CHALLENGES OF MULTIGRADE SCIENCE TEACHING IN SMALL PRIMARY SCHOOLS IN THAILAND

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ABSTRACT
In small schools, challenges of multigrade science teaching arise due to lack of sufficient and qualified teachers, which results from an inadequate budget allocated to these schools. This research delved into the challenges faced by 52 multigrade science teachers in Nakhon Nayok province through a survey. These challenges were divided into four main categories: teachers' behaviors, teachers' attitudes, student context, and positive and negative support system. The survey revealed that the top five challenges encountered by teachers fell under the categories of 'negative support system' and 'teachers' attitudes.' These challenges were: 1) Additional roles besides teaching, often consume teachers' allocated time for teaching science in multigrade classrooms (57.69%), 2) Teachers feel anxious when teaching science in a multigrade classroom (51.92%), 3) Teachers are assigned to teach subjects that do not align with their major expertise (46.15%), 4) Teachers have not received skill training or workshops on multigrade science teaching (46.15%), and 5) Students in multigrade classrooms tend to be less attentive when learning with peers from different grade levels (46.15%). However, the teachers ranked 'designing activity' within the 'teachers' behaviors' category, as the most critical issue impacting their science teaching. It can be inferred that this occurred due to a lack of a support system for teachers, since the top five challenges that the teachers assigned as 'serious' were all in the 'support system' category. Additionally, the research documented what teaching techniques teachers employed in dealing with students of different grade levels. The purpose is to ascertain the existence of the challenges of multigrade science teaching in small primary schools in Thailand and identify specific challenges that require immediate change to reduce educational inequality.
Keywords: Small Primary Schools, Multigrade Science Teaching, Challenges of Multigrade Teaching, Thailand

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INTRODUCTION

There exist many education challenges in Thailand, and inequality is arguably the most significant one. Students in large schools performed better than those in small schools in the national test, and in almost every subject (Independent Committee for Education Reform, 2022). Here, the size of the school is determined by the number of students. In government schools, teacher positions are assigned based on the number of students. The Office of the Basic Education Commission (OBEC) has set the criteria for small schools as those with 119 or fewer students and has defined the teacher-student ratio for small schools as one teacher for every 20 students. For example, an elementary school that provides education from grades 1 to 6 with a total of 78 students would be allocated only 4 teachers. Thus, the number of teachers is inadequate in the small schools. The schools usually do not have enough specialized teachers and have insufficient homeroom teachers for every classroom. In other words, they do not have enough teachers for every grade level and in all subject areas (Thailand Development Research Institute, 2015). Worst off, within the Thai current education system, full-time paid teachers are often not available for teaching students full-time as they have other duties outside of their teaching responsibilities. This, in the end, yields unqualified education. Teachers are incapable of designing activities that are aligned with content in the curriculum.

The Office of the Basic Education Commission (OBEC) has proposed multigrade teaching as a way to improve the efficiency of small school management. The implementation of multigrade classroom teaching is recognized as one of the strategies for addressing global education challenges, particularly in small schools with limited students in remote areas that experience financial difficulties (UNESCO, 2015).

While the strategy is beneficial in terms of management, many researchers reported that multigrade teaching compromised students' learning. Bongala et al. (2020) reported that teachers in Albay, the Philippines, were not adequately prepared to teach in multigrade settings, and there was a lack of sufficient resources and materials for managing instruction. Additionally, these teachers encountered difficulties in planning instructions due to the Philippines national curriculum that does not align well with the multigrade classroom teaching. Naparan & Ivy Leigh P Castañeda (2021) reported that Austria and Finland teachers faced challenges in multigrade teaching. They felt unprepared and experienced stress related to teaching. These teachers lacked teaching resources and had to work harder compared to teachers in larger schools. These findings highlight the common challenges that teachers encounter in multigrade classrooms teaching.

However, the challenges have not been widely studied in the Thai context. Nakhon Nayok province was selected in this research because Nakhon Nayok had a significant number of small schools, accounting for approximately 59.54% of all schools in the province. Many of these small schools faced teacher shortages, with around 73.41% of small schools in Nakhon Nayok lacking full teacher coverage (Nakhon Nayok Primary Education Service Area Office, 2022). Regarding student competencies, sixth-grade students in Nakhon Nayok performed lower in the national test than average students in Thailand. Students in this province also had the lowest score in the central region of Thailand (The National Institute of Educational Testing Service, 2021; The National Institute of Educational Testing Service, 2022). Hence, Nakhon Nayok is a suitable context for gaining an understanding of the challenges faced by teachers in small primary schools in Thailand.

The findings from this research will not only enhance our understanding of the challenges of multigrade science teaching, but also empower teachers in small schools to tackle the challenges with immediate concerns. This is for teachers to focus their effort on the right place to observe changes in their student learning.

LITERATURE REVIEWS

Rationale of Multigrade Teaching

The multigrade classroom is an educational setup in which students from two or more grade levels are taught in the same classroom by a single teacher (Vincent, 1999). The multigrade teaching often prevails in rural or remote schools (Cornish, 2006). Within multigrade classrooms, students of varying ages, grade levels, and abilities coexist and learn together (Little, 2006). Multigrade teaching represents the primary and critical approach for expanding access to basic education for all students. In this sense, its implementation alleviates educational disparities among poor, geographically remote students. It offers a cost-effective means of providing education in small schools (Cornish & Taole, 2021; De borja et al., 2020; UNESCO, 2015) However, for effective multigrade teaching, teachers play a central and influential role in facilitating the students' learning process (Ramrathan & Mzimela, 2016).

Ineffective Multigrade Teaching

Addressing the challenges of multigrade classroom teaching is fundamental for the development and promotion of quality education for students in rural areas of many countries. Naparan et al. (2021) emphasized that the challenges of multigrade classroom teaching should not be overlooked. According to Govinda (2007), the challenges in managing small-sized schools in Fuji included the lack of preparedness in implementing cooperative learning strategies in the teacher training institutions; insufficient learning materials for students at different grade level learning simultaneously; an extensive amount of time spent on lesson preparation, heavy workload, limited teaching time, inappropriate curriculum design for managing mixed-ability classrooms, and the pressure of nationwide knowledge assessments.

Similarly, Mulkeen, and Higgins (2009) reported the challenges faced in managing multigrade classrooms in sub-Saharan Africa. Teachers struggle to control classrooms when they teach two separate classes simultaneously. Teachers are often specialized in their subject matter, and their expertise is sometimes limited to their specific subject area. Teaching in mixed-ability classrooms is more demanding, requiring substantial preparation and leading to greater exhaustion compared to teaching single-level classrooms. Inadequate teaching and learning resources can be a hindrance. Lastly, teachers may not receive adequate training in managing mixed-ability classrooms during their university education.

Cornish and Taole (2021) pointed out that many teachers lack specialized training in managing multigrade classrooms. They were not adequately prepared during their teacher training. Additionally, some countries faced a shortage of resources and teaching materials. Furthermore, teachers often lack expertise, experience, and skills in managing multigrade classrooms. National curricula do not adequately cover the management of mixed-ability classrooms. Information on teaching in multigrade classrooms is limited. Moreover, teachers tend to have a negative attitude towards teaching in multigrade classrooms. These challenges highlight the difficulties teachers face when managing classrooms with diverse learning needs, and that these problems are still unresolved (Bongala, et al., 2020).

Multigrade Science Teaching in Thailand

In Thailand, research related to small-sized schools often predominantly focuses on educational management and policy matters. (e.g., Buaraphan, 2013; Buaraphan, Inrit, & Kochasila 2018; Wannagatesiri, et al., 2014) However, there is a noticeable lack of research when it comes to multigrade teaching in classrooms with a focus on supporting students' learning in specific subjects and in rural areas (e.g., Supramas, 2011; Tiamtiporn, et al., 2016). Plus, the performance of students, especially in science subject, has been on the decline, with average scores for core subjects, including mathematics, science, and English, consistently falling below 50%. This decline is further exacerbated by disparities in education quality across different regions, with students in poor and remote areas tending to perform less effectively (Durongkaveroj, 2022). Similarly, Chanseang (2022) highlighted the myriad challenges in science education, such as

issues related to teaching materials, equipment, school infrastructure, learning environments, general services, the core curriculum, and teacher-related challenges. These findings underscore the complexity of science education and emphasize the necessity for comprehensive solutions to effectively address these issues. Under the emphasis on the quality of science education for students in rural schools, there is certainly a gap in research that specifically addresses the challenges related to managing science education in a multigrade classroom setting. Therefore, this study aims to uncover some of the challenges faced in multigrade science teaching within these classrooms.

METHODS

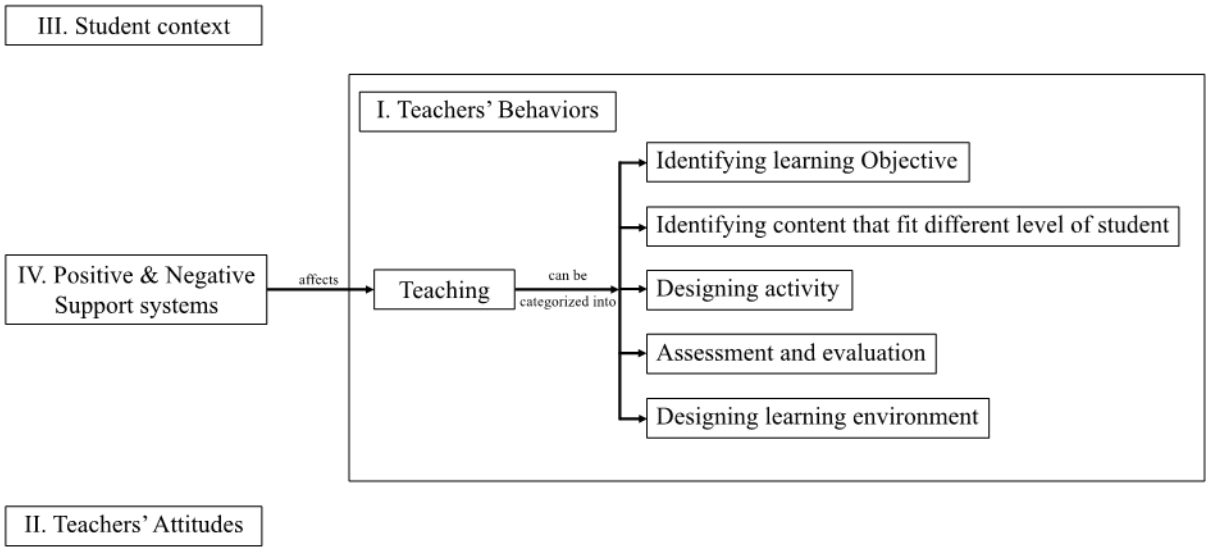
Human Research Ethics Review Committee, Chulalongkorn University approved the study (COA No. 228/66). This ensures that the research was conducted in an ethical manner and took into consideration the rights and well-being of the participants.

This research is a survey conducted among 52 teachers in small primary schools under the jurisdiction of the Nakhon Nayok Primary Education Area Office, all of whom have experience teaching science in multigrade classrooms. The researcher first sent a formal letter to the Nakhon Nayok Primary Education Area Office, to a to conduct the research. Once the Office approved the research, the office staff members contacted the heads of the small schools in Nakhon Nayok to inform them about the study. This process involved obtaining the required approvals and clearances from the relevant educational authorities and schools to ensure the successful execution of the research. The survey was then sent out to multigrade science teachers in each school.

A total of 35 survey questions, regarding teachers' experiences of encountering challenges, were administered online, with the questions being randomly ordered for each teacher participant. The questionnaire has four sections as follows: background information, teachers' experiences of encountering challenges, critical issue impacting their science teaching, and teaching techniques employed by the teachers in dealing with students of different grade levels. The first part of the questionnaires gathered information about the teachers, including gender, number of years in teaching experience, the primary subject taught, number of students and teachers in the schools, and the grade levels assigned to teach multigrade. The second part of the questionnaire asked about the teachers' experiences of encountering challenges. The teachers were asked to select one choice for each item question: "never encountered problems," "previously encountered challenges but not currently," and "currently facing challenges." If the teachers selected "previously encountered challenges but not currently" and "currently facing challenges" for their choices, they must indicate the seriousness of the challenges on a Likert scale of 1 (indicating slightly challenging) to 5 (indicating extremely challenging). The third part of the questionnaire required teachers to rank critical issues impacting their science teaching by categories. They ranked the problems that teachers believe should be urgently addressed from most to least important. The final part of the questionnaire pertains to multigrade science teaching techniques.

This study conducted item-objective congruence (IOC) and a reliability test using Cronbach's alpha to assess the quality of the questionnaire. The results showed a high IOC of 0.91 and a strong Cronbach's alpha of 0.939, indicating that the questionnaire was of sufficient quality for research purposes.

In summary, this research aimed to gather information about the challenges faced by teachers in small primary schools when teaching science in multigrade classrooms and to understand their perspectives on the most urgent problems that need to be addressed in this context. The use of a well-validated questionnaire ensures that the data collected is reliable and suitable for research purposes. Once the data collection was completed, we grouped all 35 questions into thematic categories of challenges as follows:



Data Analysis

For data analysis, descriptive statistics were utilized, including measures such as frequency, percentage, mean, and standard deviation. These statistics help summarize and describe the data collected during the research. The results will be presented in a descriptive and tabular format. All the relevant details are provided in the following section for a more comprehensive report of the findings.

RESULTS

Most of the teachers who provided information are female, accounting for 69.23%. Most of them have teaching experience in the range of 1 to 3 years, representing 61.54%. The primary subject that these teachers were assigned to teach is science, accounting for 36.54%, followed by mathematics at 15.38%. Regarding the number of students in the schools where the survey participants teach, the majority have between 41 to 60 students, representing 46.15%, followed by 61 to 80 students, accounting for 19.23%. Most of the teachers in small primary schools have four teachers, representing 30.77%, followed by three teachers at 19.23%. The grade levels where these teachers are primarily assigned to teach multigrade classrooms are primarily in grades 3-4 and grades 5-6, both accounting for 26.92%.

The research findings reveal that the most substantial challenges in multigrade science classrooms, as reported by teachers, are associated with both positive and negative support systems, constituting 41.96% of teachers who participated in the questionnaire. Issues related to identifying learning objectives and identifying content that fit different level of student, under the categories of teachers' behaviors, accounting for 39.42% and 38.46%, respectively. The least significant challenge reported is linked to designing the learning environment, with only 23.08% of teachers who participated in the questionnaire, as shown in Figure 1.

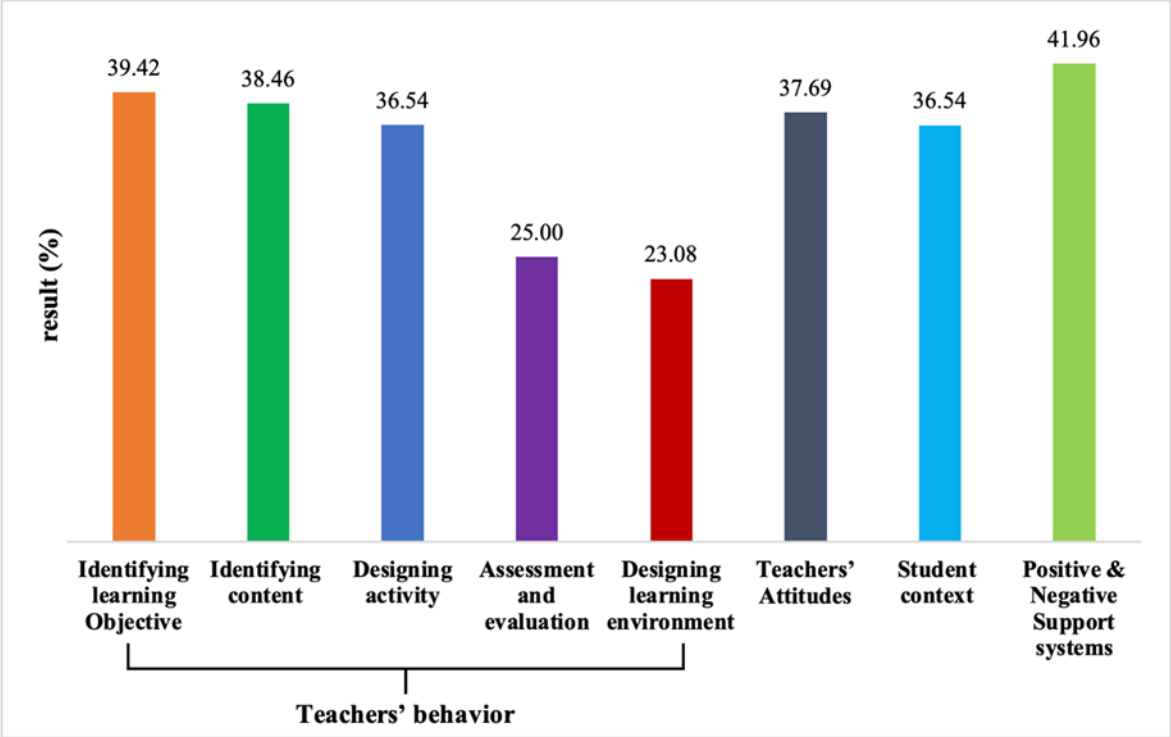


Figure 1 The identified challenges were categorized into four main categories.

The research findings indicate that the most significant current challenges in multigrade science teaching, as reported by multigrade science teachers, are related to receiving negative or undesired support. This challenge pertains to teachers having additional non-teaching responsibilities that often disrupt the time allocated for teaching multigrade science, leading to disruptions in their teaching. This challenge is reported by 57.69% of teachers who participated in the questionnaire.
The top five most significant challenges for multigrade science teachers, as indicated in research, are detailed in Table 1.

Table 1 The top five most significant challenges for multigrade science teachers

The challenges faced in multigrade science teaching	Result (%)	Categories
1) Additional tasks, apart from teaching, often disrupt the time allocated for teaching science in multigrade classroom.	57.69	Negative support
2) Teachers feel anxious when they must teach science in a multigrade classroom.	51.92	Teacher's attitude
3) Teachers are assigned to teach subjects that do not align with their major expertise.	46.15	Negative support
4) Teachers have not received skill training or workshops on multigrade science teaching.	46.15	Positive support
5) Students in science multigrade tend to be less attentive when learning with peers from different grade levels.	46.15	Identifying learning objective

The research finds that the top five most severe challenges for multigrade science teachers, rated on a Likert scale from 1 (indicating slightly challenging) to 5 (indicating extremely challenging), are as follows:
1) Teachers are assigned to teach subjects that do not align with their major expertise.

2) Additional tasks, apart from teaching, often disrupt the time allocated for teaching science in multigrade classroom.
3) Teachers believe that the media or technology they have received to support multigrade teaching cannot be effectively used in the science classroom.
4) Teachers have not received skill training or workshops on multigrade science teaching.
5) Teachers do not receive sufficient support for technology-related resources when it comes to managing science teaching in a multigrade classroom.
These challenges are detailed in Table 2.

Table 2 The levels of challenges faced by the teachers in small primary schools.

The challenges faced in multigrade science teaching	**Categories**	**Result**		**Description**
		$\bar{X}$	**S.D.**	
1) Teachers are assigned to teach subjects that do not align with their major expertise.	Negative support	4.64	0.63	Highest
2) Additional tasks, apart from teaching, often disrupt the time allocated for teaching science in multigrade classroom.	Negative support	4.44	0.89	Highest
3) Teachers believe that the media or technology they have received to support multigrade teaching cannot be effectively used in the science classroom.	Teacher's attitude	4.40	0.89	Highest
4) Teachers have not received skill training or workshops on multigrade science teaching.	Positive support	4.18	0.87	High
5) Teachers do not receive sufficient support for technology-related resources when it comes to managing science teaching in a multigrade classroom.	Positive support	4.13	0.83	High
Overall		4.36	0.82	**Highest**

The research also discovers the most important problems that teachers in small primary schools believe should be urgently addressed. The results show that the most pressing issue, which should be addressed as a top priority, is "designing activity." This is followed by the second most crucial issue, which is "positive & negative support systems." The third most important problem that requires immediate attention is "identifying learning objective." These findings are detailed in the table 3.

Table 3 summarize the order of importance based on the issues.

The issues that should be urgently addressed	**Percentage (%)**	**The order of importance based on the issues**
Identifying learning objective	49.40	3
Identifying content	41.67	4
Designing activity	81.55	1
Positive & negative support systems	58.33	2
Assessment and/or evaluation	25.00	7
Teachers' behaviors and attitudes	39.42	5
Students' context	37.50	6
Designing learning environment	22.62	8

The study finds that the most practiced teaching technique for multigrade science classrooms by teachers in small primary schools is to focus on having students work in groups at various

ability levels. This method is used by 87.50% of teachers who participated in the questionnaire, as shown in Table 4.

Table 4 multigrade science teaching techniques in small primary schools.

Practiced multigrade science teaching	**Percentage (%)**
Teaching the same science topic with different assignments for each grade level.	70.83
Teaching the same science topic with the same assignments for all grade levels.	45.83
Teaching by having students of all grade levels learn, taking turns in different years. For example, in one academic year, students in multigrade class grade 5 and grade 6 will study grade 5 subjects, and in the next year, they will study grade 6 subjects.	41.67
Teaching by focusing on having students of all grade levels work in groups, which may be groups of varying abilities or groups with similar abilities within the same class.	87.50
Teaching by encouraging students of all grade levels to help each other and share knowledge (peer tutoring).	62.50
Teaching in separate classrooms by grade level, where students in one classroom work independently on easier subjects, and students in another classroom work on more challenging subjects, with the teacher present in the classroom with the more challenging content.	37.50
Teaching content of science one grade level at a time, then assigning tasks before moving on to teach another grade level.	58.33
Teaching by integrating real-life experiences, customs, and the culture of students of all grade levels.	62.50
Teaching by focusing on encouraging students of all grade levels to learn collaboratively and have good communication.	75.00
Preparing guidelines for assessing individual student abilities according to their actual circumstances.	58.33

DISCUSSION

The Challenges Faced of Multigrade Science Teaching in Small Primary Schools.

From the survey, it was found that the challenges faced by teachers in small primary schools include: 1) Additional tasks, apart from teaching, often disrupt the time allocated for teaching science in multigrade classroom, 2) Teachers feel anxious when they must teach science in a multigrade classroom, 3) Teachers are assigned to teach subjects that do not align with their major expertise, 4) Teachers have not received skill training or workshops on multigrade science teaching, and 5) Students in science multigrade tend to be less attentive when learning with peers from different grade levels. These issues collectively highlight the challenges faced by teachers. As per the guidelines set by Office of the Teacher Civil Service and Educational Personnel Commission (OTEPC) for teacher-to-student ratios and subject standards in primary schools, schools with 1-40 students should have a teacher-to-student ratio of 1-4 teachers per core subject, which includes elementary, Thai, mathematics, and English. This guideline suggests that teachers may be assigned to teach subjects that are not their specialization, which aligns with the issues mentioned in the survey. The finding was similar to Mulkeen and Higgins (2009), who reported that a problem in managing multigrade teaching is that teachers may not have expertise in all the subjects they are required to teach, and they are often burdened with a heavy workload. Cornish and Taole (2021) reported that the national education curricula

worldwide often do not comprehensively cover the management of multigrade teaching, and teachers may not receive specific training in managing multigrade classrooms. This is consistent with the findings of Naparan and Ivy Leigh P Castañeda (2021), who highlighted the stress and workload challenges faced by teachers in multigrade classrooms. Multigrade teachers burdened with high workloads, which may lead to challenges in teaching effectively. The lack of specific training in multi-grade teaching, is also in line with the observations made by Little (2006) and other researchers (Bongala et al., 2020; Cornish & Taole, 2021; Mulkeen & Higgins, 2009). This suggests that national education systems may not adequately prepare teachers for the complexities of managing multigrade classrooms. This lack of preparation and the stress associated with multigrade teaching can further contribute to the challenges teachers face when developing instructional plans for multigrade science classes.

Furthermore, the survey results reveal that the most urgent problem to address is related to the designing activity, followed by the issue of support systems, and identifying learning objective. This indicates that when science teachers are assigned to teach subjects that do not align with their expertise and are not adequately trained for multigrade teaching, they often feel more stressed and fatigued than usual when teaching science in multigrade classrooms. This may lead to challenges in managing multigrade learning and teaching science in small primary schools.

The Management of Multigrade Science Teaching in Small Primary Schools.

From the survey results indicate that the most employed teaching technique in multigrade science classes within small primary schools is group work, where students from various grade levels collaborate. This approach is utilized for both mixed-ability groups and groups with students of similar abilities within the same grade. Approximately 87.50% of the teachers reported using this method. Following this, cooperative learning, and peer tutoring, where students assist and share knowledge with each other, were reported by 75.00% of the teachers. Conversely, the method in which teachers teach in separate classrooms by grade level, with one class working on easier subjects and the other on more difficult subjects, is the least popular and was reported by 37.50% of the teachers. It can be inferred that this method may lead to teachers feeling more fatigued than before because they must simultaneously focus on both groups of students. These findings align with various educational principles and theories. UNESCO (2015) suggests that peer tutoring is effective in single-room multigrade classrooms, as it involves pairing older or higher-achieving students with younger or lower-achieving ones, promoting collaborative learning, and scaffolding of learning concepts. This aligns with Kasten (1998) emphasized the benefits of students learning from their peers who are older or more advanced, particularly in multi-grade classrooms. Older or higher-achieving students can act as teachers to help younger or lower-achieving students, which is highly advantageous in such classrooms. This also resonates with the proposal by Cornish and Taole (2021), which recommends that teachers in multigrade classrooms focus on cooperative learning, utilizing the social constructivist learning theory by Vygotsky. In this approach, while students wait for their teacher in another grade level to teach, those students in the classroom without a teacher can work collaboratively or learn together. This strategy is consistent with Vygotsky's belief that social interaction plays a significant role in intellectual development, and individuals can learn more effectively when they receive help or guidance from others. As a result, cooperative learning and peer tutoring strategies are promoted and widely utilized in these multigrade settings.

CONCLUSION

The management of both positive and negative support systems can significantly impact teachers' teaching and students' learning, as indicated by the survey results. Challenges faced by multigrade science teachers are predominantly linked to the support systems. Teachers

encounter challenges from both positive support systems they should receive and negative support systems that hinder their teaching. These are hurdles that teachers shouldn't have to face. Ultimately, these challenges can impact the quality of education in small schools. Addressing these issues is crucial for enhancing the efficiency and effectiveness of both teaching and learning, ensuring improved outcomes for students and teachers in the multigrade education system. Resolving these problems is of paramount importance in the endeavor to enhance the quality of primary education in small schools in Thailand, thus increasing the effectiveness of teaching and learning and ultimately leading to improved learning outcomes for students in challenging multigrade teaching contexts.

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