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Scheme of Mathematical Modelling in Teaching Mathematics

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Abstract

Mathematical modelling plays a crucial role in modern education by fostering critical thinking, problem-solving, and quantitative reasoning skills necessary for navigating today's complex world. This paper explores how integrating the Wheel of Place Value and Value into mathematical modelling pedagogy enhances students' understanding of numerical systems and enriches their modelling efforts. The Wheel of Place Value and Value acts as a tangible representation of numerical hierarchy, offering students a visual and interactive tool to comprehend the importance of place value and the intrinsic value of digits within numbers. Results from using the wheel with third-grade elementary students indicate a deeper understanding of the relationship between place value and numerical value, resulting in improved skills in number representation and sequencing.

Keywords: Mathematical modelling; Wheel of Place Value and Value; Mathematics education; Critical thinking

1. Introduction:

The quick development of information and technology has changed what society expects from people and the educational system. The need for maths teachers to develop pupils who can confidently apply mathematics in their daily lives and come up with clever solutions to problems in the real world is increasing in the modern world. The goal of this change in expectations is to help students develop a positive attitude towards mathematics, motivating them to value and appreciate

the subject's importance and effectiveness rather than to fear it (Arseven, 2015). Using models to teach mathematics is one of those innovative methods. A representation of a framework using mathematical concepts and terminology is called a mathematical representation. Mathematical modelling is the process of developing a mathematical model. According to Yoon et al. (2010), a mathematical modelling task starts with a real–world problem. Then, it is solved by formulating the problem, figuring out its solution, and interpreting this arrangement in light of reality. Modelling exercises begin with real–world problems and are thought to be the best approach to recognize and comprehend the connections between learning mathematics and real–world experiences. Using mathematical formulas and equations, mathematical modelling is a potent tool for describing phenomena that occur in the real world. Its ability to express complex systems in a more straightforward mathematical framework facilitates our understanding and analysis of them. We can forecast outcomes, resolve issues, and learn about a variety of subjects, including biology, economics, physics, and engineering, by building models. We can address real–world problems, arrive at wise decisions, and consider various scenarios with the aid of mathematical modelling. It's an intriguing field that blends creativity, logic, and mathematics (Brown & Williams 2019). Several fields of study and research make use of mathematical modelling. For instance, in physics, it aids in our comprehension of particle behavior and object motion. It aids in the analysis of market trends and the forecasting of future events in economics. It aids in the modelling of population dynamics and disease spread in biology. Furthermore, it aids in the design and optimization of structures and systems in engineering. There are countless options (Smith & Johnson, 2020). The importance of introducing mathematical modelling into mathematics curricula at all educational levels has increased in recent years. This trend is fueled by the growing need for people with strong quantitative skills across a range of industries and professions, as well as the understanding of how important it is for students to develop their ability to apply mathematical reasoning and skills to real–world situations Davis et al. (2017). The effectiveness of mathematical modelling in fostering profound conceptual understanding and long–term retention of mathematical knowledge is demonstrated by research in mathematics education. Studies by Kaiser et al. (2006) and Lesh and Zawojewski (2007) show, for example, how mathematical modelling tasks improve students' capacity for mathematical reasoning and problem–solving. Furthermore, studies indicate that involving students in mathematical modelling exercises raises their

motivation and enthusiasm for the subject, which benefits their academic performance [Lesh and Doerr (2003) and Stillman et al. (2007)].

New methods and resources are always being investigated in the field of mathematics education in order to improve students' comprehension and interaction with mathematical ideas. The Wheel of Place Value and Value is one such tool that provides a dynamic and interactive approach to teach basic numerical concepts like place value and numerical value. Thompson et al. (2020) investigated the potential advantages of integrating the Wheel of Place Value and Value into mathematics instruction. We can examine the incorporation of the Wheel of Place Value and Value frameworks into mathematical modelling, according to the research conducted by Smith et al. (2021). The authors present a thorough analysis of these frameworks' theoretical foundations in this groundbreaking work, as well as examples of how they are applied in diverse modelling scenarios. The Wheel of Place Value framework is thoroughly described by Johnson et al. (2019), who also discusses the framework's practical implications for mathematics education as well as its theoretical foundations. It describes how this framework can help students grasp numerical concepts more deeply and become more proficient in mathematics. Garcia et al. (2020) shows how numerical representation can be contextualized to solve real-world problems by examining the Value framework in the context of practical applications. It emphasizes how crucial it is to comprehend the inherent worth of numbers and how they relate to daily life. In order to illustrate the effectiveness of the Wheel of Place Value and Value frameworks in modelling intricate economic phenomena, Wang et al. (2021) provides a case study on their integration in economic analysis. It serves as an example of how these frameworks can improve the precision and thoroughness of mathematical models in practical settings. Patel and Nguyen (2024) investigated the impact of the Wheel of Place Value on elementary students' numerical fluency. Their findings shed light on the effectiveness of this manipulative in promoting students' proficiency in representing and manipulating multi-digit numbers. Similarly, Wang and Li (2024) conducted a case study in primary mathematics classrooms to explore the use of manipulative, including the Wheel of Place Value, in developing place value understanding. Their research highlighted the role of hands-on experiences in deepening students' conceptual grasp of place value concepts. Furthermore, Chen and Kim (2024) examined the integration of technology-enhanced manipulative, such as digital versions of the Wheel of Place Value, in place value instruction.

Through a comparative analysis of student learning outcomes, they elucidated the benefits of leveraging technology to enhance students' engagement and conceptual development in mathematics education. These recent studies underscore the importance of innovative pedagogical approaches and tools in addressing the diverse needs of learners and fostering meaningful learning experiences.

Through a synthesis of insights drawn from the cited papers and a deeper exploration into the amalgamation of the Wheel of Place Value and Value frameworks, a pioneering mathematical modelling tool emerges. By means of theoretical explication and empirical examination, it becomes evident that the integration of mathematical modelling into mathematics pedagogy constitutes an instructional strategy that not only amplifies students' mathematical prowess but also nurtures their problem-solving acumen, critical thinking aptitude, and practical utilization of mathematical concepts in real-world contexts. Henceforth, the focus of this paper is to investigate the fusion of the Wheel of Place Value and Value frameworks as instructional tools for teaching place value in third-grade mathematics classrooms. Through the provision of tangible experiences and visual aids, educators can facilitate a more profound comprehension of place value principles among students, thereby establishing a robust groundwork for their on-going mathematical education.

2. The Theoretical Framework

This paper's theoretical framework centers on how third-grade students can learn mathematics by integrating mathematical modelling with the value and place value wheel. Based on the fundamental theories and concepts of child development and mathematics education, this framework is adapted to the developmental stage and cognitive abilities of third-grade students:

According to Piaget's Theory (Piaget, 1954) of Cognitive Development, third-graders normally belong to his concrete operational stage, which is defined by their capacity for understanding conservation and reversibility as well as their ability to reason logically about concrete events. By offering concrete tools to aid in students' comprehension of abstract mathematical ideas, mathematical modelling and concrete representations-like the place value and value wheel-align with the concrete operational stage.

According to sociocultural theory of Vygotsky (1978), students' learning is scaffold by the use of mathematical modelling and the Wheel of Place Value and Value. With the right help from peers or teachers, they can achieve higher understanding levels.

The theory of cognitive load acknowledges the finite nature of working memory and highlights the significance of effectively managing cognitive load in order

to maximize learning (Sweller, 1988). By externalizing abstract concepts, the concrete manipulative offered by the place value and value wheel can help lower cognitive load and free up students' mental energies for comprehension and problem–solving.

Worldwide, the teaching of mathematics is a crucial part of academic curricula. Using efficient teaching strategies is essential to improving students' comprehension and ability to apply mathematical concepts. Among the different teaching strategies, whole value and place value are important because they help students understand and apply mathematical concepts. The purpose of this study is to investigate how whole value and place value methods are used in mathematics education and how they affect students' learning outcomes. Across the globe, mathematics education is a fundamental component of academic curricula, giving students the tools they need to solve problems, think critically, and reason logically. Basic ideas like whole value and place value, which act as the foundation for numerical literacy and proficiency, are at the core of mathematical understanding. Educators have become more aware in the past few years of the value of creative pedagogical strategies for improving students' engagement with mathematics and conceptual understanding.

In this endeavour, the wheel of place value and value proves to be a potent tool, providing a dynamic and interactive means of exploring and visualising place value and whole value concepts. Setting the stage for a thorough examination of the wheel's function in mathematics instruction, this introduction gives a summary of the paper's goals, justification, and scope.

With an emphasis on fostering conceptual understanding, procedural fluency, and problem–solving abilities in this particular grade level, this paper aims to investigate the efficacy of incorporating mathematical modelling and the Wheel of Place Value and Value in mathematics education. It does this by integrating these theoretical perspectives that are tailored to the developmental stage of third–grade students. Among the specific goals are:

- Providing a summary of place value and whole value
- Introducing the Wheel of Place Value and Value as a teaching tool for mathematics.
- Investigating methods for teaching the wheel in mathematics classes.
- Looking into how using the wheel affects students' attitudes towards mathematics and learning outcomes.
- Recognizing common challenges and misconceptions related to place value and whole value ideas, as well as how to use the wheel to solve them.
- Supplying tools, case studies, and real–world examples to help teachers successfully apply the wheel in the classroom.

3. Methods of Research and the Tools Used

3.1 Method of Research

Among the many difficulties facing mathematics education are conceptual misunderstandings, student disengagement, and the requirement for differentiation to accommodate a range of learning styles. The use of procedural fluency and rote memorization in traditional teaching methods may impede students' ability to comprehend mathematical concepts at a deeper level. As a result, there is an increasing need for creative teaching approaches that promote mathematical fluency, critical thinking, and conceptual understanding.

By giving whole value and place value concepts a tactile and visual representation, the wheel of place value and value presents a viable answer to these problems. Teachers can foster deeper conceptual understanding, encourage mathematical discourse, and involve students in hands–on exploration by utilizing the interactive features of the wheel. Furthermore, the wheel's adaptability to different learning styles, grade levels, and mathematical subjects makes it a useful tool for teachers in a range of educational contexts (Brown & Williams 2019).

Mathematical foundations such as whole value and place value are necessary to comprehend the numerical system and carry out arithmetic operations. A thorough examination of these ideas, their importance, and how they apply to mathematical reasoning and problem–solving is given in this section. Below is a thorough explanation of every idea:

- Value:

Definition: A whole value is the entire numerical value, independent of position, that a digit within a number represents. For instance, the digits (4, 3, and 7) in the number 437 each stand for its entire value of 4, 3, and 7, respectively.

Significance: Recognizing the distinct contribution of each digit to the total numerical value of a number requires an understanding of whole value. It establishes the groundwork for efficiently handling numbers and carrying out arithmetic operations.

- Place value:

Definition: Place value is defined as a digit's value based on where it is in a number in relation to the decimal point. For instance, the ones place in the number 437 is represented by the digit 7, the tens place by the digit 3, and the hundreds place by the digit 4.

Significance: Place value tells us the positional value of each digit in a number, which helps us understand its significance. It makes mathematical operations easier to carry out as well as the representation and comparison of numbers.

- Relationship between Whole Value and Place Value:

Together, the ideas of place value and whole value enable accurate representation of numerical quantities. The place value of each digit in the decimal number system determines its total value. For instance, the digit 3 in the number 437 has a whole value of 3 because it is in the tens place, meaning that there are three tens, or thirty.

- **Importance in Arithmetic Operations**:

Understanding whole value and place value is necessary to carry out arithmetic operations like multiplication, division, addition, and subtraction.

Comprehending place value facilitates effective regrouping and column–by–column operations (Kaiser et al. 2006).

- **Real–World Applications (Garcia et al. 2020):**

There are many practical uses for whole value and place value concepts in daily life, including timekeeping, measuring, and budgeting. For instance, reading financial statements, measuring ingredients for recipes, and reading a clock all require an understanding of place value.

3.2 Tools Used

3.2.1 Description of the tool:

A dynamic and interactive tool for teaching and learning mathematics, especially whole value and place value concepts, is the wheel of place value and value. This section offers a thorough overview of the wheel, examining its composition, uses, and importance in the teaching of mathematics.

Utilizing a mixed–methods approach, the study evaluated the efficacy of the Place Value Wheel in third–grade classrooms using both quantitative and qualitative measures. Pre– and post–assessments were used to gather quantitative data on students' understanding of place value concepts both before and after the intervention. Additionally, in order to acquire insight into the experiential components of the instructional approach, qualitative data were obtained through teacher interviews, student feedback, and classroom observations.

The Place Value and Value Wheel is a circularly formatted visual aid that illustrates the concepts of place value and whole value. The wheel provides a distinctive method of visualizing the hierarchical structure of the number system, in contrast to conventional linear representations like place value charts or number lines.

The "Wheel of Place Value and Value" is a conceptual tool that teachers use to explain to students how various place values within a number relate to one another. Teaching third–grade students the fundamentals of comprehending the numerical value of digits based on their position within a number entails applying the Wheel of Place Value and Value to their education. To illustrate units, tens, hundreds, and so forth, this method usually makes use of visual aids like a place value chart or a "Wheel" diagram.

Generally, the Wheel of Place Value and Value (Johnson et al. 2019) is composed of a circular diagram that has been divided into segments, each of which represents a distinct place value position within a number. The segments are arranged in a clockwise manner, going outward in increasing powers of 10 from the bottom smallest place value position. This is how it can be made and applied, see Fig.1:

Circular Diagram: The wheel, which symboli ses

the comprehensive character of place value w ith a number, is typically shown as a circle.

Segments: The circle is segmented into ones, tens, hundreds, thousands, and so on, with each segment denoting a place value position. The maximum number of digits in the numbers under consideration determines how many segments are used.

Labels: The names of the associated place value positions, such as "Ones," "Tens," "Hundreds," and so forth, are labeled on each segment.

Numerical Representation: The place value position's numerical representation is frequently given inside each segment. For instance, the number 100 might appear in the section that represents the "Hundreds" place.

For instance, in the number 2,589, the value of the "2" in the thousands place is 2,000, the value of the "5" in the hundreds place is 500, the value of the "8" in the tens place is 80, and the value of the "9" in the ones place is 9.

Figure 1:Design of the Wheel of Place Value and Value.

Users can rotate the place value and value wheel to see various numerical values because it is made to be interactive and manipulable. The numerical value shown can be altered by users by spinning the wheel, which shows how the digits change place as the wheel turns. To improve engagement and visualization, the wheel might have extra features like digital overlays, animation, and color coding.

Furthermore, this wheel has many applications in teaching mathematics include:

- The place value and value wheel can be used to teach and practice place value and whole value concepts in a variety of mathematics classes and grade levels.
- Educators can improve students' conceptual understanding and numerical fluency by incorporating the wheel into lessons, activities, and assessments.
- The wheel is an adaptable tool for mathematics education that can be used in a variety of instructional contexts, such as whole–class instruction, small–group work, and individual practice.

In class of third grade, first, we began lessons with introductory activities that introduce students to the wheel of place value and value. Second, we demonstrated how the wheel works and its relationship to whole value and place value concepts. Third, we engaged students in interactive tasks, such as spinning the wheel to display different

numerical values and identifying the digits and their corresponding place values.

3.2.2 Evaluating Educational Outcomes through the Place Value and Value Wheel (Thompson et al. 2020):

Students' comprehension, competency, and application of whole value and place value concepts are assessed as part of the learning outcomes assessment process using the place value and value wheel. Teachers can learn a great deal about their students' conceptual understanding, problem–solving skills, and mathematical reasoning by utilizing the wheel as an assessment tool. This section examines several approaches and techniques for using the wheel in mathematics education to evaluate learning outcomes.

- Formative Evaluation:

  Observation: Pay attention to how the students engage with the wheel throughout exercises and assignments. Take note of their methods for solving problems, their use of mathematical terminology, and their application of place value concepts.

  Ask open–ended questions to elicit explanations and justifications from students for their responses. Students should explain how they calculate the place value and overall value of the numbers on the wheel.

  Peer Assessment: Use techniques for peer assessment in which students give their peers feedback based on preset standards. Students should be encouraged to compare and discuss how they responded to tasks that involved the wheel.

- Tasks related to Performance:

  Number Generation: Create assignments where students must spin a wheel to produce random numbers and determine the place value and whole value of particular digits. Pupils may use an interactive digital platform or worksheet to record their answers and justifications.

  Provide students with scenarios for solving problems that require them to apply place value concepts in practical settings. Students demonstrate their grasp of whole value and place value by modelling and resolving problems involving measurement, data analysis, and budgeting using the wheel.

  Task Cards: Using the wheel, make task cards with mathematical problems or exercises that students can work on individually or in small groups. To cater to different learning styles, task cards can have tasks with different levels of difficulty.

- Self–Reflection and Evaluation:

  Students should be encouraged to evaluate their own comprehension and competency in applying place value concepts by reflecting on how they have used the wheel. Encourage students to list their advantages, disadvantages, and future development plans.

  Give students the chance to use the wheel in mathematics activities and

tasks to set goals for their learning and monitor their progress over time.

- Summative tests:
  Summative tests, like unit exams or end–of–year exams, are a good way to gauge how well students have understood place value and whole value concepts overall. Incorporate an assortment of question formats, including multiple–choice, short–answer, and extended–response questions, to evaluate various facets of learners' comprehension.
- Teacher and Peer Feedback:
  Encourage students to participate in peer and teacher feedback sessions so they can get helpful criticism on how they apply place value concepts and the wheel. Feedback from peers and teachers can draw attention to areas of strength, make recommendations for development, and foster metacognitive awareness.
  When making instructional decisions and giving students focused support during mathematics learning activities involving the wheel, use feedback as a formative assessment tool.

As a whole, a range of formative and summative assessment techniques are used to gauge students' comprehension, competency, and application of place value concepts when evaluating learning outcomes using the wheel of place value and value. In order to inform instructional decision–making and support students' learning in mathematics, educators can obtain important information about students' mathematical reasoning, problem–solving skills, and conceptual understanding by utilizing the wheel as a dynamic and interactive assessment tool.

4. Results of Research

The findings of this study highlight the transformative impact of incorporating the Wheel of Place Value and Value into mathematics instruction for third–grade students (as shown in Fig. 2). One of the notable outcomes observed was the significant improvement in students' understanding of place value concepts. Moreover, the utilization of visual aids (as shown in Fig. 3) like the wheel of place value led to enhanced engagement among students (as shown in Fig. 4). Furthermore, the study revealed a positive correlation between the use of the Wheel of Place Value and students' problem–solving skills. Also, students can do the arithmetic operations in easily way such as addition, subtraction, multiplication, and division.

However, the are some drawbacks of using the Wheel of Place Value and Value in teaching mathematics for grade 3 include: overreliance on visual aid, limited understanding of abstract concepts, potential misconceptions, time constraints, resource dependence and individual learning styles.

Ultimately, the Wheel of Place Value is an effective visual aid for teaching mathematics that gives students a firm grasp of the idea of

place value and how it affects different mathematical operations

Figure 2: Students' participation during the use of Wheel place Value and Value

Figure 3: The utilization of visual aids

Figure 4: Engagement among students

5. Interpretation of Results

As a result, the interpretation of good results included the following important findings Wang, (Wang et al. 2021):

1- Increased Understanding: After the intervention, students' comprehension of place value concepts significantly improved, as shown by higher scores on post-assessment tests.

Instead of depending only on rote memorization, students can acquire a conceptual understanding of whole value and place value concepts by interacting with the wheel. Students can internalize the relationship between digits and their place values through practical investigation, which results in a more thorough comprehension of numerical relationships.

2- Increased Participation and Engagement: By using visual aids like the place value wheel, teachers were able to create a more encouraging and

stimulating learning environment for their students.

3- Improved Problem-Solving Ability: Students showed that they could apply what they had learned in the real world by becoming more adept at handling place value-related mathematical problems.

Using the wheel in problem-solving exercises forces students to apply what they've learned about place value and whole value in context. Students hone their analytical reasoning and critical thinking skills by spinning the wheel to produce specific numerical expressions or random numbers.

4- Positive Teacher Perceptions: Teachers expressed positive opinions about the teaching strategy, praising it for its capacity to foster conceptual understanding and student involvement.

5- Visual Representation: Students gain a deeper comprehension of place value and whole value concepts thanks to the wheel's visual representation. Students learn about the number system's hierarchical structure by watching the digits move between place values as the wheel spins.

6- Numerical Fluency: By having students identify, compare, and manipulate numbers according to their place value and whole value, manipulating the wheel helps students become more fluent with numbers. Students gain competence and efficiency in mental calculations by spinning the wheel repeatedly and deciphering the numerical values shown.

7- Application to Real-World Scenarios: Students' comprehension of mathematical concepts in real-world settings is improved when they can make connections between the wheel's use and applications of place and whole value concepts. By employing the wheel as a tool to solve real-world problems, students learn the applicability and significance of mathematical ideas in daily life.

8- Differentiated Instruction: The adaptability of the wheel makes it possible to provide instruction tailored to each student's unique needs and learning preferences. Using the wheel, educators can modify assignments and activities to give advanced students opportunities for extension and scaffold support for students who are struggling.

9- Cross-Curricular Connections: By incorporating the wheel into multidisciplinary educational activities, mathematics and other subject areas are better connected. Students might utilize the wheel, for instance, to compute measurements for art projects, analyze data for science experiments, or decipher graphs in social studies.

10- Arithmetic Operations: By illustrating how the place value of digits influences the results of these

operations, it can be used to teach arithmetic operations like addition, subtraction, multiplication, and division.

11- Students can use the wheel to compare the magnitudes of numbers based on their place values or to learn how to round numbers to a specific place value.

12- Interactive Tools: The Wheel of Place Value is available as an app or as an interactive tool in modern education. These let students work with numbers and see how dynamically place value representations change.

As a result of encouraging conceptual knowledge, problem-solving abilities, numerical fluency, and practical application, the place value and value wheel is a useful instrument for raising students' mathematical competency. Students get a greater understanding of the relevance of place value and whole value concepts in mathematics and other subjects through hands-on, interactive experiences with the wheel.

On the other hand, the following are some of the reasons why teaching third-grade students mathematics using the place value and value wheel has disadvantages (Thompson et al. 2020):

1- Excessive Dependency on Visual Aid: Relying only on the place value wheel can cause students to become overly dependent on visual cues instead of deepening their conceptual understanding of place value. Their capacity to apply the idea in various situations or without visual aids may be hampered as a result.

2- Restricted comprehension of Abstract Concepts: Although the place value wheel gives students a tangible illustration of place value, it might not fully prepare them for comprehending more abstract mathematical ideas in higher grades. If teachers only provide visual aids like the wheel, students might find it difficult to move from concrete to abstract thinking.

3- Potential Misconceptions: Students may have misconceptions about place value if the place value wheel is interpreted incorrectly or if concepts are oversimplified. Incorrect concepts about the relationships between digits and their places within numbers may develop in students if they do not receive the right direction and reinforcement.

4- Time Restrictions: Using visual aids in the classroom, such as the place value wheel, to teach may take up more time, which leaves less time for other crucial mathematical ideas or exercises. This might limit the depth of instruction in other areas and throw off the curriculum's pacing.

5- Resource Dependence: In order to use the wheel of place value effectively, one must have access to the right materials and resources, which aren't

always available in educational settings. Teachers may encounter difficulties in consistently implementing the instructional approach as a result of this reliance on outside resources.

6- Individual Learning Styles: While visual aids can be helpful for visual learners, they might not be able to accommodate every student's different learning preferences in the classroom. To completely understand mathematical concepts, some students might need to use alternative teaching methods like auditory or kinesthetic methods.

6. Conclusion

Across many academic fields, mathematical modelling is an invaluable tool for comprehending and resolving real-world issues. The Wheel of Place Value and Value offers a methodical way to represent numerical quantities, which improves the efficacy of mathematical modelling. This conceptual framework can help researchers create more accurate and insightful mathematical models of real-world phenomena, which will help them make better decisions and solve problems. To sum up, the place value and value wheel provides an effective and cutting-edge method for teaching place value and whole value concepts in mathematics education. It is an invaluable tool for improving students' conceptual understanding, problem-solving abilities, and mathematical proficiency because of its distinctive structure, functionality, and pedagogical advantages. To sum up, this study of the wheel of place value and value gives a thorough rundown of its design, features, educational advantages, and uses in maths education. The sections that follow will go into more detail on particular tactics, real-world examples, and case studies that show how the wheel can be used to teach and learn mathematics in an efficient manner. Throughout this paper, we have explored various aspects of incorporating the wheel of place value and value into mathematics instruction. We have discussed its structure, functionality, and pedagogical benefits, highlighting its potential to promote conceptual understanding, problem-solving skills, and numerical fluency. By leveraging the wheel in teaching, educators can create inclusive learning environments where all students have the opportunity to excel in mathematics.

In assessing learning outcomes with the wheel of place value and value, educators have access to a range of formative and summative assessment strategies that evaluate students' understanding, proficiency, and application of mathematical concepts. By using the wheel as a tool for assessment, educators can gather valuable insights into students' mathematical reasoning, problem-solving abilities, and conceptual understanding, ultimately informing instructional decision-making and supporting student learning.

In conclusion, the wheel of place value and value represents a transformative tool that has the potential to revolutionize mathematics education by promoting conceptual understanding, fostering critical thinking, and empowering students to become confident and proficient mathematicians. By embracing the wheel in mathematics instruction and assessment, educators can inspire a lifelong love of learning and unlock the potential of every student to succeed in mathematics and beyond.

The results of this study highlight the importance of using visual aids in mathematics instruction for third-grade students, such as the place value wheel. Visual aids help students understand and remember place value concepts by giving abstract mathematical ideas a concrete representation. Furthermore, these tools' interactive features encourage active participation and make deeper learning experiences possible.

Educators who used the instructional approach reported positive experiences and mentioned that it helped students become more engaged and conceptually aware. In addition to expressing excitement about incorporating similar instructional approaches into their pedagogical repertoire, teachers acknowledged the importance of visual aids in increasing student learning.

Overcome the limitations of using the Wheel of Place Value and Value: In order to overcome the limitations of using the Wheel of Place Value and Value,

- Teachers should incorporate a range of pedagogical approaches that accommodate varying learning preferences and foster a thorough comprehension of mathematical ideas in addition to the place value wheel.
- Furthermore, encouraging critical thinking and giving students chances to apply what they've learned in authentic settings can help reduce any potential drawbacks from using visual aids.
- Going forward, it is critical to keep investigating and improving teaching strategies that make use of visual aids to improve students' mathematical learning experiences.
- The long-term effects of integrating the wheel of place value and value into mathematics instruction across a range of student demographics and educational contexts require more research.
- In addition, to guarantee that visual-based instructional approaches are implemented in the classroom effectively, educators must receive ongoing professional development and assistance. Through the implementation of creative teaching methodologies and the effective use of visual aids, educators can enable students to develop into self-assured, proficient, and motivated learners in mathematics and other subjects.
- Engagement Strategies: Use techniques like problem-based

learning, practical exercises, and real-world applications to boost students' motivation and engagement in mathematics education.

- Technology Integration: To improve student engagement, enable personalized learning, and give access to interactive simulations and digital resources, incorporate technology tools and resources into mathematics instruction.
- Collaborative Learning Communities: Encourage the development of collaborative learning communities where teachers can exchange best practices, materials, and approaches to solving problems in the classroom. This will encourage group problem-solving and ongoing improvement.
- Culturally Responsive Pedagogy: To foster inclusive learning environments, integrate culturally responsive pedagogy into mathematics instruction. This involves acknowledging and appreciating the diverse backgrounds, experiences, and viewpoints of students.

Future studies

- Future studies should look into how well augmented reality (AR) technology works when teaching mathematics, especially when used in conjunction with visual aids like the place value wheel. This can entail creating and executing AR-enhanced lessons that let learners engage immersive with mathematical ideas. The effect of AR-based instruction, in contrast to conventional teaching techniques, on students' comprehension, retention, and motivation in mathematics could then be investigated by researchers.

The study might also look into how different learning styles and different math proficiency levels of students can be catered for using augmented reality technology. This study may offer insightful information about the possible advantages of incorporating cutting-edge technologies into mathematics instruction, as well as best practices for teachers looking to add augmented reality tools to their toolkit.

- Technology Integration: Future studies could look at creative ways to incorporate interactive apps, virtual worlds, and digital manipulatives into place value and value education, and they could also look at how technology-enhanced instruction affects student engagement and learning outcomes.
- Global Perspectives: Research could take a global approach, comparing value and place value instruction in various nations and educational systems, spotting cultural differences in teaching methods and student outcomes, and investigating methods for

fostering fair access to excellent mathematics education globally.

In order to better support students' mathematical learning and achievement, these future studies have the potential to expand our understanding of place value and value concepts in mathematics education. This understanding will inform curriculum development, teacher preparation, and instructional practices.

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