Development of the Geo-Time Interactive Learning Innovation Using the PARAM.ED Model to Enhance Geographic Learning Achievement and Analytical Thinking Skills in Lower Secondary Students

Paramed Sukchaem

196 group 3 khokdua Phaisalee Nakhonsawan Thailand.

Abstract: This study developed and evaluated the Geo-Time Interactive Learning innovation based on the PARAM.ED Model to enhance Grade 7 students' understanding of geographic coordinates and the world time system. The research objectives were to: (1) develop the innovation, (2) examine its efficiency following the 80/80 criterion, (3) compare students' learning achievement before and after using the innovation, (4) analyze their analytical thinking skills, and (5) investigate their satisfaction.

The study employed a research and development (R&D) design. The sample comprised 38 Grade 7 students selected through cluster random sampling. Research instruments included the innovation, lesson plans, a 30-item achievement test, an analytical thinking test, and a satisfaction questionnaire. Data were analyzed using mean, standard deviation, efficiency index, and dependent t-test.

Results indicated that the innovation demonstrated very high quality according to expert evaluation. Its efficiency (82.67/83.50) surpassed the 80/80 benchmark. Students showed significantly higher post-learning achievement scores than pre-learning scores at the .01 level. Analytical thinking skills were at a good level, and overall satisfaction was at the highest level. The findings confirm that the Geo-Time Interactive Learning innovation effectively strengthens learners' conceptual understanding, spatial reasoning, and analytical thinking while increasing motivation in geography learning.

Keywords: *Geo-Time Interactive Learning, PARAM.ED Model, Geographic Coordinates, World Time System, Analytical Thinking Skills.*

Introduction

Teaching geographic coordinates and the world time system poses significant challenges due to the abstract nature of the content. Students frequently struggle to visualize spatial phenomena such as latitude, longitude, hemispheres, and global time variations. Conventional instruction, dominated by textbook examples and static visuals, often results in low engagement and limited conceptual understanding.

The advancement of 21st-century education emphasizes analytical thinking, digital literacy, and active learning approaches. Therefore, integrating instructional innovation with interactive media has become essential. The PARAM.ED Model—comprising Primary Knowledge, Analysis, Renovation, Acting, Measure, Evaluation, and Development—offers a systematic learning process that encourages higher-order thinking, continuous assessment, and real-world knowledge application.

This study developed the Geo-Time Interactive Learning innovation using the PARAM.ED Model to transform abstract geographic content into interactive, student-centered experiences. The innovation integrates digital simulations, interactive applications, learning games, and multimedia elements to support visualization, exploration, and analytical reasoning.

Literature Review

Learning Innovation

Learning innovation focuses on developing or improving instructional approaches to enhance learning effectiveness. High-quality innovations must provide advantages over traditional methods, promote learner-centered pedagogy, and align with curriculum standards.

PARAM.ED Model

The PARAM.ED Model is a structured, seven-step instructional framework emphasizing cognitive development and application. Each step builds progressively from foundational understanding to evaluation and development, supporting constructivist and active learning principles.

Geographic Coordinates and World Time System

Understanding geographic coordinates involves interpreting latitude, longitude, and hemispheric divisions. World time relies on Earth's rotation, longitude differences, and the Prime Meridian. These topics require dynamic visualization tools to support accurate conceptualization.

Analytical Thinking Skills

Analytical thinking comprises classification, comparison, sequencing, inference, and cause–effect reasoning. It is vital for problem-solving and deeper learning, particularly in geography, where spatial reasoning is essential.

Methodology

Research Design

A research and development (R&D) design was employed, including innovation design, expert evaluation, pilot testing, implementation, and assessment.

Participants

The sample consisted of 38 Grade 7 students from a public school selected via cluster random sampling.

Research Instruments

Geo-Time Interactive Learning Innovation: Interactive 3D globe, coordinate tools, time-zone simulator, game-based activities, multimedia resources.

Lesson Plans: Ten 50-minute lessons based on the PARAM.ED Model.
Achievement Test: 30 multiple-choice questions.
Analytical Thinking Test: 20 items across five components.
Satisfaction Questionnaire: 25 Likert-scale items.

Procedures

1. Needs analysis and content study.
2. Innovation design and development.
3. Expert validation.
4. Pilot testing and revision.
5. Implementation in actual classroom.
6. Pre-test and post-test data collection.
7. Data Analysis.

Descriptive statistics (mean, SD)

Efficiency calculation (E1/E2)

Dependent t-test for learning achievement comparison.

Results

Quality of the Innovation

Experts rated the innovation as "very high quality" in content accuracy, presentation design, and technical usability.

Efficiency (E1/E2)

E1 = 82.67 (process efficiency)

E2 = 83.50 (product efficiency)

Both exceeded the 80/80 standard.

Learning Achievement

Post-test scores were significantly higher than pre-test scores at the .01 level, demonstrating substantial improvement.

Analytical Thinking Skills

Students achieved a mean score of 16.25, indicating a good level of analytical thinking.

Student Satisfaction

Overall satisfaction was at the highest level ($\bar{x}$ = 4.67), with the "media and technology" dimension rated highest.

Discussion

The effectiveness of the innovation can be attributed to its strong alignment with the PARAM.ED Model, which supports structured learning progression, continuous assessment, and higher-order thinking. The use of digital simulations and interactive tools enhanced students' visualization of abstract concepts, consistent with multimedia learning theories.

Interactive games and hands-on activities increased motivation, leading to deeper engagement and improved learning achievement. The significant gains in analytical thinking align with research showing that structured problem-solving and collaborative exploration foster cognitive development. High student satisfaction further demonstrates the motivational impact of integrating technology with pedagogy.

Conclusion

The Geo-Time Interactive Learning innovation using the PARAM.ED Model effectively improves students' conceptual understanding, analytical thinking skills, and engagement in learning geographic coordinates and world time systems. The innovation meets quality standards, exceeds efficiency criteria, and demonstrates strong potential for broader implementation.

Recommendations

For Practice

Integrate the innovation into geography curricula to enhance learning outcomes.

Provide teacher training on PARAM.ED-based digital instruction.

Utilize the innovation in hybrid or online learning environments.

For Future Research

Expand the innovation to other geography units.

Compare the PARAM.ED Model with other pedagogical frameworks.

Investigate additional variables such as creativity, problem-solving, or spatial intelligence.

Recommendations

For Practice

- Teachers should integrate interactive learning with PARAM.ED to promote deeper understanding.
- Schools should support digital resources for geography instruction.

For Future Research

- Apply the innovation to other geography topics.
- Compare PARAM.ED with other instructional models.
- Expand the innovation into mobile or online platforms.

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