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**EXTENDED ABSTRACTS**

**e-BOOK**

# EXTENDED ABSTRACTS e-BOOK

THE 13th INTERNATIONAL  
INNOVATION, INVENTION &  
DESIGN COMPETITION 2024



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# LeTTRaN KIT: MATHEMATICS TOOL INNOVATION FOR THE RATIONAL NUMBERS TOPIC

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## ABSTRACT

Let's Treasure The Rational Numbers (LeTTRaN) Kit is a teaching aid that integrates the game-based learning (GBL) approach. The development of the LeTTRaN Kit was motivated by the findings of a need analysis study for the development of a mathematics kit that integrated the GBL approach. The design of the LeTTRaN Kit follows the five phases of the ADDIE model: analysis phase, design phase, development phase, implementation phase, and evaluation phase. LeTTRaN Kit is developed solidly to assist the teaching and learning process for mathematics subjects focusing on the Rational Numbers topic. There are five components representing the LeTTRaN Kit: the LeTTRaN application, instructional material, lesson plan, activity sheet and worksheet. All components have their functions and play a role in completing teaching and learning activities using the LeTTRaN Kit. Besides, the LeTTRaN Kit has successfully undergone evaluation, including validation and usability testing. According to expert validation findings, the LeTTRaN Kit obtained satisfactory validity for its face and content. Furthermore, after implementing the LeTTRaN Kit, the usability results showed a high mean score, indicating the high impact of using the LeTTRaN Kit in the teaching and learning process. Overall, the LeTTRaN Kit is validated as a good teaching aid in improving student achievement and motivation in the rational numbers topic. It can serve as a viable alternative for classroom instruction and guide teachers in creating teaching aids that integrate GBL.

**Keywords:** game-based learning, mathematics, rational numbers

## 1. INTRODUCTION

A group of students perceive mathematics as a subject beyond their capabilities (Rohmat and Lestari, 2019). This perception has implications for students' achievement and motivation in mathematics. Meanwhile, high-quality teaching and learning experiences, in line with the evolving landscape of education, necessitate teachers to identify appropriate teaching aids (Abdul Rahman et al., 2022).

Let's Treasure The Rational Numbers, or LeTTRaN Kit, was developed based on a needs analysis study conducted by Abdul Rahman and Shafie (2024). This kit was developed by integrating the game-based learning (GBL) method for the topic of rational numbers, which encompasses four components: teaching aids, daily lesson plans, activity sheets, and worksheets.

There are four objectives outlined in the development of this kit, namely validity, usability level, the impact of using the LeTTRaN Kit on students' achievement, and motivation.

## 2. METHODOLOGY

The ADDIE instructional design model has been selected as a guide for developing the LeTTRaN Kit. According to Abu et al. (2020), this model is comprehensive and can assist in developing, evaluating, and maintaining teaching and learning situations to achieve learning goals. The ADDIE model consists of the analysis, design, development, implementation, and evaluation phases.

## 2.1 Analysis Phase

The analysis phase is the first phase in the ADDIE model and serves as the foundation for all subsequent phases. According to Aldoobie (2015), this phase is highly crucial and requires adequate attention. Among the analyses required in this phase are identifying problems and seeking ways to address them.

## 2.2 Design Phase

This is the second stage within the ADDIE model. According to Ahmad et al. (2020), the outcomes derived from the analysis phase will dictate the planning process in the design phase. To achieve learning objectives, researchers focus on designing daily lesson plans by integrating two learning theories. Meanwhile, learning activities and media selection are delineated in the form of applications, instructional materials, activity sheets, and worksheets.

## 2.3 Development Phase

This phase marks the third stage after researchers have successfully formulated ideas to develop the kit. This phase will detail the development of the LeTTRaN Kit. The kit's development will involve components such as teaching and learning materials intertwined with technological elements. There are applications, instructional materials, lesson plans, activity sheets, and worksheets. Following the development of the LeTTRaN Kit, this phase also involves conducting face and content validity tests on all its components.

## 2.4 Implementation Phase

According to Aldoobie (2015), three aspects require attention during the implementation phase: training teachers, preparing students, and organising the learning environment. These three aspects play a crucial role in effectively achieving the objectives and goals of this phase. Therefore, to accomplish these three aspects, this phase is divided into two processes: guidance for teachers or educators and implementation of learning for students at school.

## 2.5 Evaluation Phase

This phase is crucial in assessing each step to meet the needs of students (Aldoobie, 2015). In the context of the study, the researcher performed two forms of assessment: formative and summative.

# 3. FINDINGS

## 3.1 Development of the LeTTRaN Kit

The LeTTRaN Kit was developed based on a needs analysis study by Abdul Rahman and Shafie (2024). After the LeTTRaN Kit was developed, the validation process of the LeTTRaN Kit was carried out. The validity of the LeTTRaN Kit was assessed based on the Content Validity Index (CVI) recommended by Lynn (1986). Table 1 shows the average CVI value obtained, which is 1.00.

**Table 1** Expert Assessment on the Development of the LeTTRaN Kit

No.	Construct	CVI
1	Validity of the LeTTRaN Kit Interface	1.00
2	Validity of the LeTTRaN Kit Application	1.00
3	Validity of the LeTTRaN Kit Lesson Plan Content	1.00
4	Validity of the Equivalence of LeTTRaN Kit Lesson Plans with Conventional Lesson Plans	1.00
Average CVI		1.00

### 3.2 Usability Level of the LeTTRaN Kit

A one-sample t-test analysis was conducted for the mean score of the usability of the LeTTRaN Kit teaching aids. The analysis revealed a significant value of  $p < 0.05$ , indicating that the mean score of the usability of the LeTTRaN Kit for the rational numbers topic is high.

### 3.3 Effects of Using the LeTTRaN Kit on Student Achievement

The significant value obtained through the implementation of the ANCOVA test is  $p < 0.05$ . This significant value indicates a significant difference in the mean post-achievement test scores of the rational numbers topic between the treatment and control groups.

### 3.4 Level of Student Motivation

A one-sample t-test analysis was conducted for the level of student motivation based on mean motivation scores. The analysis revealed a significant value of  $p < 0.05$ . This significant value indicates that the level of student motivation after undergoing teaching and learning sessions using the LeTTRaN Kit for the rational numbers topic is high.

## 4. CONCLUSION

Generally, this study has successfully developed an innovative product in education that can serve as a teaching aid, particularly for the subject of mathematics. The kit that integrates GBL has had a significantly positive impact on students. Furthermore, it has elicited a positive response and altered the perceptions of both students and educators in the field of mathematics education.

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