Mathematical Problem-Solving Outcomes of Mathayom Suksa 1 Students Learning With Constructivist Digital Game-Based Learning Environment

Research Background

Mathematical Problem-Solving Challenge

In PISA 2022, Thai students' mean mathematics score fell to 394, down from 419 in 2018. This decline highlights the need to strengthen students' thinking, analytical, and real-world problem-solving skills.

Learning Design Gap

Previous studies show the potential of constructivist and digital game-based learning, yet few explain how game mechanics (Challenge, Response, Feedback) support learners at each step of problem solving.

Research Objectives

- To examine post-instruction mathematical problem-solving scores against the predetermined criterion
- To investigate problem-solving processes across Polya's four steps

Methodology

Participants

16 Grade Mathayom Suksa 1 at Siharach Dechochai School (Semester 2, academic year 2025)

Research Design

Phase 3 of the validation process in Developmental Research Type I, using a pre-experimental one-group posttest-only design (One-Shot Case Study).

Constructivist Digital Game-Based Learning Environment

A web-based constructivist learning environment with Challenge–Response–Feedback mechanics



Data Analysis

- **Quantitative:** mean (*M*), standard deviation (*SD*), and Percentage
- **Qualitative:** protocol analysis based on Polya's four problem-solving steps

Results

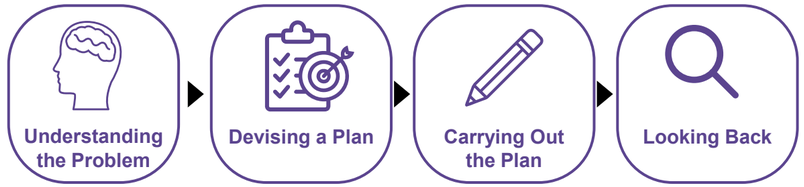
Problem-Solving Score Compared with the Criterion

Students' mean score was 13.88 out of 16 (*SD* = 1.54), or 86.75% of the full score.
Of the 16 students, 15 (93.75%) met the 70% individual criterion, exceeding the group criterion of 80%.

Mean Score (out of 16)	Students Meeting the 70% Individual Criterion
13.88 / 16 points 86.75%	15 / 16 students 93.75%

Interview Results

Interviews with 10 students showed that they applied all four of Polya's steps.



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