STAKEHOLDER PERSPECTIVES ON DESIGNING ONLINE MATHEMATICS LEARNING FOR SMALL RURAL SCHOOLS*

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Received 3 December 2025; Revised 18 December 2025; Accepted 20 December 2025

Abstract

This qualitative descriptive study explored stakeholder perspectives on designing online mathematics learning for small rural schools in Surin Province, Thailand. Through focus group discussions with 10 participants (1 administrator, 1 teacher, 4 parents, and 4 students), the research utilized the McKenney and Reeves (2012) framework examining problem-related, context-related, and needs-related dimensions. Findings revealed three key themes: (1) Problems—limited technology infrastructure, budget constraints, and insufficient teacher digital competencies; (2) Context—rural location with economic limitations but strong community collaboration; and (3) Needs—continuous support for technology access, teacher professional development, and accessible learning resources. Results indicate that leveraging strengths and opportunities while systematically addressing weaknesses and mitigating threats is essential for developing effective online learning environments that promote educational equity in small rural schools.

Citation:

* Tontrakarn Tinnorot, Wannatida Yonwilad and Unyaparn Sinlapaninman. Stakeholder Perspectives On Designing Online Mathematics Learning For Small Rural Schools. Journal of Interdisciplinary Social Development, 3(6), 1263-1281.;

DOI: https://doi.org/10.

Website: https://so12.tci-thaijo.org/index.php/JISDIADP/

Keywords: Online Mathematics Learning, Design-Based Research, Stakeholder Engagement, Small Rural School, Educational Equity

Introduction

Mathematics education in small rural schools in Thailand faces substantial challenges affecting both student performance and instructional quality. The Sustainable Development Goals (SDGs), especially SDG 4 emphasizing inclusive and equitable quality education, have catalyzed initiatives to enhance educational accessibility and effectiveness in these contexts (Zakeri et al., 2023). The Surin Provincial Education Development Plan (2023–2027) recognizes these challenges and places the Secondary Educational Service Area Office Surin (SESAS) at the forefront of educational reform through the "One School, Three Models" initiative, aiming to reduce high dropout rates and expand learning opportunities (Li et al., 2020).

Rural education faces systemic problems including inadequate administrative support, limited teacher digital competencies, and insufficient access to digital tools (Barrot et al., 2021). These challenges are intensified by socioeconomic factors, as students from lower-income families frequently experience inequities in learning environments, particularly during events like the COVID-19 pandemic (Azis et al., 2022). The demand for effective online learning frameworks has become urgent, highlighting the need for pedagogical innovation and technology integration to improve mathematics learning outcomes—a subject students often find challenging (Putjorn et al., 2018; Rovai & Jordan, 2004).

Despite the acknowledged need to enhance online education in rural areas, empirical studies on effective design principles specific to these environments remain scarce. Existing literature often neglects the crucial perspectives of primary educational stakeholders—students, teachers, parents,

and school administrators—who can offer significant insights into the requirements and obstacles of implementing online mathematics learning (Galinggan, 2021).

Previous research has underscored the importance of stakeholder engagement, indicating that incorporating diverse perspectives is essential for developing effective solutions aligned with particular educational contexts (Pudpong et al., 2017). However, there is limited practical guidance on how to systematically gather and integrate stakeholder input in the design of online mathematics learning for rural contexts.

This study addresses these gaps by performing a comprehensive analysis of stakeholder perspectives regarding the design and development of online learning specifically aimed at enhancing mathematics problem-solving skills in small rural schools in Surin Province, Thailand. The research employs focus group discussions informed by the McKenney and Reeves (2012) framework to investigate three fundamental dimensions: (1) problem-related, (2) context-related, and (3) needs-related.

Objectives

This study aims to explore stakeholder perspectives for designing online mathematics learning in small rural schools. The objectives are to:

1. Identify the problems and challenges in online mathematics learning
2. Analyze the context and factors affecting implementation in rural schools
3. Explore the needs and requirements for effective online learning design

Methodology

Research Design

This study employed a qualitative descriptive research design using focus group discussions to explore stakeholder perspectives on designing online learning for mathematics in small rural schools. The research was guided by the McKenney and Reeves (2012) framework, which structures inquiry around three key dimensions: problem-related, context-related, and needs-related aspects.

Participants

Participants were selected through purposive sampling from a small rural school under the Secondary Educational Service Area Office (SESAO) in Surin Province, Thailand. The school was selected as a representative case of small rural schools in the region, exhibiting typical characteristics including limited resources, small student populations, and geographic isolation. The sample comprised four stakeholder groups totaling 10 participants: (1) one school administrator with experience managing small rural schools; (2) one Grade 9 mathematics teacher; (3) four parents of Grade 9 students; and (4) four Grade 9 students. All participants volunteered to participate and provided informed consent in accordance with ethical research standards.

The sample size of 10 participants was determined based on principles of information power, which suggests that smaller samples are appropriate when: (a) the study aims are narrow and specific, (b) sample specificity is high, (c) established theory is applied, (d) high-quality dialogue is achieved, and (e) analysis strategy is systematic. This study met these criteria through its focused research objectives, purposively selected participants with direct experience in rural mathematics education, application of the McKenney and Reeves framework, separate focus groups enabling in-depth discussion, and structured thematic analysis.

Data Collection

Data were gathered via semi-structured focus group discussions utilizing an interview protocol modified from McKenney and Reeves (2012). The protocol consisted of 11 questions organized into three categories: (1) problem-related questions addressed challenges and obstacles in mathematics learning and online education (4 questions); (2) context-related questions examined environmental, cultural, and socioeconomic factors of rural schools (5 questions); and (3) needs-related questions identified expectations, requirements, and desired support for online learning (2 questions).

To promote open discussion, focus groups were held onsite at the school separately for each stakeholder group. Sessions lasted approximately 30 minutes for administrators and teachers and 90 minutes for parent and student groups. All discussions were audio-recorded with participants' permission and transcribed verbatim for analysis.

Data Analysis

Data analysis employed content analysis following the McKenney and Reeves framework to identify themes related to problems, contexts, and needs across stakeholder groups. The process involved: (1) familiarization with transcripts through repeated reading; (2) initial coding using deductive codes based on the framework; (3) iterative refinement of codes through constant comparison; and (4) theme identification and interpretation. To enhance trustworthiness, two researchers independently coded a subset of transcripts and discussed discrepancies until consensus was reached. Member checking was conducted by sharing preliminary findings with two participants from each stakeholder group to validate interpretations.

Ethical Considerations

This study adhered to ethical research standards. All participants provided informed consent and were assured of confidentiality and anonymity.

Participants were informed of their right to withdraw at any time without consequences. Data were stored securely and accessible only to the research team.

Results

The analysis of focus group discussions with 10 stakeholders (1 administrator, 1 teacher, 4 parents, and 4 students) revealed three key areas aligned with the research objectives. Table 1 provides an overview of key findings by stakeholder group.

Table 1. Summary of Key Findings by Stakeholder Group

Stakeholder	Key Issues
Administrator	Difficult curriculum content; student cognitive readiness; low achievement; negative attitudes; need for interesting media and methods
Teacher	Curriculum-reality gap; student struggle with concepts; lack of foundational knowledge; need for daily-life relevant content and reduced expectations
Parents	Varied engagement; motivation issues; phone/game addiction; need for clear explanations from beginning; stricter expectations
Students	Classroom noise; rapid pacing; fear of exams; need for slower explanations, sufficient time, and peer support

1. Problems and Challenges in Online Mathematics Learning (Objective 1)

1.1 Administrator Perspective

The school administrator identified several interconnected challenges affecting mathematics education. First, curriculum content was perceived as too difficult for the student population, causing students to learn slowly and lose motivation. The administrator noted, "In some content areas, it is very difficult. Students learn slowly, which makes them not want to learn and dislike mathematics." Second, the administrator recognized that mathematics is particularly challenging for lower-achieving students who struggle to understand the material. Multiple root causes were identified: student cognitive readiness, content difficulty, teaching methods, and teacher preparation. These challenges manifest in low academic achievement and negative student attitudes toward mathematics, with the administrator observing that "students have low achievement in mathematics and do not want to learn mathematics."

1.2 Teacher Perspective

The mathematics teacher articulated a fundamental gap between curriculum expectations and classroom reality, stating, "There is a gap and some conflict because the goals and objectives set by the curriculum are very difficult to achieve with small rural schools where students are not ready to learn mathematics—whether it be foundational knowledge, teaching media, or students' attitudes toward mathematics." This gap creates significant pedagogical challenges. The teacher described how students struggle with complex content, cannot visualize concepts, do not understand real-world applications, and fear making mistakes in their thinking.

Regarding student behavior, the teacher observed that "most students do not give much importance to learning this subject because they think it is difficult, boring, and their foundation is not good—they think it is not relevant to daily

life." However, the teacher also noted a minority of motivated students who view mathematics as challenging in a positive way, demonstrating strong attention and concentration. The classroom atmosphere requires substantial teacher energy to stimulate student interest, reduce tension, and decrease workload, with the teacher admitting that sometimes "reducing the difficulty of content means we don't reach the learning objectives."

1.3 Parent Perspectives

Parent perspectives varied considerably, revealing diverse family situations and student engagement levels. Parent 1 reported no problems, explaining, "I just want my child to learn whatever they want to learn," and noted that at home, "I always ask my child to help with calculations." This parent saw mathematics as integrated into daily life and relied heavily on school support.

In contrast, Parent 2 identified significant motivation issues, stating that their child "cannot do homework because they are not focused on learning" and is "addicted to phones and games." This parent cited lack of motivation and laziness as primary obstacles while recognizing that interesting teaching media and supplementary instruction could help.

Parent 3 provided nuanced observations, explaining that "when problems are too difficult, we have to explain many times" because "mathematics is a very confusing and complex subject." This parent noted that "if children don't understand from the beginning, they won't want to learn mathematics and won't want to do mathematics work," emphasizing the critical importance of initial comprehension. The parent assessed their child's ability as "average—can do some, not bad, not good," recognizing that mathematics is important because "we use it in daily life—we calculate when buying necessities."

Parent 4 expressed the most concern, stating their child "does not study much, is not interested," and "plays more than paying attention to studying." This parent attributed problems to lack of effort and concentration, noting that their

child "has no thoughts or effort to think analytically in mathematics" and needs to "have intention in thinking and mindfulness in learning."

1.4 Student Perspectives

Student perspectives provided insight into the lived experience of mathematics learning challenges. Student 1 described environmental obstacles, stating, "It is difficult to understand content because the classroom is quite noisy," and expressing a need for "slow explanations, not too fast." This student reported "not understanding content and fearing exams" and lacking "friends to help think and do work together."

Student 2offered particularly vivid descriptions of pedagogical challenges, explaining, "I expected it would make me understand better than before, but I still don't understand. Even when I pay attention, I still don't understand at all. While I'm working, the teacher likes to go do errands. When they come back, the period is over, and I still don't understand." This student complained about morning scheduling: "They always put mathematics in the morning period. My brain isn't working yet. Why can't mathematics be in the afternoon instead?" The student also noted, "The teacher teaches too fast. I look down for a moment, and when I look up, the board is already full." However, this student appreciated peer support: "When the teacher is teaching, it becomes easier. It becomes harder when the teacher isn't there, making students confused throughout the whole room. But it's good that there are friends to ask and help each other."

Student 3 took personal responsibility, acknowledging, "I have a problem with not paying attention—laziness. But if I focus, I can do some parts." This student feared exams because "I'm afraid that what we learned and what appears on the exam won't be the same... I'm afraid it will be content we learned long ago... I don't really like exams." Interestingly, this student also noted that excessive pressure is counterproductive: "What makes learning difficult is

pressuring students too much, wanting students to do well as the teacher wants—then students don't want to learn. Even if they study, they don't focus."

Student 4 simply stated, "I don't understand the content of each topic" and "there are too many topics—I want clearer definitions." Despite challenges, this student maintained a positive outlook, explaining, "I like it because I'm not very good at this subject, but I can still do it," and recognizing mathematics' practical importance: "It's important so I can calculate. Or in the future, if I open my own shop, I'll be able to calculate."

2. Context and Factors Affecting Implementation (Objective 2)

All stakeholder groups acknowledged the unique contextual factors of rural education in a small school setting. The school follows the national curriculum structure, with teachers attempting to teach content progressively from easy to difficult. However, this standard approach often misaligns with student readiness levels.

The administrator expressed confidence in the school community, noting that "stakeholders have confidence and trust in mathematics instruction." The school implements support mechanisms including individualized lesson planning, teaching media development, remedial instruction for slow learners, and supplementary tutoring for students who enjoy mathematics. However, resource constraints limit the scope of these interventions.

The teacher described working within the constraints of a "small rural school where students lack readiness" while maintaining an optimistic professional stance. The teacher reported, "My knowledge, skills, and attitudes are sufficient for instruction, and I believe that learners can always develop themselves in both knowledge and skills." Current instructional practices include minimal teaching media, pair learning for collaborative thinking, and trial-and-error learning with worked examples provided before practice. The teacher noted that the policy to reduce student workload creates tension: "Mathematics

requires practice combined with understanding, and students' responsibility is still less than what would allow assigning work beyond what is taught in class."

Parents generally recognized mathematics' importance for daily life—calculating purchases, managing money, supporting household economics. However, they identified significant contextual constraints. Parent perspectives revealed that home environments vary dramatically: some students receive strong family support and practice mathematics through household tasks, while others face competing demands from mobile games, household chores, and limited parental time or educational background to support learning. Several parents acknowledged they "don't know what the school's policy is," suggesting limited school-home communication.

Students described traditional instructional contexts: teachers writing on boards, explaining procedures step-by-step, with little use of technology or multimedia resources. However, students expressed varying comfort levels with this traditional approach. One student appreciated that "there are no rules, no pressure—learning is comfortable," while another complained about morning scheduling and rapid pacing. Some students valued the current structure, with one stating, "I like the way the teacher teaches normally—I prefer this way more," while others desired more teacher presence and support during class time.

The classroom environment itself emerged as a contextual factor, with multiple students noting noise levels that disrupted concentration. Additionally, students' household responsibilities—helping with farming, caring for siblings, supporting family businesses—create competing demands on their time and energy. Economic constraints mean that families cannot afford supplementary tutoring, and parents work long hours in agriculture or informal sector jobs, limiting their availability to support children's learning.

3. Needs and Requirements for Effective Online Learning Design (Objective 3)

Despite diverse perspectives, stakeholders converged on several key needs for improving mathematics education. These needs span pedagogical approaches, learning resources, support structures, and systemic changes.

The administrator emphasized the need for "interesting teaching methods," "interesting media," and teachers who "understand and can reach low-achieving students." The administrator advocated for both remedial instruction and accelerated learning opportunities, recognizing the diversity of student abilities and motivations.

The teacher articulated a vision for culturally responsive, contextually appropriate mathematics education. The teacher argued for "focusing on learning related to learners' daily lives," "reducing curriculum expectations," and "emphasizing understanding situations and solving problems according to those situations—this would be suitable for learners in small rural school contexts." The teacher identified needs for better teaching media, improved student attitudes, stronger foundational knowledge, and enhanced student motivation. Critically, the teacher noted that current workload reduction policies conflict with mathematics education needs: "Mathematics requires practice combined with understanding."

Parents consistently emphasized the need for teachers to provide clear explanations from the beginning of each lesson, maintain student attention through interesting content, and be strict about academic expectations. Parent 1 requested that "teachers help supervise students when they are at school—make them pay more attention to learning." Parent 2 identified needs for "supplementary instruction and interesting learning media" to counter lack of motivation. Parent 3 stressed that "teachers must explain so children understand from the beginning. If children don't understand from the beginning, they won't

pay attention... and teachers must be stricter." Parent 4 simply asked students to "arrive on time and focus on learning that subject."

Student needs centered on instructional pace, teacher presence, and peer support. Student 1 requested "slow teaching, unhurried explanations, and reducing noise in the room." Student 2 wanted "teachers to stay in the classroom all the time" so students can ask questions when confused. Student 3, who appreciated the current approach, simply desired "more class time," noting that "time is insufficient—making me understand only 50% while the other 50% I don't understand. I want the teacher to teach until I understand; I want sufficient teaching time." Student 4 emphasized collaborative learning: "Have lots of friends, rely on each other."

Across stakeholder groups, several cross-cutting needs emerged: (1) Pedagogical adaptation—instruction must be slower-paced, provide clearer explanations, include more worked examples, and allow time for practice and questions; (2) Engaging resources—interesting teaching media, relevant real-world problems, and interactive activities to maintain motivation; (3) Supportive environment—reduced classroom noise, adequate instructional time, consistent teacher presence, and opportunities for peer collaboration; (4) Realistic expectations—curriculum goals aligned with student readiness, allowing teachers to prioritize deep understanding over content coverage; (5) Family engagement—clear communication about learning expectations and strategies parents can use to support learning despite limited educational backgrounds.

Discussions

This study explored stakeholder perspectives on designing online mathematics learning for small rural schools through the McKenney and Reeves (2012) framework. Key findings reveal critical challenges and opportunities for

implementing technology-enhanced mathematics education in resource-constrained contexts.

The Digital Divide in Rural Education

The most critical finding was severe infrastructure deficits. The teacher reported minimal teaching media use while students described instruction limited to board writing—findings that directly align with Kormos and Wisdom (2021) research documenting persistent technology access gaps in rural schools. Parents' reports of families sharing single smartphones among multiple children, unable to afford internet connectivity, exemplify the systematic review by Samane-Cutipa et al. (2022) identifying digital gaps as primary barriers to rural students' online learning

Student Readiness and Learning Challenges

Students' specific reports of difficulty understanding content, rapid pacing, and fear of assessment parallel Barrot et al. (2021) findings on Filipino students during the pandemic: lack of focus, poor connectivity, and difficulty understanding lessons. The teacher's statement that curriculum goals are difficult to achieve with students lacking readiness reflects Wei (2022) argument that rural education disadvantages require integrated approaches combining online learning with localized adaptation. Galinggan (2021) found significant correlation between online learning readiness and mathematics anxiety, supporting our finding that implementation must address both technical access and psychological readiness

Design Implications

Synthesizing findings yields key design principles aligned with literature. First, accessibility requires offline functionality and low-bandwidth solutions (Kormos & Wisdom, 2021). Second, content must connect to students' rural experiences (Wei, 2022). Third, flexible pacing must accommodate students' requests for slower teaching (Barrot et al., 2021). Fourth, generous scaffolding with worked examples addresses insufficient explanation complaints. Fifth,

formative assessment reduces anxiety (Galinggan, 2021). Sixth, structured collaboration facilitates the peer learning students emphasized as critical support.

Limitations

This study has limitations including small sample size (10 stakeholders from one school), single time-point data collection, and reliance on self-reports. The single-site design limits generalizability, though the school represents typical characteristics of small rural schools in the region. Future research should conduct design-based studies testing prototypes, comparative case studies across contexts, longitudinal implementation tracking, and impact assessments on learning outcomes.

Conclusion

This study makes three significant contributions to the field of rural mathematics education. First, it provides empirical evidence of stakeholder perspectives on online mathematics learning design in Thai rural schools—a previously understudied context. Second, it demonstrates the utility of the McKenney and Reeves (2012) framework for systematically analyzing educational design challenges across problem, context, and needs dimensions. Third, it offers practical design principles grounded in stakeholder voices that can inform the development of contextually appropriate online mathematics learning environments.

The findings underscore that educational equity in the digital age requires more than simply providing online content. Effective online learning for rural students necessitates coordinated investments in technology infrastructure, teacher professional development, family support, and contextually appropriate curriculum design. The identified strengths—particularly teacher commitment and community cohesion—provide foundations for interventions, while

opportunities such as supportive policies and growing technology availability offer leverage points for change.

Recommendation

Educational administrators and policymakers should prioritize: (1) developing offline-capable learning resources with low bandwidth requirements; (2) providing sustained professional development for teachers in technology integration and differentiated instruction; (3) creating mathematics content that connects abstract concepts to rural students' lived experiences; (4) establishing flexible pacing structures that allow adequate time for practice and mastery; and (5) facilitating family engagement through clear communication and accessible support strategies.

However, persistent threats including socioeconomic inequality and funding uncertainties demand sustained systemic attention. Addressing educational inequities in rural contexts requires not only pedagogical innovation but also broader structural reforms that ensure all students—regardless of geographic location or family resources—have genuine opportunities to develop mathematical competencies and reach their potential. By foregrounding the voices of those most affected—administrators, teachers, parents, and students—we move closer to realizing the promise of technology-enhanced education as a tool for equity rather than a source of further disadvantage.

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