IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, November 2024

Enhancing Learning of Linear Equations with One Variable using Algebra Tiles Positively-Review Analysis

M. Krishna Reddy
Lecturer in Mathematics
Government College for Men, Kurnool, India

Abstract: *This research set out to investigate the potential of algebra tiles to aid students' comprehension of one-variable linear equations. In this study, we will look at the benefits of utilizing algebra tiles with younger students. The findings demonstrate that algebra tiles may aid students in comprehending how to formally solve one-variable linear equations. We shall discuss the past reviews from 2014 to 2024 in this area of teaching and learning linear equation through Algebra with one variable and portray the success rate.*

Keywords: algebraic tiles, design research, balance approach, one-variable linear equations

I. INTRODUCTION

For the purpose of learning algebraic concepts, algebra tiles are a useful mathematical tool that integrates geometric and algebraic methods [Shahi, B. B. (2015)]. Use of algebra tiles may aid students in comprehending abstract ideas and methods of algebraic reasoning. According to Ergene et al. (2021), they also provide pupils with a second opportunity to answer the algebraic issue. The algebra tiles are rectangular and square in design and stand for variables and integers. There are three pieces of algebra tiles, each with a distinct size. A tiny square tile symbolises ± 1, a medium-sized rectangle tile represents ± x, and a big square tile represents ± x2. One colour is used to denote positive values and another colour for negative values on the pieces.

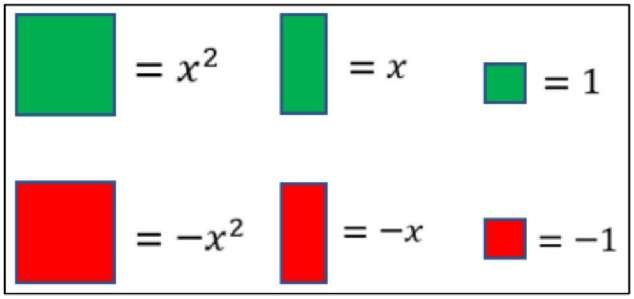

Figure 1: Algebra tiles

According to research by ERGENE et al. (2021) and Garzón et al. (2018), algebra tiles are a kind of manipulative material that may help students better understand algebraic concepts. They have several uses in the classroom, including as helping students visualise algebraic expressions (both additive and multiplicative), considering polynomials, and tackling frameworks of straight conditions. These tiles may be easily found and even made in a classroom with the use of templates, as shown in the present investigation. Basically, they are just a set of rectangles and squares, where the regions represent different algebraic monomials. According to researchers Garzón and Bautista (2018).

1.1 Linear Equation of One variable

The mathematical statement known as an equation is one in which the values on each side of the equal sign are equal. Much to the pivot point of a seesaw or balance, the equivalent sign shows that the qualities on each side are equal in

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, November 2024

importance. Therefore, in order to keep the equation in balance, it is necessary to execute operations on both sides (Beckmann et al., 2010). As per Corry (2019), conditions are maybe the most fundamental idea in mathematics. A simple formal assertion might be x+2=5, which claims that a numerical condition on two separate sides is equivalent. By applying the same operation to both sides of an equation, we may identify the roots, add, divide, and other useful functions.

Linear conditions with one variable expect understudies to have a strong grasp of algebra. Algebra is defined by Breggren (2015) as "a subfield of mathematics concerned with the proper control of unique images comprehended as factors instead of substantial numbers " (instead of raw numerical values).

Beginning algebraic concepts are introduced in seventh grade with linear equations with one variable. According to Cai et al. (2005), algebra is often described as a crucial 'gatekeeper' in mathematics. Moreover, "a motivation for studying algebra was the solution of equations" (Saraswati et. al., 2016, Krantz, 2006) is mentioned in Al Khawarizmi's book. It demonstrates that knowing about linear equations with one variable is crucial for understanding other areas of mathematics. Unfortunately, Indonesian classroom instruction does not help pupils grasp the idea of solving one-variable linear equations. According to Jupri (2015), the formal technique for teaching direct conditions with one variable is the only one that the majority of learning processes are familiar with.

In addition, according to Jupri et al. (2014), one typical blunder while trying to grasp the idea of a linear equation is to apply mathematical operations. For example, if you want to know what x is in the equation 3x= 5, you may divide 5 by 3. Nevertheless, x= 5 − 3 is a typical entry point for pupils. Students find it challenging to acquire both the conceptual and practical knowledge necessary to settle straight conditions with one variable (Magruder, 2012). Understudies making the leap from more tangible to more abstract mathematics typically struggle with linear equations. Students need education that helps them make the transition from theoretical to practical thinking.

1.2 Manipulatives

The use of manipulatives is one strategy that has been portrayed as a compelling method for supporting understudy execution (Carbonneau et. al., 2013). It is equally crucial to utilise manipulatives correctly. Using manipulatives effectively is crucial for ensuring that they contribute to meaningful learning. The best way for children to learn mathematics is for them to be actively involved in their own education, rather than just sitting passively and listening to a teacher speak. Teachers may turn their students from spectators to participants in the learning process by including manipulatives into lessons [Castro, S. (2017)].

As a result, manipulatives can only be useful when used appropriately (Furner & Worrell, 2017). Students need a bridge between real-world and abstract ideas when they study mathematics. According to Bruins (2014), manipulatives may be used to establish this link.

II. METHOD

This research involved 10 research papers based on student surveys and experimental results. The total number of papers searched was 60. The survey-based research was only 34 and out of the 34 and the final net data filtered was 10. All the filtered and final papers are published in Springer, ScienceDirect, Google scholar journals and having significant citation iterations also. The purpose of this literature review is to examine how well students in a variety of studies used algebraic tiles to solve linear equations with one variable.

III. REVIEW SUMMARY

The review summary has been presented to list down the findings and results based on the experimental studies conducted on a particular number of selected students.

Author & Year	Method used	No of population under survey	Findings	Results
Larbi, E., & Okyere, M. (2014)	questionnaire and test	70	There was less of a disparity in maths scores between the sexes after using the teaching manipulatives..	Students' meaningful and conceptual learning were boosted with the usage of the tiles.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, November 2024

Morsidi, N. M. H., &Shahrill, M. (2015).	quantitative and qualitative	27	upon proper use of the tangible manipulative materials, they seem to be more beneficial in comprehending mathematical ideas..	students showed a significant progress by using concrete manipulative materials
Saraswati, S., Putri, R. I. I., &Somakim, S. (2016).	Design research intervention	32	Results showed that students could successfully solve one-variable linier equations involving subtraction. To get the value of zero, they used the sets of algebra tiles.	Algebra tiles provide a structured approach for students to solve one-variable linear equations. Additionally, while calculating a linear equation with a single variable, it is normal to make errors. Algebra tiles might help with this.
Castro, S. (2017).	quasi-experimental quantitative	31	There was no difference reported between students solving equation through algebraic tiles and students with text books.	The result couldn't give clear direction of research due to very small size of survey sample.
Çaylan, B. (2018).	both quantitative andqualitative methods	50	Students perform better while using multiple manipulatives while learningalgebra	When students work together to solve problems using manipulatives, they are engaging in effective cooperative learning.
Belaynesh, K. (2019)	both quantitative &qualitative methods	223	Found that the students liked the balancing method as it develops the conceptual idea of solving linear equation.	Evidence suggested that the balance model teaching style not only helped students build strong conceptual ideas, but it also fostered an optimal learning environment.
Mellese, S., &Kassanew, B. (2020)	Experimental	114	Only 5 students could change a word problem to algebraic equation.	Students whose lessons used the balance paradigm showed considerable improvements in their self-assurance.
H Yansa et al 2021 J. Phys.: Conf. Ser. 1882 012091	Quantitative method	30	Misunderstandings among students lead to mistakes while trying to determine the general form of a linear equation in one variable.	instructors need to develop innovative approaches to teaching one-variable linear equations
Rini, D. S. (2022).	teacher-as-researcher methodology	36	Students used algebra tiles to quickly answer the issue using one-variable linear equations.	Students' understanding of algebra has been enhanced by the use of algebra tiles.
The authors of this work are Abdul-Karim,	both quantitative andqualitative	30	Class 7 students outperformed in test while using manipulatives.	The algebra tiles were a product of the pupils' enhanced performance

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, November 2024

H., Kasimu, O., Rahaman, A. A., Kanimam, Y. S., Imoro, M., and Dokurugu, M. E. (2018).	methods			brought about by the strategic utilisation of instructional resources.
The authors of this work are Núñez-López, J. A., Molina-García, D., González-Fernández, J. L., and Fernández-Suárez, I. (2024).	Interview method	30	The results showed that students utilizing algebra tiles did better than the standard way..	The manipulative algebra tiles greatly improved the understanding of the fundamental concepts of algebra.

IV. DISCUSSION

As we have seen that almost all aforementioned summary of research work collectively talking about the positive results of student's performance in terms of learning speed and comprehension of direct condition with one variable by utilizing polynomial math tiles. Larbi 2014 and Morsidi 2015 carried out somewhat similar methodology of intervening of individual student and conducting mathematics test found significant results as the female students scored equal marks by using tiles to solve linear equation and Morsidi found the top scorer amongst the participants as 100% which was very positively reported. Saraswati 2016 used two bathrooms construction model based on straight condition with one variable and She then inferred that the students submitted the more easier way to solve the issue by utilizing polynomial math tiles and the time taken with chances of committing mistakes got reduced. Belaynesh 2019 used balance model tool to improve student's conceptual understanding of effectively solving mathematical problems relating to linear equations. The benefit of employing using a balanced model involves the use of physical material, such as algebra tiles improved the student's performance and increased their participation also. Abdul Kareem 2023 got the similar results as of Kablan, 2016. The author solved the problem of algebraic expressions with the help of secondary school students struggling with basic arithmetic operations. With guidance and teaching the use of AT, author found that the students developed the conceptual understanding by using colored tiles and reached to the solution for the equation $2x - 3 = 5$ was $x = 4$. Núñez-López,2024 did experimental study on two groups of secondary students and the post-test survey reported that 73.30% expressed satisfaction with the use of AT to solve one variable linear equation whereas only 26% reported the use of manipulatives made them more confusing in complex algebraic problems. Thus, the research strongly suggested that students would benefit greatly from using algebra tiles, a manipulative tool, to better understand the subject's foundational concepts.

V. CONCLUSION

Algebraic tiles let pupils represent expressions in algebra and solve one-variable linear equations (Rini 2022). By using algebra tiles, students may improve their comprehension and proficiency in solving linear equations. The formal solution of one-variable linear equations using algebra tiles is up to the students and their prior knowledge. In all of the experiments that were considered, students demonstrated faster knowledge after using algebra tiles to represent the quantities of an algebraic equation that had been supplied to them. Additionally, algebra tiles may help reduce the occurrence of typical errors that occur while solving one-variable linear equations. On top of that, they go from a more casual to a more formal level of comprehension. Algebra tiles augmented with real-world situations might help students better grasp solving linear equations with a single variable, according to the study's author.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 4, November 2024

REFERENCES

[1]. Shahi, B. B. (2015). *Effect of material on mathematics achievement in algebra* (Doctoral dissertation, Department of Mathematics Education Central Department of Education).

[2]. ERGENE, B. Ç., & HASER, Ç. (2021). Students' algebra achievement, algebraic thinking and views in the case of using algebra tiles in groups. *NecatibeyEğitimFakültesiElektronik Fen veMatematikEğitimiDergisi*, *15*(2), 254-281.

[3]. Garzón, J., & Bautista, J. (2018). Virtual Algebra Tiles: A pedagogical tool to teach and learn algebra through geometry. *Journal of computer assisted learning*, *34*(6), 876-883.

[4]. Castro, S. (2017). Algebra tiles effect on mathematical achievement of students with learning disabilities.

[5]. Carbonneau, K. J., Marley, S. C., & Selig, J. P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. *Journal of educational psychology*, *105*(2), 380.

[6]. Bruins, B. E. (2014). The effectiveness of manipulatives in a high school algebra II class (Unpublished master's thesis). Eastern Kentucky University, Richmond.

[7]. Larbi, E., & Okyere, M. (2014). Algebra tiles manipulative and gender differences in learning and achievement in mathematics: A case of Sunyani West Municipality. Journal of education and practice, 5(38).

[8]. Morsidi, N. M. H., &Shahrill, M. (2015). Investigating the use of concrete manipulatives in 3-Dimensional problem solving. In In Pursuit of Quality Mathematics Education for All: Proceedings of the 7th ICMI-East Asia Regional Conference on Mathematics Education (pp. 467-473).

[9]. Saraswati, S., Putri, R. I. I., &Somakim, S. (2016). Supporting Students' Understanding Of Linear Equations With One Variable Using Algebra Tiles. Journal on Mathematics Education, 7(1), 19-30.

[10]. Castro, S. (2017). Algebra tiles effect on mathematical achievement of students with learning disabilities.

[11]. "Çaylan, B. (2018).The Effects of Using Algebra Tiles on Sixth Grade Students' Algebra Achievement,Algebraic thinking and views about using Algebra Tiles. (Unpublished master's thesis). Middle East Technical University,Malaysia ."

[12]. Belaynesh, K. (2019). Developing Students'understandingof Linear Equ Developing Students'understanding Of Linear Equ With One Variable Through With One Variable Through Balancing Model Of Teacing: Grade Fana Primary School Grade Five Students Of EwketFana Primary School In Focus Developing Students'understanding Of Linear Equation Balancing Model Of Ewket(Doctoral dissertation).

[13]. Mellese, S., &Kassanew, B. (2020). The impact of using balancing model in teaching linear equation. International Journal of Education and Management Studies, 10(1), 84-91.

[14]. H Yansa et al 2021 J. Phys.: Conf. Ser. 1882 012091

[15]. Rini, D. S. (2022). Algebra Tiles as Physical Manipulatives to Support Students' Understanding of Linear Equations in One Variable. Southeast Asian Mathematics Education Journal, 12(2), 81-94.

[16]. Abdul-Karim, H., Kasimu, O., Rahaman, A. A., Kanimam, Y. S., Imoro, M., &Dokurugu, M. E. (2023). Assessing the Impact of Algebra Tiles as Visual and Manipulative Aids on Students' Algebraic Understanding. American Journal of Educational Research, 11(10), 705-711.

[17]. Núñez-López, J. A., Molina-García, D., González-Fernández, J. L., & Fernández-Suárez, I. (2024). Enhancing the acquisition of basic algebraic principles using algebra tiles. Eurasia Journal of Mathematics, Science and Technology Education, 20(7), em2473.

[18]. Kablan, Z. (2016). The effect of manipulatives on mathematics achievement across different learning styles. Educational Psychology, 36(2), 277-296. https://doi.org/10.1080/01443410.2014.946889

[19]. Rini, D. S. Algebra Tiles as Physical Manipulatives to Support Indonesian Students' Understanding of Linear Equations of One Variable.