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THE EFFECT OF ELEMENTARY SCHOOL SIZE ON CONSTRUCTIVISM IN THAILAND

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ABSTRACT

This study investigated the relationship between elementary school size in Thailand and the use of constructivist teaching methods. An explanatory sequential mixed-methods approach was employed, combining quantitative data from the Constructivist Learning Environment Survey (CLES) and qualitative data from teacher interviews. The research revealed that school size and student-teacher ratios significantly impact the learning environment. Larger and medium-sized schools with high national test score expectations demonstrated lower levels of constructivist learning. Conversely, smaller schools without such pressures exhibited higher levels of constructivist approaches. However, the study identified that teacher-student relationships and a supportive classroom atmosphere were crucial in promoting science education aligned with constructivist principles. Teachers who fostered camaraderie and encouraged open expression of opinions were more likely to facilitate active, collaborative learning experiences. The findings suggest that school size and national test performance expectations may influence teaching approaches and student learning experiences. In larger schools, teachers may adopt more traditional methods emphasizing memorization and rote learning, while smaller schools may have more flexibility to implement constructivist techniques. This research highlights the complex interplay of factors shaping the educational environment in Thai elementary schools. It underscores the need for further investigation to better understand these dynamics and inform effective teaching practices that balance constructivist principles with educational goals and constraints.

Keywords: constructivism, science teaching, elementary school

1. Introduction

In education, the idea of constructivism, a theory first developed by Jean Piaget (Piaget, 1952), has been getting more and more attention in recent years, especially because it has the potential to help students learn better. Constructivism emphasizes the importance of active participation and engagement in the learning process, as well as the need for learners to connect new knowledge with their prior experiences and understanding (Hyslop-Margison & Strobel, 2007). This learning theory has significantly influenced modern educational practices, particularly in how teachers facilitate student-centered learning environments (Brooks & Brooks, 1999; Richardson, 2003)

Research has consistently shown that constructivist approaches can enhance student learning outcomes across various subjects (Kim, 2005; Yildirim et al., 2024). Studies have demonstrated improved critical thinking skills (Leś & Moroz, 2021) better retention of knowledge (Martínez et al., 2020), and increased student engagement (Farrelly et al., 2024) when constructivist principles are effectively implemented in the classroom.

According to the Organization for Economic Cooperation and Development (OECD), Thailand has made significant progress in expanding access to education, particularly at the primary level (OECD, 2022). However, the quality of education remains a concern, with significant variations across different school contexts (World Bank, 2021). In this context, the size of an elementary school can be an important factor in shaping the learning environment and the degree to which constructivist principles are incorporated into classroom practices (Dorman & Adams, 2004; Thompson et al., 2023)

Recent studies have shown that school characteristics significantly influence the implementation of constructivist approaches (Durmuş, 2016; Gershenson & Langbein, 2015). Research in various contexts has identified several factors that affect the successful implementation of constructivist teaching, including teacher preparation (Greenier, 2017), available resources (Black & Ammon, 1992), and institutional support (Cobb, 2013). However, there has been limited research specifically examining how school size affects these practices in the Thai context, despite evidence suggesting that school size can significantly impact teaching practices and student outcomes (Barnett et al., 2002)

Therefore, this study aims to address this significant gap in the literature by examining the effect of elementary school size on the implementation of constructivist practices in Thailand. This research is particularly timely given Thailand's ongoing educational reforms (Ministry of Education Thailand, 2022) and the increasing emphasis on learner-centered approaches in national education policies (ONESOA, 2013)

This paper will begin with a comprehensive review of the relevant literature on constructivism as well as the relationship between school size and educational outcomes. Next, we will discuss the specific context of elementary education in Thailand, including the current policies and practices related to constructivism. We will then present the results of a survey, and interviews conducted with elementary school teachers from different school sizes to examine their perceptions of constructivism and the challenges they face in implementing it in the classroom. Finally, we will conclude with a discussion of the implications of our findings and recommendations for future research and policy.

2. Research Objective

To investigate the relationship between elementary school size and the implementation of constructivist teaching methods in Thai elementary schools, and to determine whether smaller school size is associated with greater use of constructivist teaching methods.

3. Theoretical Framework

Constructivism is a learning theory that emphasizes the role of learners in constructing their own knowledge through a process of active engagement with the environment. This theory has gained popularity in the field of education as it provides an alternative approach to traditional teaching methods. In this literature review, we will explore the key concepts and principles of constructivism, the different forms of constructivism, and the practical applications of constructivism in the classroom.

3.1 Key Concepts and Principles of Constructivism

The fundamental idea of constructivism is that learning is an active process where learners construct their own knowledge and meaning from their experiences (Bada & Olusegun, 2015; Von Glaserfeld & Johsua, 1996). In this view, learning transcends the traditional notion of knowledge transfer from teacher to learner, instead emphasizing the learner's active role in constructing understanding through experience and reflection (Dewey, 1938; Fosnot, 2013). Constructivist learning manifests as a process of active inquiry, where learners engage in questioning, exploration, and problem-solving activities (Brooks & Brooks, 1999)

Constructivism is grounded in several key principles that have emerged from decades of educational research and practice (Phillips, 1995; Windschitl, 2002). First, learning is fundamentally a social process, where knowledge construction occurs through interaction with others (Palincsar, 1998; Vygotsky, 1978). Second, learning involves cognitive adaptation, as learners continuously modify their mental schemas to accommodate new experiences and information (Jean Piaget, 1952). Third, the active nature of learning requires learners' direct engagement in meaning-making processes (Driver & Oldham, 1986; Jonassen, 1991). Fourth, understanding develops through the construction of mental models, where learners build increasingly sophisticated representations of knowledge (Von Glaserfeld & Johsua, 1996). Finally, learning is inherently context-dependent, with understanding shaped by the specific situations and environments in which learning occurs (Brown et al., 1989).

Constructivism posits that learning is an active, not passive, process. Learners build knowledge through experience and reflection, moving beyond simple knowledge transfer. Key principles include learning as a social process, cognitive adaptation via schema modification, active engagement in meaning-making, construction of mental models, and context-dependent understanding. Learning involves inquiry, questioning, and problem-solving. This approach emphasizes the learner's role in constructing their own understanding, shaped by interactions, experiences, and the environment.

3.2 Forms of Constructivism

Several distinct forms of constructivism have emerged in educational theory, each emphasizing different aspects of the learning process (Bodner et al., 2001; Phillips, 1995). The two most prominent approaches are cognitive constructivism and social constructivism, which offer complementary perspectives on how knowledge is constructed, and learning occurs.

Cognitive constructivism, developed through Piaget's foundational work (1952, 1971), emphasizes the individual's internal processes of knowledge construction. This approach posits that learners actively construct mental models through their direct interactions with the environment (Von Glaserfeld & Johsua, 1996). Cognitive constructivists focus on understanding how mental processes, including attention, perception, memory, and problem-solving—contribute to knowledge construction (Bruner, 1974; Mayer, 2004). This perspective emphasizes the importance of individual cognitive development and the learner's active role in building understanding through experience and reflection.

Social constructivism, primarily associated with Vygotsky's work (1978), emphasizes the crucial role of social interaction and cultural context in learning. This approach views knowledge construction as inherently social, occurring through dialogue, collaboration, and cultural participation (Palincsar, 1998; Wertsch, 1991). Social constructivists examine how factors such as language, cultural practices, and social norms shape the learning process (John-Steiner & Mahn, 1996). The emphasis here is on how learners develop understanding through social interaction and cultural mediation.

Educational constructivism features two main branches: cognitive and social. Cognitive constructivism, rooted in Piaget's work, highlights individual mental processes in knowledge construction. Learners build mental models through interaction with their environment, with focus on internal cognitive functions. Social constructivism, stemming from Vygotsky, emphasizes the role of social interaction and cultural context. Knowledge is constructed through dialogue, collaboration, and cultural participation. Language, cultural practices, and social norms

significantly shape learning. Both perspectives acknowledge active learner participation but differ in their focus: individual cognition versus social and cultural influences.

3.3 Applications of Constructivism in the Classroom

Constructivist principles have been extensively implemented in educational settings, leading to the development of various innovative teaching methods (Jensen, 2001; Windschitl, 2002). These approaches fundamentally shift the classroom dynamic from traditional teacher-centered instruction to student-centered active learning environments that emphasize collaboration and problem-solving (Brooks & Brooks, 1999).

In constructivist classrooms, the learning environment is carefully designed to promote active engagement and discovery. Teachers serve as facilitators rather than transmitters of knowledge, guiding students through their learning journey while providing appropriate scaffolding and support (Richardson, 2003). This approach manifests through several key teaching methodologies:

Project-Based Learning (PBL): This method engages students in extended investigations of real-world topics (Blumenfeld et al., 1991; Kokotsaki et al., 2016). Students work on complex projects that require deep exploration, critical thinking, and the application of knowledge across multiple disciplines. Research has shown that PBL enhances student motivation and promotes deeper understanding of subject matter.

Inquiry-Based Learning: This approach centers on student-generated questions and investigations (Anderson, 2002; Crawford, 2000). Students learn through systematic exploration and discovery, developing critical thinking skills and scientific reasoning abilities. Teachers guide students through the inquiry process while encouraging independent investigation and evidence-based reasoning.

Problem-Based Learning: This methodology focuses on solving authentic, real-world problems (Hmelo-Silver, 2004; Savery & Duffy, 1995). Students work collaboratively to analyze complex problems, develop solutions, and reflect on their learning process. This approach helps students develop problem-solving skills while seeing the practical applications of their knowledge.

Constructivist classrooms emphasize active learning and discovery, with teachers as facilitators. Key methodologies include Project-Based Learning (PBL), engaging students in in-depth real-world investigations to enhance motivation and understanding. Inquiry-Based Learning centers on student-generated questions, fostering critical thinking and scientific reasoning through exploration. Problem-Based Learning focuses on solving authentic problems, promoting collaborative analysis and practical application of knowledge. These approaches aim to shift learning from passive reception to active construction, fostering deeper understanding and critical thinking skills.

3.4 The Constructivist Learning Environment Survey (CLES)

The Constructivist Learning Environment Survey (CLES), developed by Taylor and Fraser (Taylor & Fraser, 1991; Taylor et al., 1997), is a widely validated instrument for assessing constructivist learning environments (Taylor, 1994; Tupsai et al., 2015). The CLES consists of five distinct scales, each containing six items, designed to measure key aspects of constructivist teaching and learning:

Personal Relevance (PR): This scale evaluates the connection between school learning and students' out-of-school experiences (Taylor, 1994). It assesses how effectively teachers link scientific concepts to students' everyday lives, making learning more meaningful and contextual.

Research has shown that high personal relevance scores correlate with increased student engagement and understanding (Kim et al., 1999).

Uncertainty (UN): This dimension examines students' exposure to the nature of scientific knowledge as a human construct that evolves through inquiry and experience (Taylor et al., 1997). It measures students' understanding that scientific knowledge is culturally and historically influenced, provisional, and subject to change based on new evidence and perspectives.

Critical Voice (CV): This scale assesses the degree to which students feel empowered to question teaching approaches and express learning concerns (Taylor et al., 1994). It evaluates the classroom's social environment and whether it supports student agency in the learning process. Studies indicate that strong critical voice opportunities enhance student engagement and metacognitive development.

Shared Control (SC): This dimension measures the extent of student participation in classroom decision-making (H. Kim et al., 1999). It encompasses students' involvement in setting learning goals, planning activities, and determining assessment criteria, reflecting the constructivist principle of learner autonomy.

Student Negotiation (SN): This scale evaluates opportunities for students to explain and justify their ideas, engage with peers' perspectives, and develop critical thinking skills (Taylor et al., 1997). It measures the degree of collaborative learning and discourse in the classroom environment.

The Constructivist Learning Environment Survey (CLES) is a validated tool assessing constructivist teaching through five scales. Personal Relevance (PR) measures connections to real-world experiences. Uncertainty (UN) explores students' understanding of evolving scientific knowledge. Critical Voice (CV) evaluates students' ability to question and express concerns. Shared Control (SC) assesses student involvement in decision-making. Student Negotiation (SN) examines collaborative learning and discourse. Each scale contains six items. The CLES aims to quantify key aspects of constructivist learning, linking them to student engagement, understanding, and metacognitive development.

4. Methodology

This study employs an explanatory sequential mixed-methods design (Creswell & Clark, 2017) to investigate the relationship between elementary school size and constructivist teaching methods in Thailand. The research combines quantitative and qualitative approaches to provide comprehensive insights into this relationship.

The quantitative phase utilizes the Constructivist Learning Environment Survey (CLES) questionnaires (Taylor et al., 1997), which have been translated into Thai following systematic translation procedures. The CLES instrument consists of five scales - personal relevance, uncertainty, critical voice, shared control, and student negotiation - with six items each, designed to measure the presence of constructivist learning environments in Thai elementary school classrooms. A stratified random sampling approach will be used to select participating schools of various sizes according to the Ministry of Education's classification system.

The qualitative phase involves in-depth interviews with elementary school teachers selected through purposive sampling to represent different school sizes. These semi-structured interviews will explore teachers' understanding and implementation of constructivist teaching methods, their perceptions of how school size impacts these practices, and their experiences in creating

constructivist learning environments. The interviews will be recorded, transcribed, and analyzed using thematic analysis to identify key patterns and themes.

The integration of both quantitative and qualitative data will provide a more nuanced understanding of how school size influences constructivist teaching practices in Thailand. The CLES questionnaires will generate statistical data on the prevalence of constructivist learning environments, while the teacher interviews will offer rich insights into the contextual factors and challenges that affect the implementation of constructivist approaches in different school settings.

4.1 Participants

The This study was conducted in three public elementary schools in Chiang Mai Province, Thailand, selected based on their student enrollment numbers according to the Ministry of Education's school size classification system. The participating schools include a large institution in central Chiang Mai city area, a medium-sized school in a suburban district, and a small school in a rural district. These schools represent three distinct size categories: large (over 720 students, with 994 enrolled), medium (120-719 students, with 144 enrolled), and small (under 119 students, with 92 enrolled).

The study focuses specifically on Grade 4 science classrooms, where class sizes correspond to the school's overall size: large schools average 26 students per classroom, medium-sized schools average 18 students, and small schools average 8 students. All participating science teachers hold bachelor's degrees in science education and are currently teaching Grade 4 science classes.

Prior to data collection, formal consent was obtained from both school directors and participating teachers. Teachers were assured that the research observations would not affect their teaching assessments and were instructed to maintain their usual teaching practices during the observation period. Additionally, students were informed about the presence of observers during each classroom observation session.

The research team conducted classroom observations focusing on constructivist teaching methods in science instruction. These observations were scheduled in advance with each school to ensure minimal disruption to regular teaching activities. The study aims to understand how school size influences the implementation of constructivist teaching approaches in Thai elementary science education.

4.2 Research tools

The research will use a mixed-methods design that involves both quantitative and qualitative data collection and analysis. The quantitative data will be collected using the Constructivist Learning Environment Survey (CLES) questionnaire (Taylor, Fraser, & Fisher, 1997). It was developed with a questionnaire of 30 questions (Tupsai, Yuenyong, & Taylor, 2015), which contains five scales with six items each. The item scores show the student's reflections as Very Often = 5, Often = 4, Sometimes = 3, Seldom = 2, and Never = 1, and it measures constructivist teaching practices in the classroom.

The qualitative data will be collected through teacher interviews and lesson plan analysis. The semi-structured interview protocol includes the following key questions:

1) How do you understand and implement constructivist teaching methods in your classroom?

2) What strategies do you use to promote student-centered learning in your science lessons?

3) How does the size of your school/class affect your ability to implement constructivist teaching methods?

4) What challenges do you face when trying to create a constructivist learning environment?

5) How do you assess student learning in a constructivist classroom environment?

What resources and support do you need to effectively implement constructivist teaching approaches?

6) How do you encourage student participation and engagement in constructivist learning activities?

What differences have you observed in student learning outcomes when using constructivist versus traditional teaching methods?

The lesson plan analysis will examine the incorporation of constructivist principles in teachers' planned activities, learning objectives, and assessment methods.

4.3 Data collection

This study employed a comprehensive data collection approach over a one-week period to examine constructivist teaching practices in Thai elementary schools. The researcher personally conducted all observations and scorings throughout the study, ensuring consistency in data collection. The Constructivist Learning Environment Survey (CLES) questionnaire was administered to participants at the beginning and end of the week, providing quantitative data on constructivist teaching practices, while concurrent classroom observations were conducted using the CLES to gather first-hand observational data on the implementation of constructivist methods.

To supplement quantitative data, qualitative information was collected through teacher interviews, exploring their perceptions, barriers, and limitations in applying constructivism in the classroom, and teachers' lesson plans were collected and analyzed to assess the extent of constructivist teaching implementation. This multi-faceted data collection strategy, combining surveys, direct observations, interviews, and document analysis, allowed for a thorough examination of constructivist teaching practices in relation to school size in Thai elementary education settings.

4.4 Data analysis

The quantitative data collected through the CLES questionnaire and observation will be analysed using descriptive statistics to determine the mean scores of the constructivist teaching practices in each school size category. The qualitative data collected through teacher interviews and lesson plan analysis will be analysed thematically to identify common themes and patterns in the data. The results of the quantitative and qualitative data will be integrated to provide a comprehensive understanding of the effect of school size on constructivism in Thailand.

5. Results and Discussion

5.1 Science Teachers' performance in the constructivist learning environment.

Classroom observations monitored student behavior. The observation observed students' actions and interactions with each other and the teacher. This observation assessed the student's classroom behavior objectively. Average scores were calculated to examine observation and questionnaire data. Each questionnaire response was scored on a scale of 1 to 5, with "very often" scoring 5, "often" scoring 4, "occasionally" scoring 3, "rarely" scoring 2, and "never" scoring 1.

Table 1 Classroom activities in various school sizes

School sizes	Activities
Large School	Doing activities according to the learning plan the 5Es of Inquiry-Based learning. In the unit on energy for elementary school students in grade 4, in the engagement stage, the teacher has done a brain gym activity to stimulate children's interest by singing and doing music. In the exploration stage, the teacher showed a video clip about energy for the children to watch. The teacher divided the students into four groups and distributed matching cards about energy use in different ways. After that, have students send their representatives out to attach matching cards to the board in front of the room. When all groups were completed, the teacher explained and concluded at the explanation stage. In the elaboration stage, the teacher asked the students for their opinions and asked them to help answer questions about the activity and how it can be used in daily life. And finally, in the evaluation stage, the teacher summarizes the results of the students' activities and gives grades for the activities, presentation, and understanding of content
Medium School	Based on the 5Es of inquiry-based learning activities, teaching, and learning in medium schools are similar to what happens in large schools. The teachers show students video clips about energy. Several times during the video, the teacher stopped it, ask them questions to see how much they knew. Having seen the video. The teacher grouped the students into three groups, each of which did a different activity and talked about its benefits and how energy is used in everyday life. Then, the teacher gave each group of students a piece of paper and told them to make a sketch that summarized everything they had learned. Then, have each group send two students to present in front of the class, one at a time, until all groups have done so. The teacher talked over the whole presentation information one more time. Asking students to answer questions at the same time is a good way, to sum up what they've learned in this class.
Small School	During this time at the small school, the focus of teaching is on learning about different parts of plants. The teacher wants students to understand these things by doing activities outside the classroom. When it's time for the science lesson, the teacher tells the students to meet outside under the trees in the school's courtyard. The class starts with a question from the teacher to make the students interested in plants. The students talk about the plants they know from their everyday lives. The teacher lets the students share what they know about plants. Everyone is happy and excited about the answers. The teacher is nice to the students and listens carefully to what they say. The teacher asks the students to help come up with ideas for activities. They talk about what plants are made of and what they do. Then, they go around the school looking at different plants. They draw pictures or write down what they see. After the activity, the teacher gathers the students together again. They talk about what they found during their plant exploration. The teacher and the students share their thoughts and ideas with each other.

Figure 1 Classroom activities in a large school

Figure 2 Classroom activities in a medium school

Figure 3 Classroom activities in a small school

In Figure 1, depicting a large school, we observe a structured, teacher-led learning environment focused on energy concepts, incorporating some interactive elements within the framework of the 5Es of Inquiry-Based learning in a traditional classroom setting. Moving to Figure 2, which represents a medium-sized school, we see a shift towards more varied group

activities and student presentations on energy topics, allowing for increased student participation and discussion while still adhering to the 5Es framework. Finally, Figure 3 showcases a small school environment, characterized by highly interactive, outdoor learning about plant biology. This setting emphasizes direct observations, student-led discussions, and collaborative activity planning in a personalized environment, demonstrating a more flexible and individualized approach to learning.

Table 2 CLES Classroom Observation Scores by School Size - Single Observation Results

CLES Scales	Large School	Medium School	Small School
Personal Relevance (Learning about the world)	4.33	4.33	4.16
Uncertainty (Learning about science)	1.00	2.16	3.66
Critical Voice (Learning to speak out)	1.66	1.66	3.66
Shared Control (Learning to learn)	1.00	1.00	4.66
Student Negotiation (Learning to communicate)	2.66	4.66	4.50

Observation Context:

- Single classroom observation per school
- Data collected by one researcher
- Observations conducted during regular science lessons
- Duration: One class period per school
- Time period: Within one week in November 2023

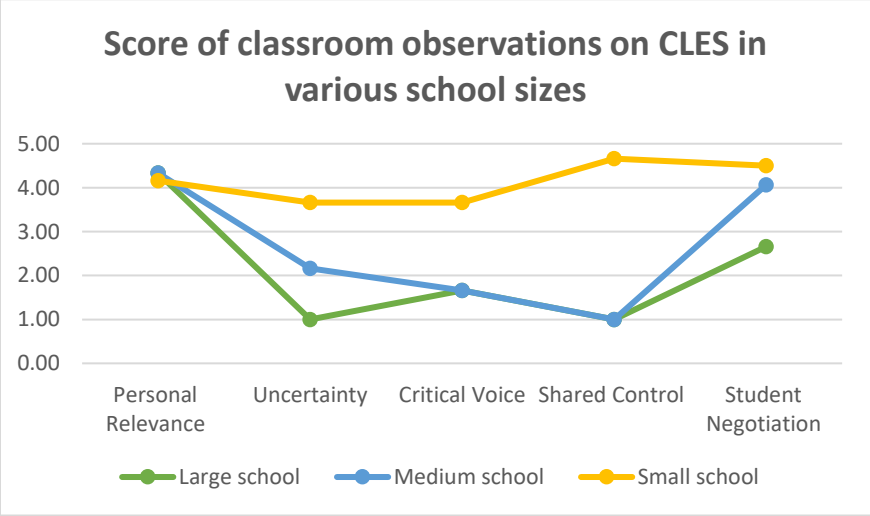

Figure 4 A score of classroom observations on CLES in various school sizes.

In the section on Personal Relevance (Learning about the world), students in all three schools had similarly high average scores, indicating that they were able to make connections between what they were learning and the world around them. However, when it came to Uncertainty (Learning about science), there were noticeable differences between the schools. Large schools had the lowest average scores, suggesting that students in these schools may have had less exposure to scientific concepts or less support for inquiry-based learning. Medium-sized schools had slightly higher scores, while small schools had the highest average scores on this topic. When it came to Shared Control (Learning to learn), which involves giving students a say in designing their own learning experiences, small schools scored very highly, while large and medium-sized schools had very low average scores. Finally, in the Student Negotiation (Learning to Communicate) section, students in the large and medium schools had similarly low average scores, while students in the small school had very high average scores on this topic.

5.2 Results of teacher interviews for all three sizes

The following table 3 presents example statements that teachers might make during interviews, which reflect the five dimensions of the Constructivist Learning Environment Survey (CLES). These examples are designed to assist researchers in identifying and categorizing qualitative data obtained from teacher interviews or classroom observations. Each statement demonstrates how teachers might articulate their implementation of constructivist principles in their teaching practice. Researchers can use this table as a guide for coding interview transcripts or as a basis for developing interview questions that probe each CLES dimension effectively.

Table 3 example statements that teachers might make during interviews

CLES Dimension	Example Teacher Statements
Personal Relevance (PR)	"I try to use examples from students' daily lives to teach scientific concepts." "I often ask students if they've seen what we're learning about in real life."
Uncertainty (UN)	"I teach students that scientific theories can change when new evidence emerges." "We discuss in class how scientific knowledge comes from experiments and questioning."
Critical Voice (CV)	"I encourage students to ask questions and share opinions about my teaching methods." "I provide opportunities for students to suggest learning activities they're interested in."
Shared Control (SC)	"I involve students in setting learning goals for the lesson.""We collectively decide how to assess students' work."
Student Negotiation (SN)	"I organize group discussions for students to exchange and critique each other's ideas.""I encourage students to explain their concepts and listen to their classmates' views."

Large school teacher’s chances and difficulties in constructivist science teaching

Large school teacher’s narrative

"To enhance the connection between knowledge inside and outside the classroom, I incorporate real-world examples and practical applications in my lessons. By engaging students through questions and video clips, I encourage them to draw upon their prior knowledge of the subject being studied. Currently, the science teaching department has developed comprehensive video resources for this purpose. ... It is not uncommon for some students to question the relevance of what they are learning. It's essential to create a safe and comfortable environment where students feel at ease expressing their doubts and concerns. Building a friendly relationship with students and offering positive reinforcement can boost their confidence in discussing their thoughts with the teacher. ... To encourage students to express their opinions freely, I adopt a friendly and open atmosphere in the classroom. When outsiders observe or record the teaching process, students might initially feel uneasy, but with time and familiarity, they will become more natural in their interactions. ... However, it's evident that students have limited involvement in the learning design. As an educator, I recognize the need to involve students in brainstorming ideas for teaching and learning management to make the process more engaging and relevant to their needs. ... The current education system heavily relies on indicators and a fixed curriculum, which can hinder students' ability to explore their interests fully. Focusing solely on meeting indicators might not allow students to reach their full potential. ... To foster a more qualitative and student-centric approach to education, we need to shift away from the overwhelming emphasis on quantitative measurement and evaluation. Instead of just completing tasks, students should be encouraged to engage in meaningful and in-depth research, which will better prepare them for higher-level examinations. ... Implementing constructive teaching and learning methods requires a systematic approach that involves changes at various levels, including entrance examinations and university admission processes. To be most effective, this approach should be supported by centralized policies and a collective effort from the education community. ..."

The narrative from the large school teacher reveals a complex educational landscape where efforts to implement constructivist principles intersect with systemic constraints. This analysis through the lens of the Constructivist Learning Environment Survey (CLES) highlights both the teacher's commitment to constructivist methods and the challenges faced in their implementation within a large school setting.

1) Personal Relevance (PR): The teacher demonstrates a strong commitment to this principle by incorporating real-world examples, practical applications, and multimedia resources into lessons. This approach aims to bridge the gap between classroom knowledge and students' everyday experiences, although some students still struggle to see the relevance.

Uncertainty (UN): While not explicitly addressed, the teacher's recognition of the limitations of a fixed curriculum suggests an awareness of the need to explore knowledge beyond predetermined boundaries.

2) Critical Voice (CV): The teacher actively fosters a safe and comfortable environment for students to express their doubts and concerns. This approach aligns well with the CLES principle of encouraging critical voice, though external observations may temporarily hinder this openness.

3) Shared Control (SC): The teacher acknowledges the limited involvement of students in learning design and recognizes the need for greater student participation in brainstorming ideas for teaching and learning management. This awareness indicates a desire to move towards more shared control, despite current limitations.

4) Student Negotiation (SN): The emphasis on engaging students in meaningful and in-depth research suggests support for student negotiation, although the focus on meeting indicators may constrain these opportunities.

The narrative highlights a significant tension between the teacher's aspirations for constructivist teaching and the realities of the current education system. The heavy reliance on indicators, fixed curriculum, and quantitative measurements poses substantial challenges to fully implementing CLES principles. The teacher's recognition of these systemic barriers demonstrates a deep understanding of the complexities involved in educational reform.

Notably, the teacher advocates for a shift towards a more qualitative, student-centric approach to education. This perspective aligns closely with constructivist principles and suggests a desire for systemic change to better support constructivist teaching methods.

Medium school teacher’s chances and difficulties in constructivist science teaching

Medium school teacher’s narrative

“The medium-sized school I teach at plays a vital role in our sub-district community. It serves as the educational backbone, providing quality education to all students, including those from low-income families. Parents in our community have high expectations for their children's education, and they look to our school to prepare them for higher education in the district secondary school. … The school aims to achieve academic performance at the national average level in the proficiency tests. Exceeding the national average brings great pride to both the school administration and the teachers. It reflects positively on the quality of education we provide and the dedication of our teachers and students. ... Teacher assessments in our school are mainly conducted internally. The principal and teachers responsible for academics evaluate our performance. These assessments are crucial in identifying areas of improvement for both teachers and students, allowing us to implement changes that enhance the quality of education. ... Active Learning is an essential part of our teaching approach, especially in science subjects. It encourages students to participate actively in hands-on learning activities, promoting critical thinking and problem-solving skills. We, as teachers, are encouraged to design creative lesson plans that foster student engagement and

enhance academic performance. ... For instance, when it comes to Personal Relevance, it can be a bit difficult to connect classroom learning with the daily lives of students in rural communities. However, we try to incorporate learning resources from outside the classroom to make it more relatable for them. ... When it comes to Uncertainty, some students tend to rely solely on textbook content, which can limit their understanding of real-world scientific concepts. We encourage them to conduct experiments and discuss the results, allowing them to question and explore beyond the textbook theories. ... Critical Voice can be a bit challenging to encourage, especially since students may hesitate to question certain topics or teaching methods. But we're working on creating a more open and supportive environment where students feel comfortable asking questions and expressing their opinions. … Student Negotiation can be limited due to pre-designed learning plans that need approval. However, we do seek student feedback on certain aspects, like experimental processes. It helps in making the learning experience more inclusive and student-oriented. ... The small class size and close-knit community provide a comfortable environment where students feel at ease exchanging ideas. However, we can further expand opportunities for student negotiation in various activities to empower them in their learning journey. ... The school director is very supportive of our student-centric approach to education. While we face some limitations due to the curriculum, the director emphasizes the benefits it brings to our students, and that motivates us to provide the best possible education for our students. ..."

The narrative from the medium-sized school teacher reveals a complex educational environment that strives to balance constructivist principles with community expectations and national educational standards. This analysis through the lens of the Constructivist Learning Environment Survey (CLES) highlights both the efforts made, and the challenges faced in implementing a constructivist learning environment.

1) Personal Relevance (PR): The school recognizes the importance of connecting classroom learning to students' daily lives, particularly in a rural community setting. While acknowledging the difficulty, teachers actively incorporate outside resources to enhance relevance, demonstrating a commitment to this CLES principle.

2) Uncertainty (UN): There's a conscious effort to move beyond textbook-based learning, encouraging experimentation and discussion. This approach aligns well with the CLES principle of exploring scientific uncertainty, though it faces the challenge of students' reliance on textbook content.

3) Critical Voice (CV): The narrative acknowledges the challenges in fostering a critical voice among students, particularly in questioning teaching methods or topics. However, there's a clear recognition of its importance and ongoing efforts to create a more open, supportive environment for student expression.

4) Shared Control (SC): While there are limitations due to pre-designed learning plans, the school seeks student feedback on certain aspects like experimental processes. This shows an attempt to incorporate shared control, albeit in a limited capacity.

5) Student Negotiation (SN): The small class sizes and close-knit community facilitate idea exchange among students. However, the teacher recognizes the need to further expand opportunities for student negotiation across various activities.

The school's context plays a significant role in shaping its approach to constructivist learning. As a vital educational institution in the sub-district, it faces pressure to meet national average performance levels while serving a diverse student population, including those from low-income families. This dual responsibility creates a tension between implementing constructivist principles and meeting standardized academic expectations.

The support from the school director for student-centric approaches is a positive factor, potentially facilitating further implementation of CLES principles. However, curriculum limitations and the emphasis on national proficiency tests pose challenges to fully embracing constructivist methods.

Small school teacher’s chances and difficulties in constructivist science teaching.

Small school teacher’s narrative

"I teach at a school situated in a rural area, and our community is actively involved in the educational process. The children here have a deep understanding of the local culture. The school has established a Memorandum of Understanding (MOU) with government agencies like Royal Park, providing valuable learning opportunities for students in agriculture and other subjects on a weekly basis. ... My class comprises only nine students, allowing me to provide individual attention and care to each child. I maintain a close and supportive relationship with my students, keeping them informed about current events outside the classroom. Every morning, during our flagpole activity, we discuss interesting and relevant news. This helps foster engaging discussions and enables them to share their perspectives. ... Most of the students' parents come from Shan State, Burma, and their main expectation from the school is a safe place for their children while they are at work. They specifically want their children to become proficient in reading and writing in Thai. ... Recognizing that science is constantly evolving, I see it as my responsibility to keep my students informed about the latest developments. They come from diverse cultural backgrounds, which enriches our classroom discussions with unique viewpoints. ... Initially, the students lacked an understanding of the significance of certain subjects, so I encourage them to question and explore the importance of what we study together. ... I firmly believe that children always possess great ideas; it's essential for me to have an open mind and listen to their thoughts to understand their perspectives better. ... To make the learning process engaging, I involve students in planning and designing teaching activities. By giving them the opportunity to create and participate actively, they have more fun and take ownership of their education. ... Regarding assessments, I use three different methods: I provide my evaluation, encourage peer evaluations, and most importantly, I welcome their feedback and opinions about my teaching during our class discussions. ... When it comes to group work, the students discover their own strengths and aptitudes, which helps in dividing

tasks efficiently based on individual capabilities. ... I am grateful for the freedom and support given by the school director, allowing me to manage my teaching effectively while fostering a safe and encouraging learning environment for all students. ..."

The narrative from the small rural school teacher presents a rich example of how constructivist principles can be effectively implemented in a unique educational setting. This analysis through the lens of the Constructivist Learning Environment Survey (CLES) reveals a learning environment that strongly aligns with constructivist ideals, facilitated by the school's small size, community involvement, and the teacher's dedicated approach.

1) Personal Relevance (PR): The teacher excels in this dimension by connecting classroom learning to the local culture and current events. The daily discussions of news during flagpole activities and the integration of local resources (such as the Royal Park) into the curriculum demonstrate a strong commitment to making learning personally relevant to students.

2) Uncertainty (UN): The teacher's acknowledgment of science as an evolving field and the commitment to keeping students informed about the latest developments align well with this CLES principle. The diverse cultural backgrounds of students further enrich discussions, promoting an understanding of multiple perspectives in knowledge construction.

3) Critical Voice (CV): The narrative shows a strong emphasis on encouraging students to question and explore the importance of subjects. The teacher's open-mindedness and willingness to listen to students' thoughts create an environment where critical voice is not just allowed but actively encouraged.

4) Shared Control (SC): This principle is well-implemented, with students involved in planning and designing teaching activities. The teacher's approach of giving students opportunities to create and participate actively in their education demonstrates a high level of shared control.

5) Student Negotiation (SN): Group work that allows students to discover their strengths and divide tasks based on individual capabilities strongly supports this principle. The emphasis on peer evaluations and class discussions further enhances opportunities for student negotiation.

The small class size of nine students enables the teacher to provide individualized attention and create a close, supportive relationship with each student. This intimate learning environment facilitates the implementation of constructivist principles by allowing for more flexibility and personalized learning experiences.

The school's context, including its rural setting and the diverse backgrounds of students (many with parents from Shan State, Burma), adds unique dimensions to the learning environment. The teacher effectively leverages these factors to enrich the educational experience, demonstrating how constructivist principles can be adapted to specific community needs and expectations.

The support from the school director, granting the teacher freedom in managing the classroom, plays a crucial role in enabling this constructivist approach. This administrative support allows for the creation of a safe and encouraging learning environment that aligns closely with CLES.

5.3 Integration of Quantitative and Qualitative Findings

The mixed-methods analysis reveals interesting relationships between school size and the implementation of constructivist approaches:

1) Personal Relevance The observational data shows high scores across all schools (4.16-4.33), which aligns with interview data where teachers from all school sizes attempt to connect lessons with real life, albeit through different methods: large schools utilize video resources, medium schools incorporate external learning resources, and small schools engage in daily news discussions.

2) Uncertainty Scores increase as school size decreases (1.00, 2.16, 3.66), reflected in interviews where small schools demonstrate greater flexibility in exploring knowledge beyond textbooks, while large schools are constrained by curriculum requirements and indicators.

3) Critical Voice Small schools score notably higher (3.66), consistent with interview data showing teachers' emphasis on student input, while large and medium schools (1.66) report student hesitancy in expressing opinions.

4) Shared Control There is a marked difference, with small schools scoring highest (4.66), aligning with teachers' reports of student involvement in activity design. Large and medium schools (1.00) face limitations from predetermined lesson plans.

5) Student Negotiation Medium and small schools show high scores (4.66, 4.50), attributed to smaller student numbers facilitating idea exchange, while large schools (2.66) face time and class size constraints.

These findings demonstrate that school size significantly influences the implementation of constructivist principles. Small schools exhibit greater flexibility and more conducive environments for constructivist learning, consistent with Taylor et al.'s (2022) research indicating that smaller class sizes promote constructivist learning approaches. Large schools, despite having strong intentions to implement constructivist methods, face systematic constraints that limit full implementation.

The integration of qualitative and quantitative data reveals that the challenges in implementing constructivist approaches are not merely pedagogical but are deeply connected to institutional structures and sizes. Small schools demonstrate advantages in creating more intimate learning environments that naturally align with constructivist principles, while larger schools must navigate more complex organizational structures that can impede constructivist implementation.

These findings suggest that efforts to implement constructivist teaching methods should consider school size as a critical factor, with different strategies potentially needed for schools of different sizes. Future research might explore how larger schools can overcome their structural constraints to better implement constructivist approaches, perhaps by developing size-specific strategies that maintain constructivist principles while accommodating larger student populations.

6. Conclusion

In the study, the researchers observed the teaching and learning practices in classrooms of large, medium, and small schools in Thailand. They used the CLES (Constructivist Learning Environment Survey) questionnaire to assess the constructivist learning environment in each classroom and also conducted interviews with teachers in all three sizes of schools. The findings of the study showed that the size and number of students, as well as the expectation of academic achievement in science for further education, have a significant impact on teaching and learning practices. In larger schools, there is a greater emphasis on teaching content by the teacher and focusing on exam preparation, as students are expected to continue their studies at a higher level and take exams for academic achievement at the national level. In contrast, smaller schools have

fewer expectations for continuing to higher education and thus give teachers more freedom to design instruction that focuses on student involvement and following the scientific quest. Another significant difference observed was the intimacy between students and teachers. In larger and medium-sized schools, the number of students per classroom is high, and many students come from faraway communities, making it difficult for teachers to establish close relationships with their students. In smaller schools, students typically come from the local community, and parents, students, and teachers are often close friends. This closeness allows for a more trusting relationship between teachers and students, providing an environment where students feel safe expressing their opinions and teachers can get to know each student individually. This, in turn, gives students the courage to express their opinions to teachers, leading to a more interactive and engaging learning environment.

In terms of learning outcomes, the study found that students in small schools who come from low-income families have the opportunity to develop professional skills through learning outside the classroom and connecting learning in the classroom to the outside world. Furthermore, students in smaller schools have more opportunities to design learning activities and participate in self-assessment, which is rare in larger schools that focus on academic subjects for higher education. The study concludes that the size of the school and the size of the classroom significantly affect constructivist learning. Larger schools with expectations for national test results tend to have less constructivist learning, while smaller schools with no expectations for national test results show constructivist learning more effectively. The researchers also noted that driving constructivist learning thoroughly and effectively must come from a centralized educational policy at the national level.

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