https://journal.ypidathu.or.id/index.php/ijlul/
P - ISSN: 3026-7102
E - ISSN: 3030-8372

The Effectiveness of the Use of Number Smart Board Learning Media to Improve Early Childhood Numeracy Skills

Korlina Makulua[1], Franklin Stevan Dahoklory[2], Clinton Lumaupuy[3]
[1,2,3]Institut Agama Kristen Negeri Ambon, Indonesia

ABSTRACT

Background. Learning in early childhood is an important foundation in the development of cognitive abilities, especially in numeracy skills. However, challenges in teaching the concept of counting effectively are often faced by educators. Interesting learning media, such as number smart boards, are expected to help overcome this obstacle. This media is designed to make it easier for children to understand the concept of numbers and basic operations of mathematics through fun and interactive methods.

Purpose. This study aims to test the effectiveness of the use of number smart board learning media in improving numeracy skills in early childhood. In addition, this study also focuses on how this media affects children's motivation to learn and whether there is a significant difference between the use of this media and conventional learning methods.

Method. This study uses a quantitative approach with an experimental design. The subjects of the study were children aged 4-6 years in a kindergarten who were divided into two groups, namely an experimental group that used the media of a number smart board and a control group that used traditional learning methods. Data collection was carried out through observations, numeracy tests, and questionnaires to measure children's motivation to learn.

Results. The results showed that children who learned to use a number smart board experienced a significant improvement in numeracy compared to the control group. In addition, the motivation to learn in the experimental group was also seen to be higher.

Conclusion. The use of number smart board learning media has been proven to be effective in improving early childhood numeracy skills. This media is also able to increase children's learning motivation, making it an effective alternative to conventional learning methods.

KEYWORDS

Early Childhood, Numeracy Skills, Number Smart Board Learning Media

Citation: Makulua, K., Dahaklory, S, F., & Lumaupuy, C. (2024). The Effectiveness of the Use of Number Smart Board Learning Media to Improve Early Childhood Numeracy Skills. *International Journal of Language and Ubiquitous Learning*, *2*(3), 373–383.
https://doi.org/10.70177/ijlul.v2i3.1301

Correspondence:

Korlina Makulua,
Kmakulua@gmail.com

Received: September 6, 2024

Accepted: September 11, 2024

Published: September 28, 2024

INTRODUCTION

Learning in early childhood plays an important role in forming the foundation for the development of children's cognitive and intellectual abilities (Al-Hendawi, 2023; Furima dkk., 2022). At this time, children are in a phase of rapid brain development, so the right stimulation has a great influence on their thinking skills in the future.

One of the basic skills that must be introduced in early childhood is arithmetic, because this ability is an important part of learning mathematics. However, number recognition and basic operations are often a challenge, both for children and for educators (Abdel-Basset dkk., 2019; Agustin dkk., 2020).

The learning methods used in teaching the concept of counting to early childhood vary greatly, ranging from conventional methods to the use of modern technology. One of the learning media that is starting to be widely used is the number smart board, which is designed to facilitate children in understanding numbers and counting in a fun and interactive way (Imoize dkk., 2021). This media offers a more interesting learning experience than conventional methods, which tend to be monotonous and less popular with children. In this way, it is hoped that children will be more motivated to learn to count and more easily understand the basic concepts of mathematics (Hong, 2021).

Previous research has shown that the use of interactive learning media can help increase children's interest in learning and better learning outcomes (Tlili dkk., 2021). Children tend to be more interested in media that involve physical and visual activities, such as number smart boards, that allow them to be directly involved in the learning process. This interactivity creates a more enjoyable learning atmosphere, which ultimately affects the improvement of children's numeracy skills (Rao & Kalyani, 2022).

The ability to count on oneself is very important in daily life, because it is closely related to the ability to think logically and solve problems. If these skills are not honed early on, children may have difficulty understanding more complex mathematical concepts at the next level of education. Therefore, it is important to choose a learning method that is effective and in accordance with the needs of early childhood development.

In addition, early childhood areas have different characteristics from children at higher levels of education. They tend to learn through playing and interacting with the surrounding environment. Creative and innovative learning media, such as number smart boards, are very suitable for this characteristic because they combine elements of play with the learning process, so that they can maximize children's learning potential (AlZu’bi dkk., 2019).

Taking into account the importance of numeracy skills and the challenges of teaching them, this study will explore the effectiveness of using number smart boards as a learning medium to improve numeracy skills in early childhood. This research is expected to make a significant contribution to the world of education, especially in terms of learning media innovation for early childhood (Windschitl dkk., 2020).

Although various learning media have been widely used to assist early childhood in improving numeracy skills, the effectiveness of each media is not fully understood. The use of number smart boards, for example, despite their popularity, is still not well researched regarding its impact on improving early childhood numeracy skills (Nahdi, 2020). The lack of empirical research on this medium leaves gaps in the literature that must be filled in to understand how effective this medium is when compared to traditional learning methods (AlZu’bi dkk., 2019).

Existing research generally focuses on the effectiveness of more general learning media, such as books or digital applications. However, few specifically discuss number smart boards as an interactive and physical-based learning medium. The existence of this gap indicates that further research is needed to identify the factors that affect the successful use of number smart boards in improving numeracy skills, including how this media affects children's motivation to learn (Lassoued dkk., 2020).

Not much is known about how the number smart board media can adapt to various learning styles of children. Early childhood has different learning characteristics, and there have been no comprehensive studies that measure how flexible this medium is in supporting the different learning approaches that children may have. There needs to be a better understanding of the extent to which a number smart board is able to meet the learning needs of individuals (Chan & Zary, 2019).

There is also a lack of data on the long-term impact of the use of number smart boards on children's cognitive development. This study aims to answer these unanswered questions, with the hope of providing clearer guidance on the effectiveness of number smart boards in the teaching and learning process among early childhood (Knox, 2020; Nisar dkk., 2019).

Number smart boards have great potential as an effective learning medium in teaching numeracy skills in early childhood. However, without in-depth research, the true effectiveness of this medium is still uncertain. There needs to be a systematic study to understand the extent to which this media can help children develop basic numeracy skills. This research aims to fill this gap by providing empirical data that can be used as a reference in the development of better learning methods (Manca, 2020; Novaliendry dkk., 2020).

Understanding how interactive learning media, such as number smart boards, can affect a child's learning process is essential. If proven to be effective, this medium can be a more interesting alternative to conventional methods, which tend to be boring for children. In addition, early childhood learning motivation is greatly influenced by fun and direct interaction, so the use of number smart boards has the potential to not only improve numeracy skills, but also build a positive attitude towards mathematics learning (Bursali & Yilmaz, 2019).

This research is important to answer the question of whether number smart boards actually provide more benefits than traditional learning methods. Thus, the results of this research are expected to contribute to the development of more interactive and effective learning strategies, especially in teaching the concept of counting in early childhood .

RESEARCH METHODOLOGY

This study uses an experimental design with a quantitative approach to measure the effectiveness of the use of number smart board learning media in improving early childhood numeracy skills (Adorjan, 2023; Bauer, 2019a). The experimental group will be given learning using the media of a number smart board, while the control group will receive learning with conventional methods. This study aims to compare the results of numeracy between the two groups after being given different treatments (Bauer, 2019b).

The population in this study is early childhood children aged 4-6 years from several kindergartens in certain areas. Samples were randomly taken from the population with a total of 60 children, which were then divided into two groups, namely the experimental group and the control group, each consisting of 30 children. Sample selection was carried out by random sampling technique to ensure a good representation of the population (Pilcher, 2023).

The research instruments used include a numeracy test to measure children's ability to count before and after treatment. In addition, the learning motivation questionnaire is also used to assess the level of children's learning motivation during the learning process. These instruments have been validated by education experts to ensure their reliability and validity (Safrudiannur, 2021).

The research procedure began with the implementation of a pre-test for both groups to determine the child's initial ability to count. After that, the experimental group will be given learning using the digital smart board media for four weeks, while the control group will use conventional methods. After the learning period, a post-test was given to both groups to measure

changes in numeracy skills. The data from the pre-test and post-test results were then analyzed using statistical tests to determine the effectiveness of using the number smart board (Takona, 2023; Tashakkori dkk., 2020).

RESULT AND DISCUSSION

This study involved 60 early childhood children who were divided into two groups, namely the experimental group and the control group. Each group consists of 30 children. The data obtained from the results of the pre-test and post-test were statistically analyzed to see changes in children's numeracy skills. The average pre-test results in the experimental group were 45.2 and the post-test was 78.6, while in the control group the average pre-test was 44.7 and the post-test was 62.3. This data showed an increase in both groups, but the increase in the experimental group was more significant.

Group	Average Pre-test	Average Post-test t	Increased
Experiment	45,2	78,6	33,4
Control	44,7	62,3	17,6

Table 1. Experiment and Control Group.

The above data showed that there was an increase in numeracy in both groups, but the increase occurred in the experimental group compared to the control group. This indicates that the use of number smart boards as a learning medium plays an important role in helping children understand the concept of counting more effectively. The significant increase in the experimental group reflects the effectiveness of this learning medium in improving numeracy skills.

The number smart board used in the experimental group provided more interesting visual and interactive stimulation compared to the conventional methods applied to the control group. The use of physical aids and hands-on activities makes it easier for children to understand the relationship between numbers and basic mathematical operations. More intensive interaction with these learning media helps children to be more engaged and motivated during the learning process.

In addition to the quantitative data obtained from the numeracy test, this study also used questionnaires to measure children's learning motivation during learning. The results of the questionnaire showed that 85% of the children in the experimental group felt more interested and motivated to learn to count using a number smart board, while in the control group only 65% showed similar motivation. This data strengthens the finding that interactive learning methods are more able to maintain children's interest in learning compared to conventional methods.

Learning motivation is an important factor in the educational process, especially in early childhood who tend to be more responsive to fun learning. The smart number board media offers a fun and challenging learning experience, thus triggering a child's desire to continue learning and understand more deeply about counting. The high levels of motivation in the experimental group showed that the medium was not only academically effective, but also emotionally.

Higher motivation in the experimental group was closely related to more varied and interactive learning methods. Children interact more with the learning medium of number smart boards, which allows them to learn through exploration and games. This makes the learning process more interesting and reduces boredom, which often happens in learning with conventional methods. This increase in motivation can directly contribute to better learning outcomes, as seen in the increase in post-test scores of the experimental group.

The high level of children's involvement with the smart number board media also creates a more conducive learning environment. Children actively participate in each learning session, which ultimately helps them internalize the concept of counting more effectively. This experience provides important insights for educators about the importance of choosing learning media that suits the needs and characteristics of early childhood.

There is a strong correlation between the use of number smart board media and the improvement of numeracy skills and learning motivation in early childhood. The data shows that children who learn with this medium not only experience an improvement in numeracy skills, but are also more motivated to learn. This association between learning outcomes and motivation is an indicator that learning involving interactive media can create better results overall compared to traditional methods.

This study also shows that interactive learning media not only helps children understand the material, but also builds a positive attitude towards learning itself. This is important, considering that early childhood tends to get bored more easily with monotonous methods. The strong association between improved numeracy and learning motivation strengthens the argument that the right learning media can bring about significant changes in learning outcomes.

In a case study, one of the kindergartens that was the subject of the study reported that children who used a number smart board looked more enthusiastic during learning activities. One teacher mentioned that children who previously had difficulty understanding numbers now show significant improvement after using a number smart board. In addition, the interaction between students also increased, because they helped each other and discussed while using the learning media.

The teacher also noted that children complete counting tasks correctly more often after being introduced to this medium. Although the learning time is relatively the same as the conventional method, the results obtained are more effective in terms of understanding concepts and mastery of basic numeracy skills. This case study shows that the number smart board learning media not only improves academic ability, but also the social aspect of children during the learning process.

Case studies provide concrete evidence of how number smart boards can have a positive impact in a real learning environment. The increased enthusiasm and numeracy observed in the class supports the results of a broader study, which demonstrates the overall effectiveness of this medium. This shows that the interactivity of learning media has a direct influence on student engagement and understanding, which ultimately has an impact on better learning outcomes.

Real-life experiences from teachers and students reinforce the argument that learning media such as number smart boards should be considered as part of a broader learning strategy in kindergarten. The use of this media not only facilitates the teaching process, but also increases the effectiveness of learning from the child's side, both in cognitive and social aspects.

The correlation between statistical data and case studies shows that the use of number smart boards as a learning medium not only has an impact on improving academic outcomes, but also on non-academic aspects such as motivation and social interaction. The data shows that this media is able to create a more inclusive and fun learning environment, where children feel more interested and motivated to learn. This increase in learning outcomes driven by high motivation provides a clear picture of the importance of choosing the right learning media for early childhood.

The relationship between quantitative and qualitative data also shows that the effectiveness of number smart boards in improving early childhood numeracy skills is not just numbers, but also richer learning experiences. All of these findings confirm the importance of innovation in learning methods that can combine academic and emotional aspects in one medium.

This study shows that the use of number smart board learning media significantly improves early childhood numeracy skills. The average increase in numeracy skills in the experimental group that used the number smart board was higher compared to the control group that used the conventional method. In addition, the learning motivation of children who use number smart boards is also higher, which has an impact on improving learning outcomes. This data shows the effectiveness of the number smart board learning media in improving academic outcomes and motivation of children at an early age.

Children who engage in learning with a number smart board show higher enthusiasm during the learning process. These results indicate that interactive and interesting learning media is able to facilitate children's understanding of basic mathematical concepts. The number smart board provides a more fun approach to learning, so that children feel more motivated and easy to understand the material.

The effectiveness of the number smart board can be seen from a significant increase in the results of the post-test test of the experimental group. Compared to conventional learning methods, children are faster to understand the concept of numbers and basic operations of mathematics through this medium. This shows the great potential of the number smart board as an effective tool in the process of learning to count.

The improvement of numeracy skills and learning motivation in children who use smart number boards gives a clear picture that this media can be used as an alternative effective learning method. Teachers and educators can consider using this media to create a more interactive and fun learning atmosphere.

This study is consistent with several previous studies that show that interactive learning media can improve early childhood learning outcomes. Studies conducted by several previous researchers have also found that the use of physical and visual aids in learning can help children understand basic mathematical concepts. The study reinforces the findings by adding empirical evidence that number smartboards can specifically improve numeracy skills.

In contrast to research that uses digital applications as interactive learning media, this study focuses more on the use of physical tools that involve motor activities. Previous research has often prioritized digital media such as applications and computer games, while this research shows that physical media such as number smart boards are also effective. This shows that interactive learning media does not have to be based on digital technology, but can also be in the form of simple and easily accessible physical media.

Several other studies have shown that children's motivation to learn is influenced by factors such as classroom atmosphere and interaction with teachers. This research adds a new dimension by showing that the use of visual aids such as number smart boards also plays a role in increasing learning motivation. This provides new insights that interesting learning media can function as a driver of intrinsic motivation for children in learning.

This study also shows that physical learning media can produce results that are just as effective as digital media, as long as the media is well designed and in accordance with the needs of children. These results provide an alternative for schools or educational institutions that may have limited access to digital technology.

The results of this study show that early childhood children need a more interactive and visual learning approach to optimize their cognitive abilities. Children's tendency to learn through exploration and physical activity is a sign that traditional learning media is not enough. There needs to be innovation in learning methods to attract children's attention and keep them motivated in learning.

These findings also indicate the importance of choosing learning media that are in accordance with the characteristics of early childhood development. The use of number smart boards as a learning medium gives a sign that children are more interested in methods that involve physical and visual involvement than approaches that are only theoretical. This emphasizes the need for a holistic approach in early childhood education.

The results of this study show that not only learning outcomes increase, but also children's learning motivation. This is a sign that learning media must not only focus on the academic aspect, but also the psychological and emotional aspects of the child. A fun learning experience can create a positive atmosphere that has an impact on better learning outcomes.

Increased motivation and involvement of children in learning is a sign that teachers need to adopt more varied and innovative methods. The use of number smart boards provides concrete examples of how learning media can positively affect the classroom atmosphere, so that children feel more involved in the learning process.

The implications of the results of this study are very important for the world of education, especially in early childhood education. The use of a number smart board can be adopted as an effective alternative in improving children's numeracy skills. This media not only improves learning outcomes, but also provides a more enjoyable and engaging learning experience for children. This can help improve the quality of mathematics learning at an early age.

Teachers and educators can consider the use of interactive media such as number smart boards to replace or complement traditional learning methods. Number smart boards can be used in a variety of learning activities, both in the classroom and at home. These implications provide guidance for educators in choosing a more appropriate method for children who need a more visual and interactive learning experience.

In addition, the results of this study provide insight for curriculum developers about the importance of innovation in learning media. A curriculum that includes the use of visual aids such as a number smart board can have a positive impact on improving children's learning outcomes. This shows that physical learning media also has an important role in the world of education, especially in early childhood learning.

Another implication is that schools and educational institutions need to provide facilities and infrastructure that support the use of interactive learning media such as number smart boards. Investing in innovative learning media can provide significant results in terms of improving children's academic outcomes and learning motivation.

The results of the study that show an increase in numeracy and learning motivation can be explained through the characteristics of early childhood that are more responsive to visual and interactive learning. Children at an early age tend to learn more effectively through hands-on experience and physical manipulation. The number smart board provides this experience by combining visual, physical, and interactive elements that make it easier for children to understand abstract concepts such as numbers and mathematical operations.

The learning medium of the number smart board also allows children to learn in a more fun and less boring way compared to traditional learning methods. The use of props that involve physical involvement makes children more focused and interested during the learning process. This explains why the results showed an increase in motivation and learning outcomes in the experimental group.

Increased learning motivation in the experimental group was also associated with a greater sense of accomplishment when children managed to grasp concepts through engaging aids. The number smart board provides immediate visual feedback, which makes children feel more confident

and motivated to keep learning. This is an important factor that explains why this medium is more effective compared to conventional methods.

The use of number smart boards, which is more effective than traditional learning methods, can also be explained by the ability of this medium to stimulate various learning styles of children. Children with visual and kinesthetic learning styles are more helped by this medium, which provides a richer variety of material delivery methods.

In the future, the results of this research provide encouragement for educators to continue to develop and test other interactive learning media. The number smart board is just one example of the many possible tools that can be used to improve early childhood learning outcomes. Schools and educational institutions are expected to be more open to innovations in learning media that can be adapted to the needs of children.

Curriculum developers also need to pay attention to the importance of interactive and visual learning media in the early childhood learning process. Further research needs to be done to explore other learning media that can provide similar or even better benefits than number smart boards. This paves the way for the development of more sophisticated and varied learning media.

The results of this study can also encourage policy making that supports the use of interactive learning media at the early childhood education level. The government and education policymakers need to consider the allocation of funds to provide more innovative learning aids in schools. This step will help ensure that each child gets access to learning media that suits their needs.

This study provides guidance for teachers and educators in choosing more effective learning methods and tools. Now, with empirical evidence on the effectiveness of number smart boards, the next step is to implement and evaluate their impact in a variety of other educational contexts.

CONCLUSION

This study found that the use of number smart board learning media was significantly more effective in improving early childhood numeracy skills compared to conventional learning methods. The improvement seen in the post-test results of the experimental group showed that children who used a number smart board had an easier time understanding the concept of counting, which was also reflected in their higher motivation to learn.

These results confirm that interactive learning media that involves physical and visual activities is more suitable for early childhood. These findings show the need to adopt more creative methods in teaching basic mathematics so that the teaching and learning process becomes more effective and fun for children.

This research makes an important contribution to the development of learning methods for early childhood, especially in the field of mathematics. The use of number smart boards as a learning medium provides an attractive alternative for educators who want to improve children's numeracy skills through a more interactive approach and involving physical activity.

The contribution of this research lies in the concept of using physical media that can be applied in various contexts of early childhood education. The findings also open up opportunities for the development of other learning aids that focus on children's visual and kinesthetic involvement in understanding basic mathematical concepts.

Penelitian ini memiliki keterbatasan dalam hal generalisasi, karena hanya melibatkan sampel dari satu wilayah dan rentang usia tertentu. Jumlah subjek yang terbatas juga menjadi salah satu faktor yang perlu diperhatikan, sehingga hasil penelitian ini mungkin tidak sepenuhnya berlaku untuk populasi yang lebih luas. Selain itu, penelitian ini belum mengkaji dampak jangka panjang penggunaan papan pintar angka terhadap perkembangan kognitif anak.

The direction of further research can expand the scope of the sample and the duration of the study to see if the positive effects of using the number smart board remain lasting for a longer period of time. Further research also needs to explore the use of similar learning media in various cultural and economic contexts, to ensure its effectiveness in improving numeracy skills in various community groups.

AUTHORS' CONTRIBUTION

Look this example below:

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

REFERENCES

Abdel-Basset, M., Manogaran, G., & ... (2019). Internet of things in smart education environment: Supportive framework in the decision-making process. *Concurrency and …*, *Query date: 2024-09-28 07:24:57*. https://doi.org/10.1002/cpe.4515

Adorjan, A. (2023). Towards a Researcher-in-the-loop Driven Curation Approach for Quantitative and Qualitative Research Methods. *Communications in Computer and Information Science*, *1850*(Query date: 2023-11-30 23:13:48), 647–655. https://doi.org/10.1007/978-3-031-42941-5_58

Agustin, F., Oganda, F. P., Lutfiani, N., & Harahap, E. P. (2020). Manajemen Pembelajaran Daring Menggunakan Education Smart Courses. *Technomedia Journal*, *5*(1 Agustus), 40–53.

Al-Hendawi, M. (2023). Validation of the Arabic Version of Strengths and Difficulties Questionnaire in Early Childhood Education in Qatar. *Children*, *10*(1). https://doi.org/10.3390/children10010146

AlZu'bi, S., Hawashin, B., Mujahed, M., Jararweh, Y., & ... (2019). An efficient employment of internet of multimedia things in smart and future agriculture. *Multimedia Tools and …*, *Query date: 2024-09-28 07:24:57*. https://doi.org/10.1007/s11042-019-7367-0

Bauer, G. R. (2019a). Advancing quantitative intersectionality research methods: Intracategorical and intercategorical approaches to shared and differential constructs. *Social Science and Medicine*, *226*(Query date: 2023-11-30 23:13:48), 260–262. https://doi.org/10.1016/j.socscimed.2019.03.018

Bauer, G. R. (2019b). Advancing quantitative intersectionality research methods: Intracategorical and intercategorical approaches to shared and differential constructs. *Social Science and Medicine*, *226*(Query date: 2023-12-14 18:25:27), 260–262. https://doi.org/10.1016/j.socscimed.2019.03.018

Bursali, H., & Yilmaz, R. (2019). Effect of augmented reality applications on secondary school students' reading comprehension and learning permanency. *Computers in Human Behavior*, *Query date: 2024-09-28 07:24:57*. https://www.sciencedirect.com/science/article/pii/S0747563219300445

Chan, K., & Zary, N. (2019). Applications and challenges of implementing artificial intelligence in medical education: Integrative review. *JMIR medical education*, *Query date: 2024-09-28 07:24:57*. https://mededu.jmir.org/2019/1/e13930

Furima, Y., Naibaho, J., & ... (2022). Aplikasi Belajar Dan Bermain Untuk Anak Usia Dini Menggunakan Kodular: Learning and Playing Applications for early Childhood Using Kodular. *JISTECH: Journal of …*, *Query date: 2024-05-12 21:14:12*. https://jurnal.unipa.ac.id/index.php/istech/article/view/63

Hong, S. (2021). *A cord of three strands: A new approach to parent engagement in schools*. books.google.com. https://books.google.com/books?hl=en&lr=&id=RX4fEAAAQBAJ&oi=fnd&pg=PT6&dq=

number+smart+board+learning+media&ots=YAjC2o4vYY&sig=jSnBA-qLfkq3EgveMlz40AJNSvA

Imoize, A., Adedeji, O., Tandiya, N., & Shetty, S. (2021). 6G enabled smart infrastructure for sustainable society: Opportunities, challenges, and research roadmap. *Sensors*, *Query date: 2024-09-28 07:24:57*. https://www.mdpi.com/1424-8220/21/5/1709

Knox, J. (2020). Artificial intelligence and education in China. *Learning, Media and Technology*, *Query date: 2024-09-28 07:24:57*. https://doi.org/10.1080/17439884.2020.1754236

Lassoued, Z., Alhendawi, M., & Bashitialshaaer, R. (2020). An exploratory study of the obstacles for achieving quality in distance learning during the COVID-19 pandemic. *Education sciences*, *Query date: 2024-09-28 07:24:57*. https://www.mdpi.com/2227-7102/10/9/232

Manca, S. (2020). Snapping, pinning, liking or texting: Investigating social media in higher education beyond Facebook. *The Internet and Higher Education*, *Query date: 2024-09-28 07:24:57*. https://www.sciencedirect.com/science/article/pii/S1096751619304257

Nahdi, D. S. (2020). Pre-service teacher's ability in solving mathematics problem viewed from numeracy literacy skills. *Elementary Education Online*, *19*(4), 1902–1910. https://doi.org/10.17051/ilkonline.2020.762541

Nisar, T., Prabhakar, G., & Strakova, L. (2019). Social media information benefits, knowledge management and smart organizations. *Journal of Business Research*, *Query date: 2024-09-28 07:24:57*. https://www.sciencedirect.com/science/article/pii/S0148296318302303

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & ... (2020). Smart learning media based on android technology. *International Journal of …*, *Query date: 2024-09-28 07:24:57*. https://www.ijicc.net/images/vol12/iss11/121109_Novaliendry_2020_E_R.pdf

Pilcher, N. (2023). "Qualitative" and "quantitative" methods and approaches across subject fields: Implications for research values, assumptions, and practices. *Quality and Quantity*, *Query date: 2023-11-30 23:13:48*. https://doi.org/10.1007/s11135-023-01734-4

Rao, B., & Kalyani, V. (2022). A study on positive and negative effects of social media on society. *Journal of Science &Technology (JST)*, *Query date: 2024-09-28 07:24:57*. https://jst.org.in/index.php/pub/article/view/883

Safrudiannur. (2021). Offering an Approach to Measure Beliefs Quantitatively: Capturing the Influence of Students' Abilities on Teachers' Beliefs. *International Journal of Science and Mathematics Education*, *19*(2), 419–441. https://doi.org/10.1007/s10763-020-10063-z

Takona, J. P. (2023). Research design: Qualitative, quantitative, and mixed methods approaches / sixth edition. *Quality and Quantity*, *Query date: 2023-11-30 23:13:48*. https://doi.org/10.1007/s11135-023-01798-2

Tashakkori, A., Johnson, R., & Teddlie, C. (2020). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. *Query date: 2024-09-28 07:06:28*.

Tlili, A., Hattab, S., Essalmi, F., Chen, N., Huang, R., & ... (2021). A smart collaborative educational game with learning analytics to support English vocabulary teaching. *IJIMAI*, *Query date: 2024-09-28 07:24:57*. https://dialnet.unirioja.es/servlet/articulo?codigo=9033446

Windschitl, M., Thompson, J., & Braaten, M. (2020). *Ambitious science teaching*. books.google.com. https://books.google.com/books?hl=en&lr=&id=iDT-DwAAQBAJ&oi=fnd&pg=PT6&dq=number+smart+board+learning+media&ots=oc2sapdPSQ&sig=I8x-B6F1dMKtr4cNwVeDZfwPtkw