

Mathematics Sense of Numberblocks as a Source of Mathematics Learning

Shofia Hidayah¹, Nur Hamid¹, Qonita Kamilia Fiddinina¹

¹ Department of Mathematics Education, Faculty of Social Sciences and Humanities, Nurul Jadid University, Probolinggo, Indonesia

¹Email: qonitafiddinina@email.com

Proceedings of the Kalijaga International Conference on Education 2026

Abstract. Technological development is forcing the new generation to hone their skills in more advanced ways. Mathematics as one of the basic skills in this new era has a lot of easier, fun, and engaging ways to be learned with one of them is Numberblocks. Despite the popularity of the Numberblocks channel in the west, the use of mathematics concepts in Numberblocks for fundamental mathematics learning has never been studied. Therefore, this study aims to analyze how math concepts are presented in Numberblocks, their correlation with the early school curriculum, and their applicability in both formal and informal learning environments, so teachers can consider using them in formal classes or recommend them for informal mathematics learning. This study uses a descriptive qualitative method. We analyzed the content of some Numberblocks episodes. The results show that Numberblocks contains concepts like addition, subtraction, linear equality, inequality, patterns, sequences, and measurement. Those concepts are aligned with the standard school curriculum, and some concepts can serve as a foundation for higher education topics such as real analysis. We also provide some tips on how to use Numberblocks so it can be applied with teacher guidance in day-to-day classes. Future research can analyze the effectiveness of using Numberblocks as a source of mathematics learning in formal classes.

Keywords: *Early School Curriculum; Formal and Informal Learning; Numberblocks; Mathematics Learning; Qualitative Descriptive*

Abbreviations: EYFS (Early Years Foundation Stage), KS1 (Key Stage 1), NCETM (National Centre for Excellence in the Teaching of Mathematics)

INTRODUCTION

Technological development is forcing the new generation to adapt with cultural change. Learning is not just from class but also from a lot of other source. Not adapting with these new way to learn could be fatal and make them got left behind by their peers. Media has developed in a lot of field, one of them is math which have a lot of developed media like Numberblocks.

Numberblocks is a step-by-step learning journey grouped into five colour-coded levels. Each level introduces ever greater numbers and a sequence of key topics and skills to build natural number sense and a solid foundation of mathematical understanding. Numberblocks uses best-practice visual teaching techniques aligned to the EYFS (Early Years Foundation Stage) framework and KS1 curriculum, and mathematics curricula from around the world. Working with NCETM (National Centre for Excellence in the Teaching of Mathematics) to ensure that every episode contributes to a confident and rounded understanding of essential mathematical ideas [1]. Numberblocks is one of the accessible channel to learn math informally.

Number sense is an important part of cognitive development and needs to be developed in kindergarten-aged children. Number sense in early childhood is the ability to have a conceptual understanding of number concepts, development of relationships between numbers, recognition of relative magnitudes between numbers, the relative relationship of the properties of number operations, and development of basic knowledge related to objects. Number sense is related to a child's sensitivity to the concept of numbers and the calculation process, which plays a crucial role in the problem-solving process [2].

According to Piaget, naturally a child have interest of the world and actively search information that can help them to understand the world. This differs from Vygotsky, who believes that children will be able to learn well if they continue to socialize and need the help of more experienced people to develop their knowledge [3]. They both discuss cognitive development in children using a constructivist approach [4]. Implications of the theory by Piaget can be seen in informal learning, whereas Vygotsky leans toward formal learning in todays curriculum. The Informal learning is defined as the process of acquiring

knowledge through non-traditional means, without institutional support, in which learners play a role during the process. In this approach, self-regulation of the learning process is embedded, meaning that the individual decides what to learn, when to learn it, where to seek information and from whom to learn it [5]. Formal learning broadly aligns with organised, institutionalised learning models (such as learning seen in schools) [6]. Both side could use media to improve learning process.

The use of media can help student to improve their learning processes and outcomes. Animation media is one particularly effective tool which help student to learn. Animation media presents complex concepts in an engaging and easy-to-understand way, in line with constructivist learning theory [7]. In many studies, visual media [8] and animated media [9] has been proven effective in math learning. Thus why, we are trying to identify and analyze math concept in Numberblocks series and evaluate its potential as the source of informal learning and can support formal learning in elementary school.

METHODS

Study area

The approach of this research is qualitative descriptive, and the method used is content analysis. The main instrument is the researcher who acquired, collected, and analyzed the data[10].

Procedures

Material Selection

The object of this research is the Numberblocks YouTube series compilation episode with the title "When Numbers are alive! | Patterns and Palaces, Superhero Numbers, Geometry! | Learn to Count." This video covers various episodes from season 3 to season 6, mostly consisting of season 6 episode 1 until episode 15. [11]

Data Collection

The data collecting technique used is content analysis. The researcher analyzed the selected compilation episode to gather relevant mathematical concepts presented in the video.

Data analysis

Data analysis was conducted using the Miles and Huberman model, which includes data reduction, data display, and conclusion drawing/verification[12]

RESULTS AND DISCUSSION

In the compilation episodes of Numberblocks, several mathematical concepts are presented in a visually engaging manner.

Abacus and Basic Arithmetic

The media demonstrates the use of an abacus where beads on the top and bottom rows represent numbers[13]. For instance, having 10 beads on the top and 7 on the bottom illustrates the number 17 (Figure 1). This visual representation supports elementary math curricula by introducing addition, subtraction, and combinations[14]. Furthermore, the abacus helps students understand number sense, such as decomposition and place value, which are fundamental to early arithmetic[15].

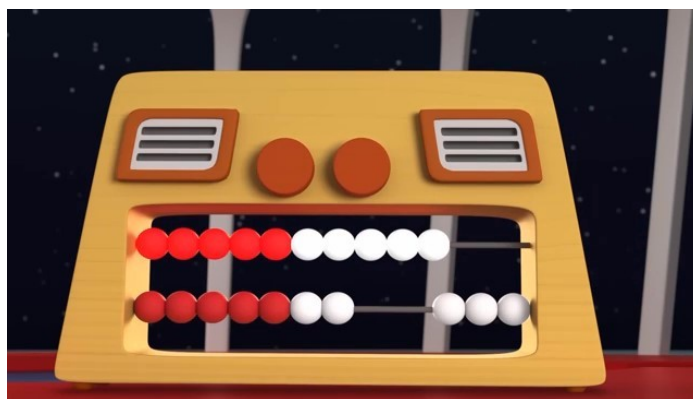


Figure 1. Abacus as media to count presented in Numberblocks

Equality and Inequality

In the episode comparing weights and quantities, characters determine that one green fruit equals three purple fruits in weight (Figure 2). Teachers can translate this into mathematical equations by setting x as the weight of the green fruit and y as the weight of the purple fruit, yielding equations such as:

$$x = 3y$$

$$y = \frac{1}{3}x$$

$$x - 3y = 0$$

$$3y - x = 0$$

Furthermore, when the dinosaur character, Blockzilla, compares fruits, it is shown that 6 purple fruits are greater in quantity than 2 green fruits ($6 > 2$). Conversely, in terms of weight, 1 green fruit is heavier than 1 purple fruit. If x is the weight of the green fruit, y is the weight of the purple fruit, a is the quantity of the green fruit ($a = 2$), and b is the quantity of the purple fruit ($b = 6$), teachers can guide students to formulate inequalities such as $x > y$ and $a < b$. It is crucial for teachers to clarify variables to prevent common misconceptions between variable, such as quantity and weight[16].



Figure 2. Equality presented in Numberblocks

Number Combinations

The media also visualizes number combinations, which can answer questions such as how many combinations of natural numbers under 10 can make 10. The scene displays 10 Numberblobs on a bed. As they drop off, combination of 10 is visualized, such as $10 - 1 = 9$, $10 - 3 = 7$, and $10 - 5 = 5$ (Figures 3).



Figure 3-5. Three Combination of 10

Later, another combination of 10 is shown when the characters regroup, such as $4 + 6 = 10$. Teachers can use this as a prompt for students to systematically list combinations, enhancing their logical thinking and collaborative skills in class[17].

Patterns and Sequences

Numberblocks introduces discrete mathematical structures like ordered lists and sequences. Characters observe a geometric pattern: a circle (1 edge/vertex), an ellipse (2 edges/vertices), a triangle (3 edges/vertices), and a square (4 edges/vertices), implying the next shape is a pentagon with 5 vertices (Figure 6).

The series also depicts arithmetic and inductive sequences. For example, domino pips showing 1, 3, 5, 7, 9 represent an arithmetic sequence of odd numbers where $U_n = 2n - 1$ (Figure 7). Bunches of dice representing 1, 4, 9, 16, 25 illustrate a square sequence where $U_n = n^2$, serving as an early visualization of exponents (Figure 8). Other sequences shown include the standard sequence of integers ($U_n = n$),

geometric sequences like 2, 4, 8, 16 where $X_{n+1} = 2X_n$ (Figures 9-10), and the triangular number sequence 1, 3, 6, 10, 15 where the difference between terms increases consecutively (+2, +3, +4, +5) (Figure 11). These patterns act as excellent alternative media because they can be understood visually, making them ideal for quick quizzes.

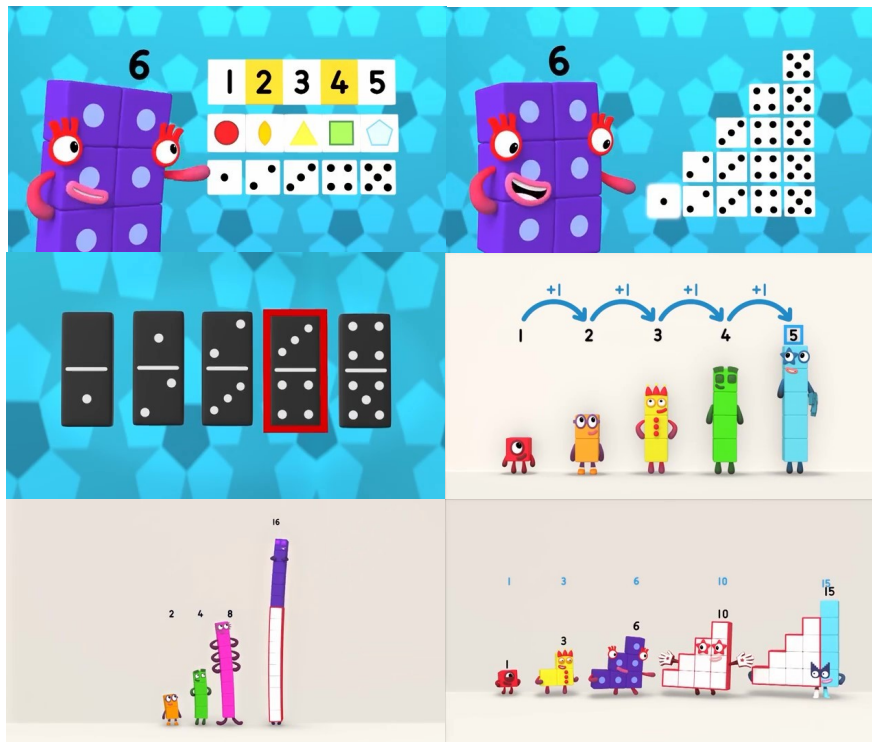


Figure 6-11. Pattern and Sequence presented in Numberblocks

Measurement and Limited Scales

The concept of measurement is demonstrated by using a 10-block stair as a reference height (Figure 12, left). If a sunflower is 4 blocks shorter than the stairs, its height is calculated as $10 - 4 = 6$ blocks. If a flower extends 2 blocks above the stairs, its height is $10 + 2 = 12$ blocks (Figure 12, right). This teaches students how to measure objects using a limited scale or reference point, rather than counting from one each time, growing critical problem-solving skills.

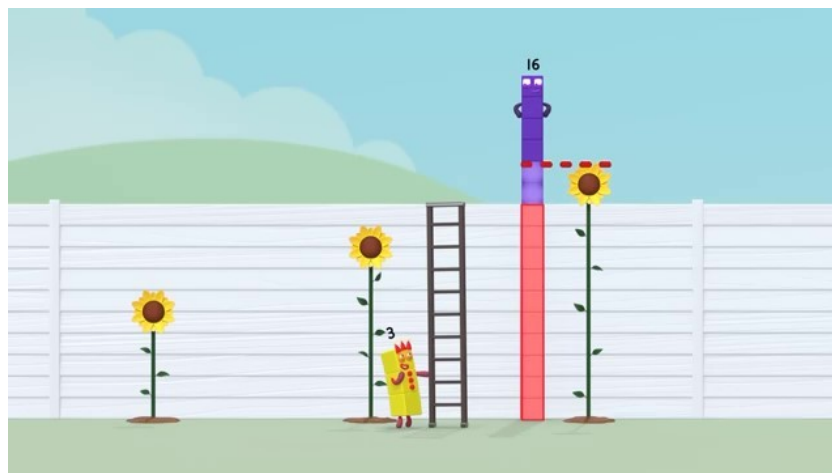


Figure 12. Measuring presented in Numberblocks

Discussion

While Numberblocks is commonly used in informal settings due to its long narrative, its application in formal education requires strategic implementation. Because the episodes simplify concepts and may not show every mathematical combination, some educators might initially perceive it as ineffective. However, using this media as an eye catching visual for student is more engaging[18]. This media can help visualizing abstract concepts into students minds. Visualizing how combinations form certain numbers captures student attention far better than traditional learning[19].

Using this media strictly informally without guidance can lead to fatal misconceptions [20], such as confusing quantity with physical weight as observed in the equality segment. Therefore, it is essential for parents and teachers to actively evaluate students understanding by prompting them to articulate their thought processes out loud. With proper advisory and guidance, Numberblocks effectively bridges the gap between abstract arithmetic and realistic applicability, making the mathematical comprehension of early learners significantly faster and easier compared to conventional methods.

CONCLUSION

The mathematical concepts presented in Numberblocks include addition, subtraction, number sense, combinations, measurement, equality, inequality, patterns, and sequences. These concepts are seamlessly integrated with engaging storylines, colorful visuals, and cheerful music, allowing students to engage with mathematical ideas without feeling overburdened by formal study. Consequently, this media serves as an accessible and enjoyable resource for both formal and informal learning environments, particularly for students who struggle with or dislike mathematics. With minimal optimization, Numberblocks effectively supports early grade education by establishing foundational number sense and conceptual understanding.

This media has certain limitations, particularly regarding conceptual depth and the absence of formal evaluation mechanisms. Conceptual depth can be supplemented using standard classroom textbooks, while assessment can be facilitated by teachers and parents through interactive discussion and educational games. Overall, Numberblocks offers a visually appealing and intuitive foundation for early mathematics learning that aids cognitive retention. Future research could evaluate the effectiveness of Numberblocks in both formal classroom settings and informal learning contexts.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to the Department of Mathematics Education, Faculty of Social Sciences and Humanities, Nurul Jadid University, for supporting this research. This study received no specific financial support from any funding agency in the public, commercial, or not-for-profit sectors.

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