

Learning Basic Mathematics among Children with Intellectual Disabilities about Place Value Concept using Virtual Base Ten Blocks

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Abstract

A virtual learning environment, such as VAKT, enhances the present research, instruction, and learning (visual, auditory, kinesthetic and tactile). Children who have intellectual difficulties could find it difficult to understand place value. Understanding place value is a necessary pre-requisite for learning other mathematical concepts, such as how to use computational skills. Understanding place value becomes vital for enhancing mathematical operation like addition and subtraction. The learning of mathematical concepts should follow the pattern of starting with concrete, then semi-concrete, and finally abstract concepts. The researcher's planned place value teaching technique enables understandings to construct knowledge of ones, tens, and hundreds. This study used a quantitative methodology. The research was conducted through an experiment using a single group design. For CWID, the researcher evaluates the effects of manipulative interventions. The results of the sample (N = 8) revealed that manipulative-based treatments for teaching the place value concept were effective for a range of learning achievements. Base ten blocks may help children with cognitive disabilities comprehend mathematics, according to studies. Additionally, adopting digital learning resources increases their passion and makes learning fun in the current digital era.

Keywords: place value, mathematical concepts, manipulatives, Intellectual Disabilities

Introduction:

According to Mittler (1995), the phrase that means "mental retardation" is out of date and is considered derogatory. As previously stated by the American Association on Mental Retardation (AAMR), it is characterised by severely below-average cognitive ability and deficiencies in adaptive skills. Individuals with below-average intellectual capacity and difficulties with daily functioning skills are now referred to as having intellectual disabilities (ID). Although individuals who have ID can learn new things and develop new skills, they could do so more slowly than average. From mild to extreme, the range of intellectual disability varies. Under DSM-5, children with an IQ below the threshold of 70 are restricted as having an intellectual disability. Clinical assessment of difficulty in reading, writing, calculation, communication, practical skills, self-care, and organizational skills.

Children with mild intellectual disabilities understand the numerical place values and its place. Also they can't determine what a number exactly means of the whole of while they perceive it. Struggles with represent numbers even when given the opportunity to use pictures (Donovan & Fyfe, 2022). Children with special needs are having less abstract thinking. This problem additionally create hard to organize the operating with mathematics concept, to confused whole number comprehension ability. According to (Van de Weijerw, 2015) Children who struggle with mathematics learning have difficulties using their verbal and visual-spatial working memories for math activities. Additionally, it seems inappropriate given their age. Processing speed for this mathematical concept cannot understand the age-related differences that the researcher observed. This can make it hard for them to study the introductory calculation data that they need to develop a number sense and intuitive understanding of how place value works in environment (Donovan & Fyfe, 2022). Many children with learning disabilities have a hard time with any mathematical tasks that are language-embedded, or couched in words and

phrases. These types of children struggled with math concepts in real time and didn't even bother to explore language problem (Greiner-Petter , 2020).

Review of related literature:

A study has shown that primary school students are taught the concrete-semi-concrete-abstract (CSA) approach to numeracy, rather than the abstract-representational model (RA) used by researchers in other countries (Estella, 2017).

A recent study investigated how children facing math difficulties (MD) struggle with grasping the concept of place value in basic math tasks. It aimed to determine if these challenges extend to multi-digit addition, which requires a solid understanding of place value. The research included 29 third-grade children with MD (around 9 years old) and compared their performance to 50 peers of the same age. The findings demonstrated that children with MD encountered difficulties when processing place value during multi-digit addition, particularly in tasks involving carrying over numbers. This struggle was evident from their longer response times and a higher rate of errors. This suggests that issues with understanding place value among children with MD can hinder their proficiency in solving multi-digit math problems. The study also delved into factors such as problem-solving strategies and working memory that might contribute to these difficulties (Lambert & Moeller, 2019).

Virtual manipulatives suggested such as a digital interaction can provide children with a more awareness and create a pattern enjoyable opportunities. Digital interaction platforms are increasingly attractive as a teaching tool in schools and colleges across the country, it has been suggested (Cavanaugh's, 2014).

The study (Emily, 2020) emphasized how technology, particularly virtual manipulatives, may be used to overcome educational difficulties and adapt training for a range of learners. This study stands out because it places a strong emphasis on integrating modern resources into special education, which suggests a radical change in instructional strategies that will help kids with disabilities. The research is crucial for people working in the educational sector who want to investigate cutting-edge strategies for inclusive learning because of its data-backed insights and comprehensive viewpoint.

The investigator (Peltier.et.al, 2019) examined that the use of manipulatives by students with disabilities helps them develop, ensure, and apply their mathematical abilities.

The research investigator (Bouck, Chamberlain, Park, 2017) briefed how to teach children with special needs about place value using a virtual base 10-block manipulative. If CWID used virtual manipulatives, their independence might rise. Children with developmental delays are often trained arithmetic using conventional methods.

Problems associated with understanding place value

Arithmetical skills are required for effective functioning in an educated and trained environment. It is vital to understand how all these skills are learned, or fail to be gained, not just for children with special needs, but also for the design of conventional teaching and learning. Every digit has a set location known as its place (Lafay et al., 2023). The place value of the digit refers to the value that each digit has in relation to its position. Already every one known that a number's digits individually had a place value. The number a digit takes in a number indicates the place value of that digit (Flevaris et al., 2022).

How to bridge the need of children with intellectual disabilities using technology

It is possible to greatly improve the learning possibilities and quantitative ratio of educational development for children with intellectual disabilities by making technology more accessible to help them in the classroom. It is commonly accepted that children with intellectual disabilities have the same fundamental right to an education as their peers who are usually developing, and they should have the same opportunity to engage in classrooms with other children their age (Durmaz et al., 2021).

How manipulative using in digital era

Manipulatives are a method that is widely used in teaching methods to enhance students' abstract thinking of math concepts (Carbonneau, 2013). Manipulative area unit a tool widely utilized in arithmetic school rooms and support students' abstract understanding of mathematical content (Lambert & Moeller, 2019). Instructional strategies help children with disabilities with significant exposure to and assistance in the teaching process (Litster et al., 2019). Special educators will identify students with intellectual impairments and their difficulties in learning place value at the elementary level. The instructor will choose virtual manipulatives to enhance, or replace physical ones for students with disabilities. Digital technologies is now highly used as an educating children the assistance of children with disabilities. In the previous study, base ten blocks were evaluated for the concrete, devices with base ten block representations were used for the semi-concrete, and number devices with numbers were used for the abstract representations (Thanheiser & Melhuish, 2019). The study's goal was to examine single-case experimental designs that used a Manipulatives has been assessed for the first time to analyze their influence on children with disabilities that provide teaching method using manipulative (Corey Peltier et.al, 2020).

Need of the study

Understanding place value is essential to mastering mathematical operations. When dealing with computational skills like addition, subtraction, multiplication, and division (both with and without regrouping the number). Students must acquire and understand the place value concepts. Children can learn about place value by using game based methods. Base 10 blocks and other children's manipulatives can also help in helping children in understanding place value.

Statement of the problem

Basic mathematical concepts are difficult for children with intellectual disability, particularly for place value skills at the primary level. It is essential to recognize the lack of the basic mathematical concept in this scenario. Generally Children with intellectual disabilities having the place value concepts, poor sequential counting skills, and low self-esteem. So that the invigilator planned to teach place value in manner of using base ten blocks and enhancing the basic mathematical concept.

Objectives of the study

- To assess the educational needs of primary school-aged children with mild to severe intellectual disability (CWMID).
- To analyze the existing educational strategies that use manipulatives to teach basic mathematical concepts linked to place value
- To compare gain scores of place value achievement between pre-test and post-test.

The research hypothesis

- The impact of utilising virtual base ten blocks as an intervention for enhancing place value learning outcomes for children with intellectual disabilities changes significantly.

Methodology

This study's main goal was to find out how treatments using virtual base ten blocks can affect how children in the Trichy district with mild intellectual disabilities learn about place value. An experimental design was used in the study, namely a pre-test and post-test single-group design.

Sample for the study

Eight CWMID studying in special school were selected for the study.

Tools and Techniques

The researcher used the following tools to collect data for this study: “COOL MATH 4 KIDS” is the free online source website for teaching and learning place value concept and enhancing basic mathematics skill. Achievement Test in place value concept for basic mathematics the tool developed by the researcher.

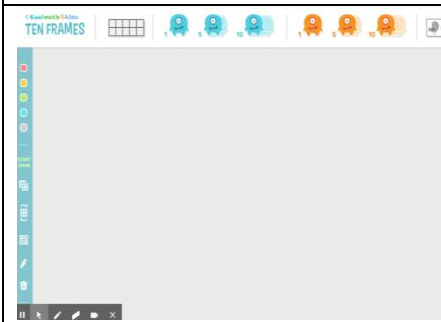
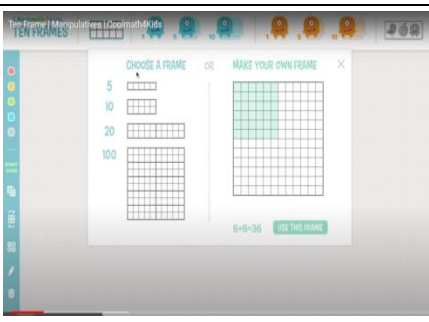
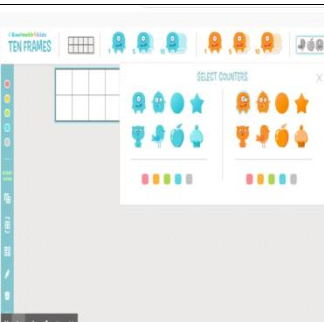

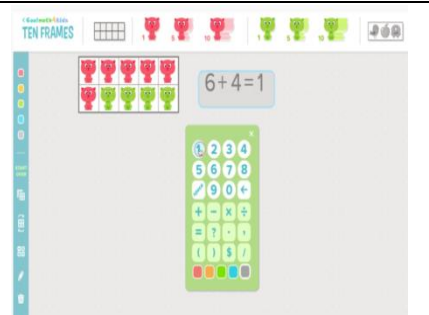

Statistical techniques

Statistical Techniques used in the study were: Mean, Standard Deviation, and ‘t’-test

Procedure and Data collection

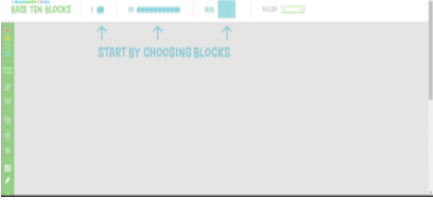
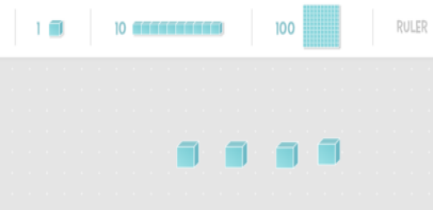
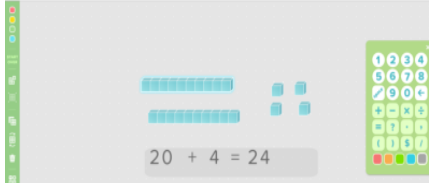
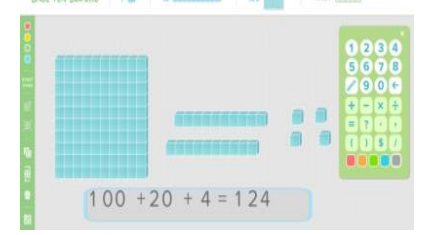
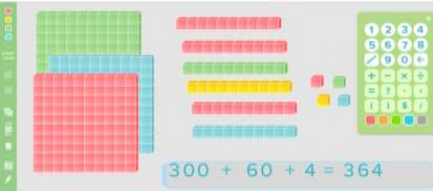
The researchers followed the methods for data collecting and timetable setting as follows: approval for the research was acquired from the authorities of the special school and the parents of the special children. A pre-test was used to determine the current level of understanding of basic mathematics for place value. The "Tablet" is used to carry out the intervention strategy. Through the use of a tablet, the target group was taught and learned basic mathematical concept. "Cool math 4 kids" was the name of the internet page, and it walked that through the process step by step. Understanding base-ten block models, adding and subtracting multiples of ten, and comparing values by counting by ones, groups and singles, and tens and ones.

1. **Internet game for CWID practice with the computer mouse:** Dragging, dropping, and double clicking in respective website Dragon Drop is a fun way to practice their computer mouse using skills: <https://www.roomrecess.com/games/DragonDrop/play.html>
2. **Practice in colouring for CWID:** <https://www.coloringpages-forkids.com/animals/elephant-2.php>
3. **Producer for teaching for ten frame and place value via desktop :** <https://www.coolmath4kids.com/manipulatives/ten-frame>

Coolmath4Kids – Ten frame		
STEP:1	STEP:2	STEP:3
		
STEP:4	STEP:5	STEP:6
		

Coolmath4kids is a website that offers a variety of educational games and activities for child of all ages. Their ten frame manipulative is a great tool for teaching place value and basic addition and subtraction. The manipulative allows kids to visualize how numbers are made up of units, tens, and hundreds, and to practice adding and subtracting numbers using the ten frames. The ten frames manipulative are available on the Coolmath4kids website in both a desktop and mobile version. The desktop version is a bit more complex, as it allows kids to customize the ten frames with different colors and shapes. The Coolmath4kids ten frame manipulative is a great tool for teaching place value and basic addition and subtraction. It may be accessed from both desktop and mobile devices, and using it is simple.

<https://www.coolmath4kids.com/manipulatives/base-ten-blocks>

<p>STEP: 1</p>		<p>First the child is taught to hold and use the mouse</p>
<p>STEP: 2</p>		<p>The child is given an overview of the functions of the each and every icon</p>
<p>STEP: 3</p>		<p>The child is made to drag the image of given number</p>
<p>STEP: 4</p>		<p>Under the structure of base ten concept with the number</p>
<p>STEP: 5</p>		<p>Finally they understood the concept of place value i.e., ones, tens, hundreds and its expanded form</p>

Virtual manipulative that helps to develop children’s basic number sense through the composition and decomposition of numbers within 5, 10, 20, 50, 100. The base ten frames application helps to develop students number counting, manipulate the number and most importantly, it enhance to practice for number concept.

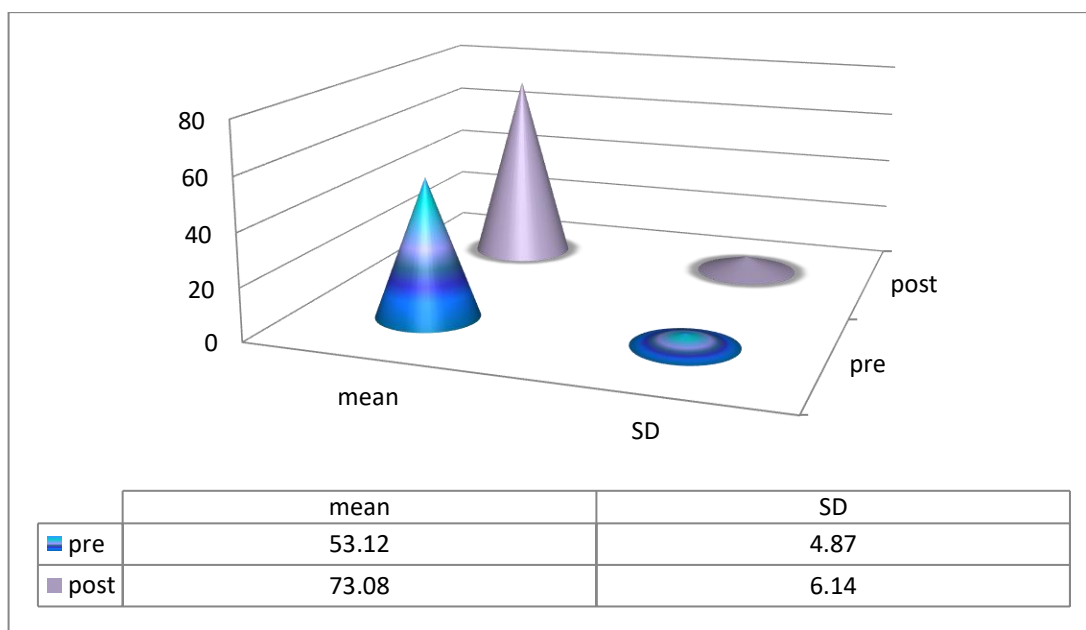
Result and Discussion:

a process of pre- and post-test evaluations, the study acquired achievement test results. The data showing how one group performed in these exams is shown in the table and graph below. The statistical importance of the variation in accomplishment scores connected to the acquisition of place value in mathematical concepts is also disclosed by them.

Table: Analysis of Achievement Mean Scores of the pre and post test

Test	No. of students	mean	Standard deviation	't'-Test	Differ
Pre-test	08	53.12	4.87	2.48	0.05 at level of
Post- test		73.08	6.14		

Figure (1): Difference between Achievement Mean Scores of pre and post-test.



The mean scores and standard deviations for the experimental group are shown in the table and figure above. The experimental group's place value comprehension initially had a pre-test mean score of 53.12 and a standard deviation of 4.87. The post-test score, which increased from 53.12 to 73.08 following the intervention utilising "coolmath 4 kids," showed a significant improvement. Additionally, the standard deviation rose from 4.87 to 6.14. Based on the data analysis, the determined t-value of 2.48 denotes a very significant difference. The findings of this observation thus support the finding that, at the 5% level of significance, the 'coolmath 4 kids' intervention has a very significant effect on the development of place value skills in children with mild intellectual disabilities. Consequently the hypothesis is accepted.

Conclusion:

The study's findings suggest that the use of virtual base ten blocks affects children's levels of accomplishment and how quickly they pick up basic mathematical concepts. Those who got training through VKAT enjoyed the educational process. Learning possibilities for students with intellectual impairments are made possible by the use of virtual manipulatives like base ten blocks, which take into account individual characteristics and give individualized accessibility. It has been proven to be more effective than conventional virtual techniques in teaching basic mathematical concepts to children with intellectual disability. This strategy has significant promise for boosting the understanding of basic mathematical concepts since it not only improves performance but also enriches the VKAT learning experiences.

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