

Development of Teachers' Classroom Research Skills through Mathematics Instructional Innovation Using Application Technology to Improve Students' Learning Achievement

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Abstract

This research aimed to (1) investigate the level of teachers' skills in utilizing mathematics instructional innovation through application technology under the Office of the Basic Education Commission (OBEC), and (2) develop classroom research skills among teachers through the use of mathematics instructional innovation employing application technology to improve students' learning achievement. The sample group consisted of 367 teachers from secondary schools under OBEC during the 2024 academic year. The research instrument was a questionnaire with an overall reliability coefficient of 0.885. Data were analyzed using mean and standard deviation. The findings revealed that (1) teachers' skills in using mathematics instructional innovation with application technology were at the highest level (Mean = 4.58, S.D. = 0.48), and (2) teachers' classroom research skills through this instructional innovation were also at the highest level (Mean = 4.53, S.D. = 0.45).

Keywords : classroom research, instructional innovation skills, application technology, learning achievement

1. Introduction

Mathematics plays a crucial role in the success of learning in the 21st century, as it enhances creativity, rational and systematic thinking, and the ability to analyze problems or situations thoroughly. It supports planning, decision-making, problem-solving, and proper application in daily life (Institute for the Promotion of Teaching Science and Technology, 2002; Ministry of Education, 2017). Instructional management that fosters mathematical thinking processes is essential to promote students' understanding of mathematical concepts.

The Basic Education Core Curriculum B.E. 2551 (Revised Edition 2017) under the Mathematics Learning Area sets the goal for learners to acquire necessary knowledge and understanding of mathematical concepts, principles, and theories, and to apply them effectively. Learners should develop problem-solving, mathematical communication, reasoning, and creativity skills, possess positive attitudes towards mathematics, recognize its value and importance, and use mathematical knowledge as a tool for further education, career, and life-long learning. They should also be able to select appropriate media, tools, technologies, and information sources for learning, communication, work, and problem-solving effectively (Institute for the Promotion of Teaching Science and Technology, 2017).

In the 21st century, mathematics teaching must involve educators who possess strong mathematical knowledge and the ability to transfer it to learners, enabling them to keep pace with rapid scientific and technological changes in the globalized world. Education should therefore enhance quality of life and align with the socio-economic context (Noichun, Chuchuo, and Srirama, 2024). Hence, mathematics instruction today must enable learners to

achieve conceptual understanding and sufficient mathematical foundation to apply knowledge in solving real-life problems. Integrating digital technology into education in Thailand's 4.0 era aims to foster analytical, creative, and innovative thinking, as well as self-directed and responsible learning. Teachers must adapt by incorporating technology into instructional management (Suman & Bamrungcheep, n.d.).

Research has become essential in education since the promulgation of the National Education Act B.E. 2542 (1999), particularly Section 24(5), which mandates that educational institutions or related agencies promote and support teachers in creating conducive learning environments and using research as part of the learning process. Section 30 also requires institutions to develop effective instructional processes and encourage teachers to conduct research to enhance learning suitable for each educational level (Ministry of Education, 1999).

Classroom research, therefore, serves as an essential mechanism for teachers to improve their knowledge and enhance student learning outcomes in accordance with curriculum standards. Wongwanich (2010: 21) stated that classroom research is conducted by teachers to solve problems that occur in the classroom, and its results are used to improve instruction or enhance student learning. It should be conducted quickly, applied immediately, and provide reflective feedback to teachers and colleagues for shared discussion and learning.

Ritcharoon (2014: 37) further emphasized that classroom research arises from teachers' recognition of learning or instructional problems and their determination to find solutions through appropriate innovations. It originates from teachers' genuine care and goodwill toward students, aiming to improve learning outcomes. Therefore, classroom research becomes a means for teachers to seek new knowledge and methods for student development.

Consequently, this study aims to develop teachers' classroom research skills through mathematics instructional innovation using application technology to enhance students' learning achievement under the Office of the Basic Education Commission. The research results will help teachers improve their use of mathematics innovation and classroom research skills to generate new knowledge for enhancing student learning in alignment with the Basic Education Core Curriculum.

2. Objective

1. To study the level of teachers' skills in utilizing mathematics instructional innovations through application technology under the Office of the Basic Education Commission.

2. To develop teachers' classroom research skills through mathematics instructional innovation using application technology to enhance students' learning achievement under the Office of the Basic Education Commission.

3. Methodology

1. Population and Sample

The population consisted of 4,500 teachers in 30 secondary schools under the Office of the Basic Education Commission during the 2024 academic year. The sample comprised 367 teachers, determined using Yamane's formula at a 95% confidence level (Tirakanant, 2008: 179–180). Simple random sampling was employed to ensure representativeness.

2. Research Instrument

The instrument used was the Classroom Research Skills Assessment Form, developed as follows:

- 2.1 Study of relevant concepts, theories, documents, and research related to classroom research skills.

2.2 Development of a 5-point rating scale assessment form.

2.3 Content validity was verified by five experts using the Item-Objective Congruence (IOC) index, ranging between 0.80 and 1.00.

2.4 Revisions were made based on experts' feedback, followed by a try-out with 30 teachers outside the sample group. The scoring criteria were as follows:

5 = Highest level of classroom research skill

4 = High level

3 = Moderate level

2 = Low level

1 = Lowest level

Average scores were interpreted according to Srisakda (2013: 209):

Mean Score	Interpretation
4.51–5.00	Highest
3.51–4.50	High
2.51–3.50	Moderate
1.51–2.50	Low
1.00–1.50	Lowest

The reliability of the instrument, determined by Cronbach's Alpha Coefficient, was 0.885.

2.5 The finalized assessment form was printed and distributed to the sample group for data collection.

3. Data Collection

3.1 The researcher requested permission from the Dean of the Faculty of Education to conduct the study.

3.2 The researcher coordinated with school administrators and personally collected data through workshops designed to enhance innovation utilization and classroom research skills.

3.3 Teachers in the sample group completed the assessment form.

3.4 The data were reviewed for completeness.

3.5 The data were analyzed using statistical software.

4. Data Analysis

Data were analyzed using mean and standard deviation.

4. Results

Table 1 Mean and Standard Deviation of Teachers' Skills in Utilizing Mathematics Instructional Innovation through Application Technology

Item	Mean	S.D.	Interpretation
Knowledge of innovation manual	4.65	0.40	Highest
Understanding of innovation download	4.60	0.48	Highest
Understanding of innovation access system	4.58	0.50	Highest
Understanding of lesson use	4.48	0.55	High
Understanding of innovation rules and regulations	4.63	0.44	Highest
Understanding of exercises	4.59	0.42	Highest
Understanding of students' access statistics	4.57	0.58	Highest
Understanding of testing	4.58	0.46	Highest
Understanding of score processing	4.55	0.57	Highest

Item	Mean	S.D.	Interpretation
Application of innovation in classroom instruction	4.49	0.62	High
Overall	4.58	0.48	Highest

Teachers' overall skills in utilizing mathematics instructional innovation through application technology were at the highest level (Mean = 4.58, S.D. = 0.48).

Table 2 Mean and Standard Deviation of Teachers' Classroom Research Skills

Item	Mean	S.D.	Interpretation
Understanding of classroom research methodology	4.53	0.49	Highest
Understanding of problem identification	4.60	0.42	Highest
Understanding of literature review	4.57	0.55	Highest
Understanding of research objectives	4.55	0.48	Highest
Understanding of population and sample	4.52	0.50	Highest
Understanding of sample size determination and sampling	4.58	0.52	Highest
Understanding of instrument construction and quality checking	4.52	0.58	Highest
Understanding of statistical analysis	4.51	0.50	Highest
Ability to write preliminary report sections	4.53	0.57	Highest
Ability to write Chapter 1	4.54	0.48	Highest
Ability to write Chapter 2	4.49	0.40	High
Ability to write Chapter 3	4.51	0.54	Highest
Ability to write Chapter 4	4.48	0.62	High
Ability to write Chapter 5	4.52	0.49	Highest
Ability to write concluding sections (references, appendices, researcher's biography)	4.55	0.52	Highest
Application of knowledge to conduct classroom research	4.54	0.50	Highest
Overall	4.53	0.45	Highest

Teachers' overall classroom research skills were at the highest level (Mean= 4.53, S.D. = 0.45)

5. Conclusion And Future Work

The study found that (1) teachers' skills in utilizing mathematics instructional innovations through application technology were at the highest level (Mean = 4.58, S.D. = 0.48), and (2) teachers' classroom research skills using mathematics instructional innovation through application technology were also at the highest level (Mean = 4.53, S.D. = 0.45). These results may be attributed to the practical workshops that provided teachers with training in the use of innovation manuals, system access, lesson practice, testing, and utilization statistics for individualized learning assessment. Teachers were also trained in classroom research methodology, including problem identification, literature review, setting objectives, determining sample size and sampling, instrument development, data analysis, and five-chapter research report writing.

These findings align with Boonphadung (2014), who developed teachers' research competencies based on Vygotsky's partnership principle and found that teachers' post-development classroom research competencies exceeded 85% at a statistically significant level of 0.05.

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