboration, and reflective learning while responding to diverse learner needs and contextual limitations. In many cases, teachers innovate through localized instructional materials, manipulative-based activities, culturally responsive approaches, translanguaging practices, and experiential learning tasks

that connect mathematics with learners' social and cultural realities (Gaylo, 2025). These innovations demonstrate how teachers redesign instruction not only to improve academic performance but also to humanize mathematics learning experiences.

However, while many studies have examined the effectiveness of instructional innovations in mathematics education, limited research has explored how mathematics teachers themselves experience the process of redesigning classrooms through design thinking. Existing studies often focus on learner outcomes, intervention effectiveness, or technology integration, with less attention given to the reflective, contextual, and iterative processes teachers undergo in creating instructional innovations (Gagaza & Sarmiento, 2022). Moreover, there remains limited understanding of how teachers negotiate implementation challenges, contextual constraints, learner diversity, and professional growth while sustaining innovative practices in actual classroom settings.

Understanding teachers' experiences in redesigning mathematics classrooms is significant because instructional innovation is deeply influenced by teachers' beliefs, reflections, contextual realities, and pedagogical decision-making. Examining these lived experiences may provide deeper insights into how teachers function as reflective instructional designers who continuously adapt instruction to create meaningful, inclusive, and engaging mathematics learning environments. Such understanding may also inform teacher education programs, professional development initiatives, and curriculum policies aimed at strengthening innovation and contextual responsiveness in mathematics education.

Objectives

This study explored how in-service mathematics teachers redesigned mathematics classrooms through design thinking for instructional innovation. Specifically, the study aimed to answer the following questions:

1. How do mathematics teachers ground classroom redesign on learners' experiences and contextual realities?
2. How do mathematics teachers contextualize mathematics learning through instructional design?
3. How do mathematics teachers design interactive and meaningful mathematics learning experiences?
4. What challenges do mathematics teachers encounter in redesigning mathematics classrooms through instructional innovation?

5. How do mathematics teachers sustain instructional innovation through reflective practice?

Conceptual Framework

This study is anchored on design thinking and constructivist learning perspectives, particularly the view of teachers as reflective instructional designers. Design thinking, popularized in educational and innovation contexts by Brown (2009), is a human-centered and iterative approach to problem-solving that involves understanding users' experiences, defining problems, generating ideas, prototyping solutions, testing innovations, and continuously refining practices. In educational settings, design thinking positions teachers as active designers of learning environments who creatively respond to learners' needs and classroom realities.

The study is also informed by constructivist learning theory, which posits that teachers actively construct knowledge through meaningful experiences, social interaction, and contextual engagement (Chand, 2023). Constructivist perspectives emphasize learner-centered instruction, collaboration, experiential learning, and scaffolding, all of which were evident in the teachers' instructional redesign practices. Teachers designed manipulatives, contextualized tasks, collaborative activities, games, and experiential learning experiences that enabled learners to actively participate in constructing mathematical understanding rather than passively receiving information.

Furthermore, the study draws from culturally responsive pedagogy, which emphasizes the importance of connecting instruction to learners' cultural backgrounds, lived realities, and community experiences (Samuels, 2018). The participating teachers integrated indigenous materials, local resources, contextualized datasets, and community-based experiences into mathematics instruction, demonstrating how culturally grounded practices support meaningful and inclusive learning. Taken together, these theoretical perspectives frame redesigning mathematics classrooms as a reflective, contextual, and human-centered process where teachers continuously empathize with learners, redesign instructional experiences, negotiate classroom realities, and refine practices to create engaging and meaningful mathematics learning environments.

Figure 1 presents the conceptual framework following the input, process, and output (IPO) model. The framework illustrates that classroom redesign is

influenced by various inputs, transformed through the design thinking process, and results in teachers' experiences in creating innovative and meaningful mathematics learning environments. The Input component represents the essential factors that influence teachers' instructional redesign practices. These include teacher-related factors, such as teachers' knowledge, beliefs, creativity, reflective practices, and willingness to innovate; contextual factors, which refer to learners' needs, classroom realities, cultural backgrounds, learning challenges, and school conditions; and resource inputs, including available instructional materials, local resources, technologies, and community-based materials. These inputs serve as the foundation that guides teachers in identifying instructional problems and designing appropriate learning experiences.

The Process component highlights the application of the Design Thinking Cycle as the mechanism through which teachers redesign mathematics instruction. Teachers begin by empathizing with learners to understand their experiences, difficulties, and needs. They then define specific learning problems, ideate possible instructional solutions, prototype learning materials and strategies, and test these innovations in actual classroom contexts. This iterative process allows teachers to continuously evaluate and improve their instructional approaches based on learner responses and classroom experiences.

The Output component represents the resulting teachers' design thinking experiences developed through the instructional redesign process. These experiences include teachers' improved capacity as reflective instructional designers, enhanced ability to create learner-centered and contextualized mathematics activities, and deeper understanding of how innovation can address classroom challenges. Through this process, teachers become active designers of meaningful, engaging, and culturally responsive mathematics learning environments. The framework emphasizes that instructional innovation is not a linear activity but a reflective and continuous process shaped by teachers, learners, and classroom contexts.

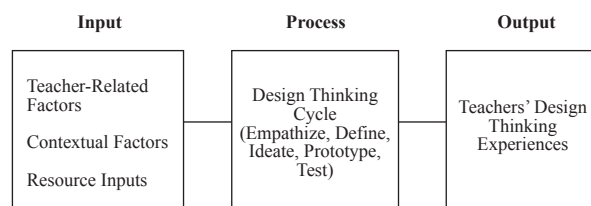


Figure 1. Conceptual Framework

Research Methodology

1. Research Design

This study employed a qualitative case study (Yin, 2018) to explore how in-service mathematics teachers redesigned mathematics classrooms through design thinking for instructional innovation. The case study approach enabled the researcher to examine instructional innovation as a bounded system situated within the participants' professional contexts, teaching environments, and classroom realities. The study particularly focused on how mathematics teachers experienced the process of identifying learner difficulties, contextualizing instruction, implementing learner-centered innovations, navigating classroom constraints, and sustaining reflective instructional redesign. Rather than isolating variables, the case study design allowed the researcher to investigate the complexity, interconnectedness, and contextual nature of instructional innovation in mathematics education. The case study design was appropriate because the study sought to generate an in-depth and contextually grounded understanding of teachers' lived instructional experiences, innovation practices, reflective processes, and classroom redesign efforts within real educational settings.

2. Population and Samples

The study was conducted among 12 purposively selected in-service mathematics teachers enrolled in a mathematics teaching course at a state university in Northern Mindanao, Philippines. The participants represented diverse teaching contexts, including rural and resource-constrained schools, multilingual classrooms, and culturally diverse communities. Their innovations included manipulative-based instruction, contextualized mathematics tasks, translanguaging strategies, game-based learning, scaffolded interventions, localized instructional materials, and culturally responsive teaching practices.

Participants were selected based on specific inclusion criteria to ensure that they could provide rich and relevant insights into instructional innovation in mathematics education. Eligible participants were those who were currently teaching mathematics in elementary, secondary, or related educational settings and were enrolled in graduate studies in Mathematics Education. In addition, participants must have developed or implemented an instructional innovation in mathematics teaching and demonstrated a willingness to share their reflective narratives and instructional experiences pertinent to the study. The participants were considered

appropriate sources of data because they possessed direct experiences in instructional redesign, contextualized teaching, and classroom innovation within actual mathematics learning environments.

3. Research Instrument

The primary research instrument used in this study was a reflective narrative guide specifically developed to elicit participants' experiences in redesigning mathematics classrooms through instructional innovation. The guide contained open-ended prompts that encouraged participants to provide rich and detailed descriptions of their classroom practices, instructional decisions, learner-related challenges, innovation development processes, reflections, successes, and areas requiring further improvement. Reflective narratives were selected because they enable participants to articulate their experiences, beliefs, and professional insights in their own words, thereby generating in-depth qualitative data that may not be captured through structured instruments alone. Through these narratives, the study was able to explore how teachers conceptualized, implemented, evaluated, and refined innovative instructional practices within their specific educational contexts.

In addition, a document analysis matrix was utilized to systematically examine participants' written reflections, innovation descriptions, lesson materials, photographs, instructional artifacts, and other supporting documents related to classroom implementation. The document analysis matrix served as a blueprint for identifying recurring concepts, instructional strategies, contextual factors, evidence of innovation, and indicators of reflective practice. These documentary sources complemented the reflective narratives by providing tangible evidence of the instructional innovations and allowing for data triangulation. The integration of reflective narratives and documentary evidence enabled a more comprehensive understanding of teachers' design thinking processes, contextualized instructional practices, and continuous efforts toward improving mathematics teaching and learning.

To establish the trustworthiness and rigor of the instruments, content validation was conducted prior to data collection. The reflective narrative guide and document analysis matrix were reviewed by experts in mathematics education, qualitative research, and instructional innovation to assess the relevance, clarity, comprehensiveness, and alignment of the questions with the study objectives. Suggestions provided by the validators were incorporated to improve the wording,

sequencing, and coverage of the prompts. Furthermore, the instruments were examined to ensure that they effectively captured dimensions related to instructional redesign, learner-centered innovation, contextualization, reflection, and professional growth. The validation process enhanced the credibility, dependability, and appropriateness of the instruments for generating meaningful and trustworthy qualitative data.

4. Collection of Data

Prior to data collection, the researcher secured the necessary permissions and informed consent from the participants. Ethical considerations such as voluntary participation, confidentiality, anonymity, and the right to withdraw from the study were observed throughout the research process. The researcher identified in-service mathematics teachers who met the inclusion criteria of the study. Participants were informed about the objectives, significance, and procedures of the research. Consent was secured before participation. Participants were asked to prepare reflective narratives discussing their experiences in redesigning mathematics classrooms through instructional innovation. The narratives focused on instructional redesign processes, learner-centered practices, contextualization strategies, implementation experiences, challenges encountered, and reflective professional growth.

The collected reflective papers, innovation descriptions, and related instructional narratives were retrieved, organized, and coded systematically. The researcher carefully reviewed the narratives to identify meaningful statements and recurring experiences related to design thinking and instructional innovation. The researcher revisited selected narratives for clarification and validation of emerging interpretations when necessary. This process helped ensure that the meanings derived from the narratives accurately reflected participants' experiences. Throughout the data gathering process, the researcher maintained ethical sensitivity and ensured that participants' identities and institutional affiliations remained confidential.

5. Data Analysis

The qualitative data generated from participants' reflective narratives, written outputs, and supporting documents were analyzed using the content analysis framework of Krippendorff (2019). This approach was employed to systematically examine textual data and uncover patterns, meanings, and themes relevant to the research questions. The analysis began with data preparation and familiarization, wherein all narratives

and documents were compiled, transcribed when necessary, and reviewed repeatedly to achieve immersion in the data. Following unitizing procedure, meaningful units of analysis, including words, phrases, sentences, and paragraphs that conveyed significant ideas or experiences, were identified and extracted. These meaning units were then subjected to inductive open coding, where labels were assigned to capture their essential meanings. The codes were continuously compared across the dataset to identify similarities, differences, and recurring patterns, allowing the analysis to remain grounded in participants' perspectives rather than predetermined assumptions.

Subsequently, related codes were clustered into categories based on conceptual similarities and refined through constant comparison to ensure consistency and representativeness. These categories were further synthesized into broader themes that captured the underlying meanings and shared experiences reflected in the data. Throughout the analytical process, themes were repeatedly reviewed against the original narratives to ensure coherence, credibility, and alignment with participants' intended meanings. To enhance the trustworthiness of the findings, peer debriefing, researcher reflexivity, and the maintenance of an audit trail documenting coding decisions and thematic development were employed. Representative excerpts from participants' reflections were also selected to support each theme and provide evidence for the interpretations.

Results and Discussion

This study explored how in-service mathematics teachers redesigned their classrooms through design thinking for instructional innovation. The analysis of teachers' reflective narratives revealed that instructional innovation emerged from teachers' continuous efforts to understand learner difficulties, contextualize mathematics instruction, design learner-centered experiences, negotiate implementation challenges, and sustain reflective improvement practices. Five major themes emerged from the data: (1) *Grounding Classroom Redesign in Learner Experiences*, (2) *Contextualizing Mathematics Learning through Instructional Design*, (3) *Designing Learner-Centered and Meaningful Mathematical Learning Experiences*, (4) *Confronting the Realities of Instructional Innovation*, and (5) *Sustaining Instructional Innovation through Reflective Community of Practice*.

Theme 1: Grounding Classroom Redesign in Learner Experiences

This theme highlights how teachers initiated the redesign of mathematics classrooms by carefully examining learners' struggles, disengagement, misconceptions, language barriers, and contextual limitations. Teachers demonstrated empathy by recognizing that traditional instructional approaches often failed to address the realities of learners, particularly those from rural and resource-limited settings. Their reflections reveal that meaningful instructional innovation begins with understanding learners' lived experiences and identifying the barriers that hinder mathematical learning.

Many teachers recognized that learners struggled with abstract mathematical concepts and disconnected instructional practices. Teacher Ana shared that she became aware of persistent challenges such as learners' low conceptual understanding, lack of engagement, and difficulty in applying mathematical concepts to real-life situations. Similarly, Teacher John noted that *"learners felt bored and uninterested because my lessons were not interactive and were rarely connected to real-life situations."* These narratives indicate that teachers viewed disengagement not merely as a learner problem but as an instructional design concern requiring pedagogical transformation. Gaylo & Dales (2017) further emphasized that even the most well-designed instructional efforts may yield limited learning outcomes when students remain disengaged from the learning process.

The findings illustrate how mathematics teachers increasingly function as instructional diagnosticians rather than mere content deliverers. In many rural and public-school settings, teachers encounter learners who can mechanically perform procedures but fail to explain mathematical reasoning or apply concepts to authentic situations. Such realities compel teachers to redesign lessons that move beyond rote computation toward inquiry, visualization, and contextualized problem-solving. Practically, this may involve introducing community-based examples, local data, or familiar scenarios to bridge abstract concepts with learners' lived experiences. The findings therefore imply that effective mathematics instruction requires continuous learner analysis, classroom observation, and responsiveness to student engagement patterns.

Beyond disengagement, the reflections revealed teachers' sensitivity to foundational learning difficulties and misconceptions. Teacher Mark identified persistent challenges in the four fundamental operations namely

addition, subtraction, multiplication, and division. Likewise, Teacher Mary shared that *"learners struggled distinguishing variables from constants and translating verbal phrases into algebraic expressions."* Teacher Jane similarly observed difficulties in algebraic expressions, operations involving integers, and mathematical problem-solving. These findings suggest that teachers' innovations were deeply rooted in diagnosing specific learner misconceptions and conceptual barriers. Sugawara et al. (2026) expounded that identifying and addressing learners' misconceptions is essential for effective mathematics instruction, as unresolved conceptual misunderstandings can impede students' long-term mathematical growth and achievement.

The findings emphasize the importance of formative assessment and learning diagnostics in mathematics education. Teachers are expected not only to teach competencies but also to uncover the underlying misconceptions that prevent conceptual understanding. In practice, mathematics teachers may redesign instruction by simplifying algebraic representations through manipulatives, scaffolded visual models, or concrete experiences before gradually transitioning learners toward abstraction. Such strategies are particularly relevant in classrooms where students experience mathematics anxiety or possess weak numeracy foundations. Consequently, the findings imply that teacher education and professional development programs should strengthen competencies in misconception analysis, differentiated instruction, and intervention design to support diverse learners effectively.

The narratives further highlighted contextual and linguistic inequalities affecting mathematics learning. Teacher Rose explained that *"rural learners struggled with financial mathematics because of limited language proficiency and the educational gap between rural and urban contexts."* Similarly, Teacher Jose pointed to the challenges rural students faced in understanding financial mathematics concepts due to language and contextual limitations. These findings underscore that teachers' instructional redesign efforts were responsive not only to cognitive needs but also to sociocultural and linguistic realities. Horn et al. (2025) similarly asserted that teachers' responsiveness to students' thinking, cultural backgrounds, linguistic diversity, emotions, and identities plays a crucial role in the learning process.

The findings demonstrate the necessity of culturally responsive and linguistically inclusive mathematics instruction. In multilingual and geographically

isolated communities, teachers often become translators of mathematical meaning by contextualizing terminologies, integrating local language scaffolds, and using familiar economic or agricultural examples. For instance, lessons on percentages, interest rates, or financial literacy may be connected to local farming income, sari-sari store transactions, or lending practices familiar to learners' families. Such approaches help reduce the cognitive distance between formal mathematics and everyday experiences. Supporting this perspective, Jimenez-Silva et al. (2025) employed collaborative inquiry cycles in which educators functioned as learners, contributors, and designers of practice, continuously implementing and reflecting on instructional strategies that leveraged students' linguistic and cultural strengths. Professionally, these findings imply that mathematics teachers require greater support in designing localized instructional materials and implementing translanguaging strategies that acknowledge linguistic diversity without compromising conceptual rigor.

The findings also reveal that empathy became a critical driver of instructional innovation. Teachers redesigned instruction because they recognized emotional barriers such as fear, frustration, disengagement, and lack of confidence among learners. This suggests that mathematics classroom redesign extends beyond improving academic performance; it also involves creating psychologically safe and motivating learning environments where students feel capable of participating in mathematical thinking and problem-solving.

Moreover, the results align with human-centered design perspectives, which emphasize empathy and responsiveness as fundamental foundations of innovation. The teachers' experiences suggest that instructional redesign in mathematics education begins when teachers intentionally seek to understand learners' lived experiences, frustrations, and contextual realities before developing interventions. More importantly, the findings position mathematics teachers as reflective instructional designers who continuously adapt and redesign classroom experiences in response to evolving learner needs, contextual conditions, and educational realities.

Theme 2: Contextualizing Mathematics Learning through Instructional Design

This theme reflects teachers' intentional redesign of mathematics instruction through contextualization, localization, cultural integration, and the use of familiar community experiences. Teachers transformed local resources into meaningful mathematical learning

opportunities that made mathematics more authentic, relevant, and accessible to learners. Rather than presenting mathematics as abstract and decontextualized content, teachers intentionally connected lessons to local experiences, cultural practices, indigenous materials, and community-based resources.

Several teachers localized mathematical tasks using familiar community experiences. Teacher Ana developed an innovative approach that integrated community-based experiences into teaching graphing skills. Likewise, Teacher Grace designed the data challenge, in which learners gathered vegetable production and sales data from their own communities, making graphing activities more authentic and relatable. These practices demonstrate how teachers leveraged familiar contexts to enhance learner engagement and increase the relevance of mathematical concepts. These findings position mathematics teachers as contextual curriculum designers who bridge academic competencies with learners' lived realities. Rather than treating mathematics as a collection of isolated procedures detached from everyday life, teachers reconstructed lessons to reflect the social, economic, and cultural environments of learners.

In practical classroom situations, this may involve integrating local farming statistics when teaching graphs, using market transactions to discuss percentages, or employing indigenous patterns in geometry lessons. Such practices enable learners to perceive mathematics not merely as a school subject but as a meaningful tool embedded in their communities and everyday decision-making processes. The findings imply that contextualization strengthens learner engagement because students are more likely to participate actively in lessons that reflect familiar experiences and realities. Supporting these findings, Legarde (2026) found that mathematics lessons grounded in learners' community experiences and culturally familiar practices enhanced the relevance of instruction and made abstract concepts more meaningful. Similarly, Diago & Dillo (2022) reported that mathematics teachers in Surigao integrated locally available indigenous materials into their instruction to support learners' understanding of mathematical concepts.

Beyond contextualization, the findings also highlighted the integration of cultural and indigenous elements into mathematics instruction. Teacher May utilized a beadwork activity in transforming statistical concepts into a hands-on and meaningful learning

experience. Similarly, Teacher Mary employed bamboo sticks to represent variables and river stones to represent constants within a Concrete–Representational–Abstract (CRA) guided algebra lesson. These innovations demonstrate how teachers situated mathematics learning within learners’ cultural and environmental realities. The results align with the work of Nur et al. (2022), who reported that Indonesian mathematics teachers widely recognized the presence of mathematical ideas embedded in cultural practices and artifacts. Most respondents believed that incorporating cultural contexts into mathematics instruction serves as a meaningful and effective strategy for learning mathematics.

From a professional perspective, these findings underscore the importance of culturally responsive mathematics teaching in promoting inclusivity and conceptual understanding. Teachers functioned not only as facilitators of mathematical knowledge but also as cultural mediators who intentionally connected mathematical ideas to indigenous materials, local crafts, and environmental resources. In practice, this may involve designing algebra activities using locally available objects, integrating weaving or beadwork patterns in statistics and geometry lessons, or contextualizing measurement concepts through agricultural and community practices. Such approaches help reduce learners’ perception of mathematics as abstract and foreign by grounding instruction in culturally recognizable experiences. Consequently, teacher preparation programs and curriculum developers should encourage the integration of indigenous knowledge systems and local cultural practices into mathematics instruction to strengthen relevance, inclusivity, and learner identity formation.

The findings further revealed that meaningful instructional innovation does not necessarily require expensive materials or advanced technologies. Teacher John reflected that *“the innovation used materials that are readily available in the school and community.”* Likewise, Teacher Grace emphasized that *“simple, low-cost, and localized activities can still produce meaningful learning outcomes.”* These reflections suggest that contextualization itself became a powerful instructional design strategy. These findings are particularly significant for public schools and geographically isolated schools with limited instructional resources. Teachers demonstrated that innovation can emerge from creativity, resourcefulness, and responsiveness rather than dependence on sophisticated technologies or commercially produced materials.

In many classroom contexts, teachers may redesign instruction using recycled objects, indigenous materials, locally gathered data, or community artifacts to support mathematical understanding. Such practices challenge the notion that instructional innovation is synonymous with high-cost technological integration and instead highlight the professional value of adaptive, low-cost, and sustainable instructional design. In consonance, Serdyukov (2017) argued that technology alone cannot guarantee productive and enriched learning experiences. In addition, Filiz, & Öztel, (2026) emphasized that contextualization enables learners to connect mathematical concepts and problems to their everyday experiences, thereby increasing the relevance and meaningfulness of learning. The authors further noted that guided reinvention allows learners to build upon prior knowledge and experiences to independently construct and discover new mathematical ideas.

Mathematics teachers may be empowered to redesign curriculum delivery flexibly according to contextual realities rather than relying solely on textbook-centered instruction. School leaders and curriculum planners may likewise support localized instructional development by creating opportunities for collaborative material design, contextualized lesson planning, and culturally responsive innovation initiatives. Moreover, the findings highlight the importance of valuing teacher creativity and local knowledge as legitimate sources of instructional innovation in mathematics education. More importantly, the findings reveal that contextualization is not merely an instructional technique but a transformative design approach that enables mathematics classrooms to become more inclusive, authentic, engaging, and socially connected learning spaces.

Theme 3: Designing Learner-Centered and Meaningful Mathematical Learning Experiences

This theme captures how teachers redesigned mathematics classrooms through learner-centered, participatory, and experiential instructional innovations. Teachers moved beyond traditional lecture-driven instruction toward collaborative, scaffolded, multimodal, manipulative-based, and meaningful learning experiences that actively engaged learners in constructing mathematical understanding. The findings reveal a deliberate shift from viewing learners as passive recipients of knowledge to positioning them as active participants in mathematical exploration and meaning-making.

One of the most prominent instructional redesign

strategies involved the use of manipulative-based, game-based, and multimodal learning experiences. Teacher John developed a place value playboard to strengthen learners' understanding of decimal place value, while Teacher Joan created a game-based learning material that allowed students to actively participate, collaborate, and practice skills repeatedly in a fun way. Likewise, Teacher June introduced the mnemonic technique as a kinesthetic strategy to support trigonometric recall. These innovations demonstrate how teachers intentionally transformed mathematics learning into active, embodied, and interactive experiences rather than passive reception of content.

These findings highlight the evolving role of mathematics teachers as designers of learning experiences rather than mere transmitters of information. Teachers intentionally structured activities where learners manipulate objects, interact with peers, move physically, and engage cognitively with mathematical ideas. In practical classroom settings, this may involve students using improvised manipulatives to model algebraic relationships, participating in mathematical games to reinforce operational skills, or employing body movements and gestures to strengthen memory retention. Such practices are especially beneficial in addressing abstract mathematical concepts that learners often find intimidating and disconnected from experience. The findings imply that effective mathematics instruction increasingly requires experiential and multimodal pedagogies that accommodate diverse learning styles and promote active learner participation.

Supporting these findings, Simms et al. (2018) reported that research on mathematics instructional approaches consistently demonstrates that creative and innovative teaching methods can be more effective than traditional forms of instruction in enhancing student learning. Similarly, Escalaw (2024) recommended the continued use of multimodal teaching approaches in mathematics education, citing their significant positive impact on student learning outcomes.

Beyond manipulative-based innovations, teachers also emphasized scaffolding and experiential learning as critical instructional redesign strategies. Teacher Jane developed the a three-phase strategy to simplify difficult procedures into manageable steps. Likewise, Teacher Ana observed that *"contextualized and scaffolded instruction can significantly enhance learning outcomes,"* while Teacher Mary noted that the use of concrete materials improved learners' conceptual understanding

and participation. These practices reflect teachers' efforts to reduce mathematical anxiety and facilitate conceptual progression from simple to complex ideas. By making mathematical concepts tangible, interactive, and enjoyable, teachers created psychologically safe learning environments where learners felt more comfortable exploring ideas and participating in classroom discussions.

The results underscore the importance of instructional scaffolding in mathematics education. Teachers recognized that learners require guided progression from concrete experiences toward abstract reasoning, particularly when foundational numeracy skills remain weak. In actual classroom situations, scaffolding may involve chunking procedures into smaller tasks, utilizing visual organizers, modeling step-by-step solutions, or gradually transitioning learners from manipulatives to symbolic representations. Such strategies are particularly critical in inclusive classrooms where learners demonstrate varying levels of readiness and learning pace. The findings therefore imply that instructional redesign should consider cognitive sequencing and developmental readiness to support deeper conceptual understanding.

The findings likewise highlighted the importance of collaborative and participatory learning. Teachers reported increased learner engagement, confidence, and interaction during innovative classroom activities. Teacher Ana observed that *"students became more active and participative during lessons,"* while Teacher John shared that *"the class became lively."* These observations suggest that instructional redesign encouraged teachers to create learning environments that prioritize learner agency, participation, and shared meaning-making.

Collaborative learning environments provide opportunities for learners to verbalize mathematical thinking, negotiate ideas, and solve problems collectively. In many classroom situations, group activities, peer discussions, and cooperative tasks encourage students to explain reasoning processes, ask questions freely, and learn from one another's perspectives. Such participatory structures shift classroom dynamics from teacher-dominated recitation toward shared mathematical inquiry. Professionally, the findings imply that mathematics instruction should cultivate communication, collaboration, and reasoning competencies alongside procedural fluency. These learner-centered environments likewise align with the development of 21st-century skills emphasized in contemporary educational reforms.

The findings further indicate that experiential and

participatory innovations contribute to more meaningful and sustained mathematical understanding. Rather than merely memorizing isolated procedures, learners engage in mathematical exploration through hands-on activities, real-time feedback, and reflective participation. In practical settings, this may result in stronger knowledge retention, improved problem-solving confidence, and greater willingness to engage in challenging mathematical tasks. The findings therefore suggest that instructional innovation becomes transformative when learners are actively involved in constructing and experiencing mathematical meaning. More importantly, the findings reveal that redesigning mathematics classrooms through interactive and meaningful learning experiences transforms mathematics from a procedural subject into a dynamic, participatory, and engaging process of exploration, understanding, and knowledge construction.

Theme 4: Confronting the Realities of Instructional Innovation

This theme highlights the realities, tensions, and constraints teachers encountered while redesigning mathematics classrooms. Although instructional innovations generated positive learning outcomes, teachers recognized that meaningful redesign required significant time, preparation, flexibility, and adaptation to diverse learner needs and contextual limitations. The findings reveal that innovation is a complex and demanding process characterized by continuous negotiation between instructional aspirations and classroom realities.

One of the most frequently reported challenges involved the extensive preparation required to design and implement innovative instructional practices. Teacher Ana explained that *“the time required to design and implement contextualized activities was demanding”*. Similarly, Teacher John noted that *“developing the intervention required time, effort, and careful planning,”* while Teacher Joan emphasized that *“designing instructional games demanded time, creativity, and careful planning.”* These experiences suggest that instructional innovation requires labor-intensive preparation that extends far beyond conventional lesson delivery. These findings underscore the often-unrecognized workload associated with innovative teaching. Teachers were not merely implementing lessons but were simultaneously conceptualizing interventions, designing materials, testing strategies, documenting implementation processes, and revising activities based on learner responses.

In school settings, being innovative often requires teachers to devote additional hours to preparing

manipulatives, contextualized examples, assessment tools, and instructional resources beyond their regular teaching responsibilities. Such realities become particularly challenging in public-school environments where teachers manage heavy teaching loads, administrative assignments, co-curricular functions, and large class sizes. The findings therefore imply that sustainable instructional innovation requires institutional recognition of teachers’ design work as a legitimate and demanding professional practice.

Beyond preparation demands, teachers also encountered challenges related to learner adjustment and diverse readiness levels. Teacher Ana shared that “students initially struggled to adjust to a more active learning approach,” while Teacher Mary observed that “some learners experienced difficulties transitioning from concrete representations to abstract mathematical concepts.” Likewise, Teacher Grace noted that “some learners struggled with reading tables or interpreting scales.” These findings indicate that learner-centered innovation requires continuous differentiation, scaffolding, and responsiveness to diverse learner needs.

From a practical perspective, these findings highlight the complexity of implementing learner-centered pedagogies in heterogeneous classrooms. Teachers frequently worked with learners who varied in confidence, literacy skills, mathematical proficiency, and readiness for independent learning. In many classroom situations, some learners quickly adapted to collaborative and exploratory activities, whereas others required repeated demonstrations, structured guidance, and individualized support. Consequently, teachers continuously redesigned activities and adjusted instructional approaches to ensure inclusivity and equitable participation. The findings therefore suggest that differentiated instruction and flexible scaffolding are essential competencies for mathematics teachers engaged in instructional innovation.

Furthermore, results indicate that innovation requires professional resilience, adaptability, and reflective problem-solving. Teachers often modified strategies when initial implementations did not immediately yield the desired outcomes. In actual classroom situations, learners may resist active learning approaches because they are more accustomed to teacher-centered instruction and procedural memorization. Such circumstances compel teachers to revisit pacing, instructions, grouping structures, and scaffolding techniques. These experiences suggest that instructional

innovation should not be evaluated solely by immediate success but also by teachers' capacity to adapt, refine, and persist through implementation challenges. With these, teacher preparation and professional development programs should equip teachers with competencies in scaffolding, formative assessment, classroom facilitation, and adaptive instruction.

Resource limitations and time constraints likewise emerged as persistent concerns. Teacher May described the difficulty of implementing and documenting innovations with limited materials and technology. Teacher Rose highlighted the challenge of preparing bilingual instructional materials, while Teacher John emphasized restricted implementation time because of school schedules. These findings suggest that innovative mathematics instruction requires institutional support, flexibility, and sustained access to professional resources. Similar observations were reported by Gaylo (2025) in a study examining mathematics teachers' practice-based instructional transformation.

The findings reflect the realities faced by many teachers working in geographically isolated and resource-constrained schools. Innovation often occurred despite limited access to technology, inadequate instructional materials, and constrained implementation time. Teachers demonstrated remarkable creativity and resourcefulness by improvising materials and utilizing available community resources; however, such efforts also exposed structural limitations within educational systems. In actual practice, teachers may struggle to sustain innovations when resources, preparation time, and administrative support remain insufficient. It implies that innovation cannot depend solely on individual teacher initiative but must be supported through broader systemic and institutional mechanisms. School leaders and educational institutions play a critical role in sustaining innovative instructional practices.

The findings additionally reveal that instructional innovation is inherently iterative and nonlinear. Teachers frequently encountered trial-and-error situations where activities required revision, pacing needed adjustment, and instructional strategies had to be modified in response to learner feedback and classroom realities. In practical terms, redesigning mathematics classrooms involves continuous experimentation, reflection, and adaptation rather than implementing fixed teaching formulas. Teachers therefore functioned as reflective practitioners who responded dynamically to emerging classroom needs and contextual conditions. More importantly, the findings

reveal that meaningful mathematics classroom redesign requires not only teacher creativity and commitment but also supportive institutional structures, professional collaboration, and systemic recognition of the complexities involved in sustaining instructional innovation.

Theme 5: Sustaining Instructional Innovation through Reflective Community of Practice

This theme highlights how teachers viewed instructional innovation as a continuous cycle of reflection, refinement, collaboration, and professional growth. Rather than perceiving innovation as a one-time intervention, teachers emphasized the importance of ongoing redesign, continuous improvement, and sustained commitment to enhancing mathematics teaching and learning. The findings suggest that meaningful instructional innovation is sustained through reflective practice, collaborative learning, and a shared commitment to addressing evolving learner needs.

Reflection emerged as a central mechanism for professional learning and instructional improvement. Teacher Ana shared that she learned the value of reflection in improving my teaching practice, while Teacher May reflected that *"the experience helped her grow not only as a Mathematics teacher but also as a professional and as an individual."* These reflections indicate that instructional innovation extended beyond the development of teaching strategies and contributed to the transformation of teachers' pedagogical identities and perspectives toward teaching. These narratives position reflective practice as a critical competency in mathematics instructional design. Teachers did not simply implement strategies mechanically; rather, they continuously examined learner responses, classroom dynamics, and instructional outcomes to refine their practices.

In the classroom, this reflective process may involve revisiting lesson pacing, modifying activities after observing learner confusion, redesigning assessment approaches, or adapting instructional materials to improve participation and conceptual understanding. Such practices demonstrate that effective mathematics teaching requires ongoing professional inquiry and self-evaluation rather than reliance on fixed instructional routines. The findings therefore imply that reflective teaching should be cultivated as a sustained professional habit within mathematics education.

The findings further suggest that reflective practice contributes to the development of teachers' professional identities and adaptive expertise. Through

continuous reflection, teachers became more aware of their roles not only as instructors but also as innovators, facilitators, and designers of learning experiences. In practical terms, reflective teachers are more likely to become responsive to learner diversity, open to experimentation, and willing to redesign classroom experiences based on evidence and observation. This transformation is particularly significant in mathematics classrooms where traditional lecture-based practices often remain dominant. Supporting this perspective, Fabrigas & Taban (2023) emphasized the importance of establishing communities of practice among mathematics teachers to promote collaboration, shared learning, and the continuous improvement of mathematics instruction. Professionally, these findings imply that reflective practice strengthens teachers' adaptive expertise and instructional decision-making capacities in increasingly complex educational environments.

Beyond reflection, teachers emphasized the continuous refinement and scalability of instructional innovations. Teacher Jane stated that *"innovation is a continuous process,"* while Teacher Joan likewise emphasized that *"innovation in teaching is an ongoing process."* Teacher Rose proposed developing innovations for broader implementation, and Teacher Mark envisioned transforming manipulative-based strategies into digital formats. These aspirations suggest that teachers viewed innovation as sustainable, expandable, and capable of extending beyond immediate classroom contexts.

The findings further suggest that sustaining innovation requires long-term professional commitment and collaborative support systems. Teachers demonstrated aspirations not only to improve existing practices but also to scale innovations, explore emerging pedagogies, and continuously adapt to educational changes. Such commitment reflects the emergence of reflective practitioners who view professional growth as lifelong, iterative, and collaborative. The results underscore the importance of institutional structures that sustain innovation beyond isolated classroom efforts and transform it into a shared professional endeavor. More importantly, the findings reveal that sustaining instructional innovation requires reflective professionalism, collaborative communities of practice, institutional support, and continuous redesign efforts that enable teachers to respond meaningfully to evolving learner needs and educational realities.

Conclusion

The reflective narratives revealed five interconnected themes that characterize teachers' instructional innovation experiences: (1) *Grounding Classroom Redesign in Learner Experiences*, (2) *Contextualizing Mathematics Learning through Instructional Design*, (3) *Designing Learner-Centered and Meaningful Mathematical Learning Experiences*, (4) *Confronting the Realities of Instructional Innovation*, and (5) *Sustaining Instructional Innovation through Reflective Community of Practice*. Collectively, these themes illustrate how teachers navigate the complex process of redesigning mathematics classrooms by balancing learner needs, contextual relevance, instructional creativity, practical constraints, and ongoing professional learning.

This study reveals that redesigning mathematics classrooms through design thinking is not simply an act of introducing new teaching strategies, but a deeper professional reorientation in how teachers understand learning, learners, and the purpose of mathematics education itself. The experiences of the in-service mathematics teachers suggest that instructional innovation emerges when teachers move beyond viewing mathematics as a fixed body of procedures and instead approach it as a lived, contextual, and human-centered experience that must be continuously reconstructed in response to learners' realities.

The study further highlights that meaningful innovation in mathematics education is fundamentally relational and reflective. Teachers redesigned instruction not because of institutional mandates alone, but because they encountered learners who were disengaged, intimidated, linguistically challenged, or disconnected from mathematical abstractions. In this sense, innovation became an ethical and responsive practice grounded in empathy, care, and professional responsibility. The redesign of mathematics classrooms therefore reflects a shift from content transmission toward designing inclusive environments where learners can meaningfully participate, explore, and construct mathematical understanding.

The findings also suggest that instructional innovation is deeply shaped by contextual realities. The teachers' experiences challenge dominant assumptions that educational innovation depends primarily on advanced technologies or standardized interventions. Instead, the study demonstrates that transformative mathematics instruction may emerge from localized resources, indigenous materials, community experiences,

and culturally meaningful practices. This highlights the professional creativity of teachers who, despite limited resources and structural constraints, continuously negotiate ways to make mathematics accessible and relevant to learners. Innovation, therefore, becomes less about technological sophistication and more about contextual responsiveness and pedagogical intentionality.

Moreover, the study underscores that redesigning mathematics classrooms is neither linear nor effortless. Innovation involves uncertainty, experimentation, revision, and sustained reflection. Teachers continuously balanced curricular demands, learner diversity, institutional limitations, and classroom realities while refining their practices. This suggests that instructional redesign is an ongoing process of professional inquiry where teachers learn through implementation, reflection, and adaptation. Such a process positions teachers not merely as practitioners of prescribed methods but as reflective instructional designers capable of generating context-sensitive pedagogical solutions.

The study additionally reveals that reflective practice serves as the sustaining force behind instructional innovation. Reflection enabled teachers to critically examine learner responses, refine interventions, and rethink their assumptions about teaching and learning mathematics. Through this process, teachers developed stronger professional identities as innovators, facilitators, and designers of learning experiences. The findings therefore imply that sustainable innovation in mathematics education requires cultivating reflective professionalism, collaborative learning cultures, and institutional environments that value experimentation, creativity, and continuous improvement.

Ultimately, the study contributes to a broader understanding of mathematics teaching as a dynamic design practice shaped by empathy, contextual awareness, and reflective action. Redesigning mathematics classrooms through design thinking repositions teachers as active creators of meaningful learning experiences who continually negotiate between theory and practice, structure and flexibility, innovation and constraint. More importantly, the study suggests that the transformation of mathematics education begins not solely through curricular reforms or technological integration, but through teachers' capacity to critically and compassionately redesign learning in ways that honor the experiences, identities, and possibilities of learners.

Suggestions

Mathematics teachers may continuously redesign instructional practices by grounding lessons in learners' experiences, local contexts, and community realities. Teachers may strengthen learner-centered approaches through the use of manipulatives, contextualized activities, collaborative learning, translanguaging strategies, and experiential tasks that make mathematics more meaningful and engaging. Teachers may also cultivate reflective practice by regularly evaluating learner responses, revising instructional strategies, and conducting classroom-based action research to improve teaching effectiveness.

School leaders may establish supportive environments that encourage instructional innovation and reflective teaching practices. Schools may provide dedicated time, professional learning opportunities, instructional resources, and collaborative spaces for teachers to design, pilot, and refine innovative mathematics instruction. Administrators may also recognize and support teacher-led innovations through mentoring programs, innovation showcases, and school-based research initiatives that sustain professional growth and classroom redesign efforts.

Teacher education institutions may strengthen pre-service and graduate mathematics education programs by integrating design thinking, contextualized instruction, culturally responsive pedagogy, and instructional innovation into teacher preparation curricula. Greater emphasis may also be placed on reflective practice, experiential learning design, classroom-based research, and adaptive instructional planning to prepare future mathematics teachers as instructional designers capable of responding to diverse educational realities.

Curriculum developers and policymakers may encourage flexible and contextualized curriculum implementation that allows teachers to localize mathematics instruction according to learners' needs and sociocultural contexts. Policies and curriculum frameworks may support learner-centered, participatory, and culturally responsive instructional approaches rather than overreliance on textbook-driven instruction. Furthermore, professional development programs may focus on design thinking, contextualized innovation, inclusive pedagogy, and technology integration in mathematics education.

Future studies may further examine the long-term effects of design thinking-based instructional innovations on learner achievement, mathematical reasoning,

engagement, and confidence across different educational contexts. Researchers may also explore quantitative, mixed methods, or longitudinal approaches to investigate the sustainability and scalability of contextualized mathematics innovations. Additional studies may examine how institutional support, leadership practices, and professional learning communities influence teachers' capacities to sustain instructional redesign and innovation.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

ChatGPT was used for enhancing the language clarity and on improving the grammar during the preparation of this manuscript. The final content was reviewed and edited by the author, who will take full responsibility for the accuracy and integrity of the publication.

Conflict of interests

The authors declare no conflict of interests.

References

- Amir, M., & Ansari, A. (2026). Challenges related to mathematics education. *International Journal of Multidisciplinary Research*, 8(1), 1–9. <https://doi.org/10.36948/ijfmr.2026.v08i01.69466>
- Brown, T. (2009). *Change by design: How design thinking creates new alternatives for business and society*. Harvard Business Press.
- Chand, S. P. (2023). Constructivism in education: Exploring the contributions of Piaget, Vygotsky, and Bruner. *International Journal of Science and Research*, 12(7), 274–278. <https://doi.org/10.21275/SR23630021800>
- Deng, Y., Lucas, C., & Liu, W. (2026). A systematic review of design thinking implementations in higher engineering education. *European Journal of Engineering Education*, 1–41. <https://doi.org/10.1080/03043797.2026.2640060>
- Diago, P. N., & Dillo, L. R. (2022). The practices of Filipino teachers in contextualizing mathematics. *International Journal of Science and Research*, 11(7), 318–325. <https://doi.org/10.21275/ART20204104>
- Escalaw, M. (2024). Revolutionizing math education: The impact of multimodal teaching approaches. *EPRA International Journal of Research and Development*, 9(7), 21–26.
- Fabrigas, J. P., & Taban, J. G. (2023). Contextualization and localization of teaching mathematics in the new normal. *The Asian Journal of Education and Human Development*, 4(1), 153–166.
- Fernandez, R. S., & Aclao, J. T. (2025). Trends and innovations in mathematics education: A bibliometric review of pedagogical methods, technological integration and global perspectives. *Psychology and Education: A Multidisciplinary Journal*, 50(7), 837–843. <https://doi.org/10.70838/pemj.500705>
- Filiz, T., & Öztel, N. Ç. (2026). Strategy instruction integrated with realistic mathematics education: A design-based research on teaching word problem solving to students with learning disabilities. *Thinking Skills and Creativity*, 61, Article 102203. <https://doi.org/10.1016/j.tsc.2026.102203>
- Gagaza, M., & Sarmiento, C. (2022). Investigating mathematics teachers' perceived design thinking mindset and related factors. In *Proceedings of the 2022 13th International Conference on E-Education, E-Business, E-Management, and E-Learning (IC4E '22)* (pp. 59–64). Association for Computing Machinery. <https://doi.org/10.1145/3514262.3514291>
- Gaylo, D. (2025). Learning by design: An exploration of mathematics teachers' practice-based transformation. *Journal of Multidisciplinary in Social Sciences*, 21(2), 180–191.
- Gaylo, D. N., & Dales, Z. I. (2017). Metacognitive strategies: Their effects on students' academic achievement and engagement in mathematics. *World Review of Business Research*, 7(2), 35–55. <https://doi.org/10.5281/zenodo.3951851>
- Horn, I., Aggöl, Y., Li, S., & Hood, C. (2025). Teachers' subjectivities in responsive instruction: When ambitious practice encounters challenging teaching situations. *Instructional Science*, 53, 1889–1909. <https://doi.org/10.1007/s11251-025-09742-7>
- Jimenez-Silva, M., Martin, R., Restani, R., Abdelrahim, S., & Albano, T. (2025). Supporting multilingual students' mathematical discourse through teacher professional development grounded in design-based research: A conceptual framework. *Education Sciences*, 15(6), 778. <https://doi.org/10.3390/educsci15060778>
- Kannan, K., Patil, K., Dharmavaram, A., Shukla, P., & Kumar, S. (2025). Design thinking for innovative solutions for math education. In *2025 International Conference on Computing for Sustainability and Intelligent Future (COMP-SIF)* (pp. 1–6). IEEE. <https://doi.org/10.1109/COMP-SIF65618.2025.10969899>
- Krippendorff, K. (2019). *Content analysis: An introduction to its methodology* (4th ed.). SAGE Publications. <https://doi.org/10.4135/9781071878781>
- Legarde, M. A. (2026). Reimagining mathematics education through context and culture: Emerging opportunities and pedagogical challenges. *Journal of Qualitative Research in Education*, 46, 131–144. <https://doi.org/10.54963/jqre.i46.2307>
- Nur, A. S., Kartono, Zaenuri, & Rochmad. (2022). Teacher's perception of culture-based mathematics learning. *AIP Conference Proceedings*, 2633(1), 030007. <https://doi.org/10.1063/5.0102825>

- Organisation for Economic Co-operation and Development. (2024). *An evolution of mathematics curriculum: Where it was, where it stands and where it is going*. OECD Publishing. <https://doi.org/10.1787/0ffd89d0-en>
- Samuels, A. J. (2018). Exploring culturally responsive pedagogy: Teachers' perspectives on fostering equitable and inclusive classrooms. *SRATE Journal*, 27(1), 22–30.
- Serdyukov, P. (2017). Innovation in education: What works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*, 10(1), 4–33. <https://doi.org/10.1108/JRIT-10-2016-0007>
- Simms, V., Gilmore, C., Sloan, S., & McKeaveney, C. (2018). Protocol for a systematic review: Interventions to improve mathematics achievement in primary school-aged children: A systematic review. *Campbell Systematic Reviews*, 14(1), 1–26. <https://doi.org/10.1002/CL2.215>
- Sugawara, M., Sekao, D., & Sibiya, M. R. (2026). Investigating learners' misconceptions on division of whole numbers to identify a goal of research lesson: A case of lesson study. *International Electronic Journal of Mathematics Education*, 21(1), Article em0863. <https://doi.org/10.29333/iejme/17700>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage Publications.