



International Teaching Aid  
**Competition 2023**

Reconnoitering Innovative Ideas in Postnormal Times

**iTAC**

**2023**

**iTAC 2023**  
**INTERNATIONAL TEACHING AID COMPETITION**  
**E-PROCEEDINGS**

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## **PREFACE**

iTAC or International Teaching Aid Competition 2023 was a venue for academicians, researchers, industries, junior and young inventors to showcase their innovative ideas not only in the teaching and learning sphere but also in other numerous disciplines of study. This competition was organised by the Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch, Malaysia. Its main aim was to promote the production of innovative ideas among academicians, students and also the public at large.

In accordance with the theme "Reconnoitering Innovative Ideas in Post-normal Times", the development of novel ideas from the perspectives of interdisciplinary innovations is more compelling today, especially in the post-covid 19 times. Post-pandemic initiatives are the most relevant in the current world to adapt to new ways of doing things and all these surely require networking and collaboration. Rising to the occasion, iTAC 2023 has managed to attract more than 267 participations for all categories. The staggering number of submissions has proven the relevance of this competition to the academic world and beyond in urging the culture of innovating ideas.

iTAC 2023 committee would like to thank all creative participants for showcasing their innovative ideas with us. As expected in any competition, there will be those who win and those who lose. Congratulations to all the award recipients (Diamond, Gold, Silver and Bronze) for their winning entries. Those who did not make the cut this year can always improve and join us again later.

It is hoped that iTAC 2023 has been a worthy platform for all participating innovators who have shown ingenious efforts in their products and ideas. This compilation of extended abstracts published as iTAC 2023 E-Proceedings contains insights into what current researchers, both experienced and novice, find important and relevant in the post-normal times.

Best regards,

**iTAC 2023 Committee**  
**Special Interest Group, Public Interest Centre of Excellence (SIG PICE)**  
**UiTM Kedah Branch**  
**Malaysia**

## S PLUS-MATH TILES

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### ABSTRACT

S Plus-Math Tiles are a newly developed and enhanced version of S-Math Tiles. The improved version comes with letter tiles in addition to a set of number and symbol tiles. The improved functionality is intended to be used as a tool for changing the subject of a formula on top of solving linear equations with a single variable on one side. When changing the subject of a formula, students move a term from one side of the equals sign to the other and change the operation to the opposite. The steps of changing the subject of a formula are identical to solving linear equations with a single variable on one side. This is exactly the same process for solving linear equations. Students, however, constantly struggle to figure out which term moves first in order to solve a linear equation or change the subject of a formula. S Plus-Math Tiles were developed to serve as a hands-on tool that actively engages students in the learning process through visual and interactive experiences. The development of S Plus-Math tiles with the BODMAS rule integrated into the transpose method to assist students in choosing which term moves first from one side of the equal sides to the other. The students only need to perform four simple steps to obtain the solution. As a result of adopting S Plus-Math tiles, students may easily change the subject of a formula as well as solve all kinds of linear equations with a single variable on one side. Teachers can also benefit from S Plus-Math Tiles by using them to create a productive learning environment for students and get them actively involved in their studies. S Plus-Math Tiles have the potential to be commercialized for the general public, particularly education professionals, parents, and students.

**Keywords:** Linear equation, Subject of formula, BODMAS, Transpose method, Teaching and learning aids

## INTRODUCTION

Algebra is one of the branches of mathematics that helps in the presentation of problems or situations in the form of mathematical expressions. It involves symbols, and these symbols do not have any fixed values and are called variables. In order to generate a meaningful mathematical expression, algebra uses variables like  $x$ ,  $y$ , and  $z$  together with mathematical operations like addition, subtraction, multiplication, and division. Algebra is used in all areas of mathematics, including trigonometry, calculus, and coordinate geometry.

Algebra is divided into different sub-branches, such as elementary algebra, advanced algebra, abstract algebra, linear algebra, and commutative algebra. Some of the main topics coming under algebra include the basics of algebra, exponents, simplification of algebraic expressions, polynomials, quadratic equations, and so on. The transformation of a formula or changing the subject of a formula is one of the topics in elementary algebra. Subject of a formula is a variable which is expressed in terms of other variables involved in the formula. In other words, it is the variable which stands on its own, usually on the left side of the equation. Every time a formula's subject is changed, we must ensure sure the new subject only appears once.

When changing the subject of a formula, we rearrange the formula so that we have a different subject. To do this, we move a term from one side of the equal sign to the other, change the operation to the opposite. Formulas are written so that a single variable, the subject of the formula is on the left-hand side of the equation. Everything else goes on the right side of the equation.

## PROBLEM STATEMENT

The transpose method is a common method that is implemented by students when changing the subject of a formula. Transpose means transferring the term from its place to the opposite side of a formula. In transposition, the plus sign of the term changes into a minus sign on the other side, and vice versa. Students, however, constantly struggle to figure out which term moves first in transposition. Therefore, S Plus-Math Tiles are introduced to students when changing the subject of a formula.

## OBJECTIVES

This product was developed to achieve the following objectives:

- a) To act as a hands-on tool
- b) To engage students in the learning process through visual and interactive experiences

- c) To determine which term moves first in applying the transpose method to change the subject of a formula

## PRODUCT DESCRIPTION

S Plus-Math Tiles are a newly developed and enhanced version of S-Math Tiles. The improved version comes with letter tiles in addition to a set of number and symbol tiles. The original version, S-Math Tiles, only consists of a set of number and symbol tiles. S-Math Tiles were developed to assist students in solving linear equations with one variable on one side. Since changing the subject of a formula is very similar to solving an equation, S-Math Tiles were innovated to change the subject of a formula as well. The improved functionality is intended to be used as a tool for changing the subject of a formula on top of solving linear equations with a single variable on one side.

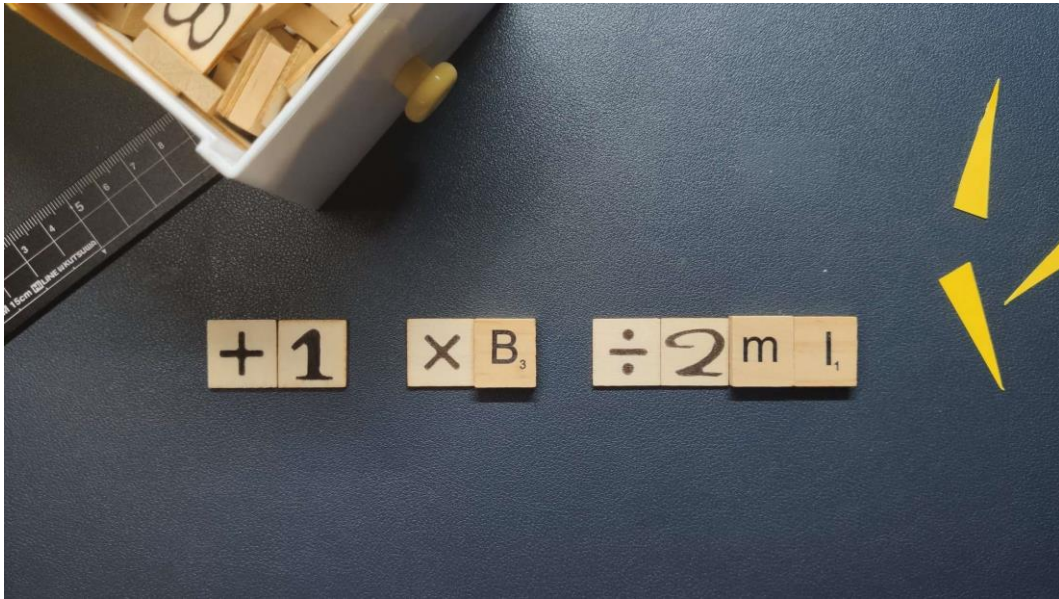
Students only need to perform four steps to change the subject of a formula. The steps are as follows and are explained through an example.

For example, given  $r = \frac{2mI}{B(n+1)}$ , express  $n$  in terms of  $r, m, I$  and  $B$ .

Step 1: Make sure the desired subject is in the numerator. If the desired subject is not in the numerator, both sides (fractions) invert upside down.

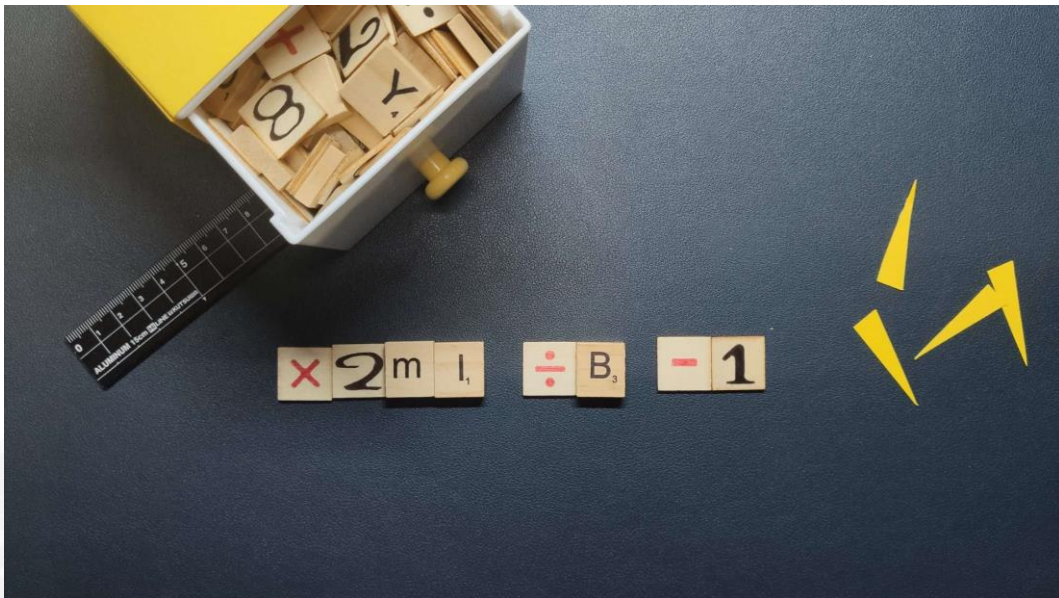
$$\frac{1}{r} = \frac{B(n+1)}{2mI}$$

Step 2: Arrange the terms and their operations according to the BODMAS rule. The BODMAS rule is an acronym representing the order of operations in mathematics. It stands for bracket, order, division, multiplication, addition, and subtraction.



**Figure 1.** Arrange the terms and their operations according to the BODMAS rule

Step 3: Move the terms and their operations to the opposite side in reverse order. Then, flip the sign tile.



**Figure 2.** Move the tiles in reverse order and flip the sign tiles



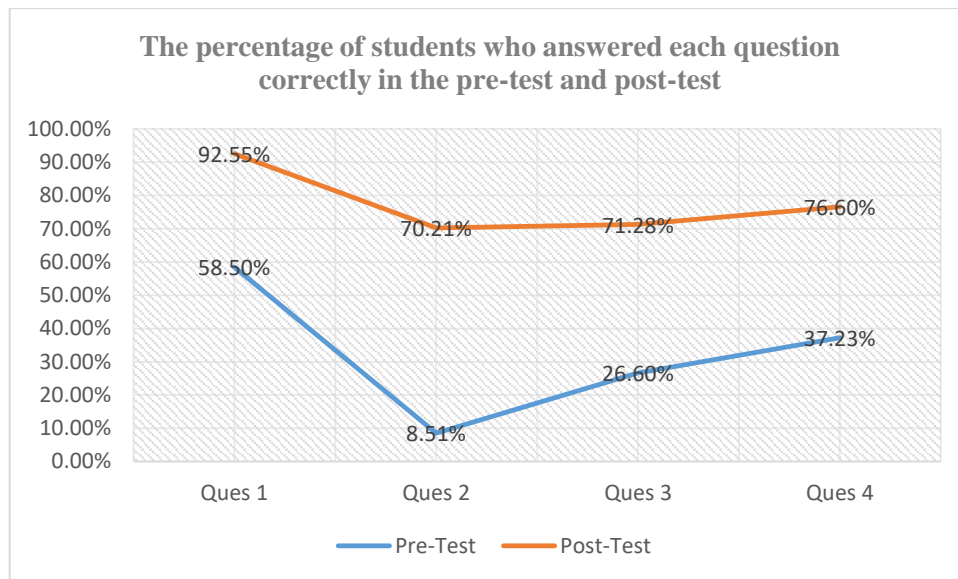
Step 4: Rewrite the formula.

$$\frac{\frac{1}{r}(2mI)}{B} - 1 = n$$

$$\therefore n = \frac{\frac{1}{r}(2mI)}{B} - 1$$

## RESULTS AND DISCUSSIONS

A pre-test and post-test survey were conducted to evaluate the effectiveness of the S Plus-Math Tiles. The respondents were randomly selected from pre-diploma students of the semester Oct 2022-Mar 2023 who took the course MAT037 Intensive Mathematics I at UiTM Sarawak Branch, Mukah campus. Data has been collected from 94 students who used S Plus-Math Tiles. The students were asked to answer four questions prior to using the S Plus-Math Tiles and after using the S Plus-Math Tiles. Figure 3 below illustrates the findings for both the pre-test and post-test. The results revealed a significant rise in the percentage of students who answered each question correctly. For question 1, 58.5% of the students answered correctly in the pre-test, and it then rose to 92.55% in the post-test. Same goes for question 2, where just 8.51% of the students were able to answer accurately as compared to 70.21% in the post-test. While for question 3, 26.6% and 71.28% were shown in the pre-test and post-test, respectively. Similar results were observed for question 4, in which 37.23% of students were able to come up with a correct answer in the pre-test and later increased to 76.6% in the post-test. On average, the percentage of questions that were answered correctly by the students increased from 32.5% to 77.5%.



**Figure 3.** The number of students who answered each question correctly in the pre-test and post-test

## CONCLUSION

Mathematical tools encourage learning on a variety of levels, including the learning of concepts, methods, and facts. The learning tools can be traditional, technological, or social. They make mathematics more approachable and easier for students to comprehend by allowing them to adapt and think about concepts. In conclusion, it is evident that S Plus-Math Tiles, an innovative product, are a learning tool that aids students in being more engaged in their learning process, learning more effectively and efficiently, and improving their mathematics performance in changing the subject of a formula.

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## REFERENCE

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