**International Journal of Emerging Research and Review**
Homepage : https://ijoerar.net/index.php/ijoerar
p-ISSN : 3024-8825; e-ISSN : 3021-8950

IJOERAR, Vol. 2, No. 2, June 2024


# Effectiveness of Using Building Spaces Media to Improve Mathematical Problem-Solving: Literature Review

**Hadi Purnomo[1]*, Tatag Yuli Eko Siswono[1], Wiryanto[1]**
[1*]Universitas Negeri Surabaya, Surabaya, Indonesia

**DOI:** https://doi.org/10.56707/ijoerar.v2i2.67

**Sections Info**
***Keywords:***
Building Space Media
Physical and Digital Media
Mathematic Problem Solving

**ABSTRACT**
***Objectives:*** *This study investigated the effectiveness of various spatial learning media in improving students' mathematical problem-solving.* ***Method:*** *The research method used is a literature review of articles and journals on Google Scholar from 2019-2024 that discuss the media of building space. The 33 national and international journal literature reviews identified 23 digital and 10 physical media suitable for teaching the material.* ***Results:*** *The outcome of this study was the effectiveness of media use for spatial learning in mathematics, which showed a preference for digital media due to its engaging, dynamic, and flexible nature. In addition, the study showed that incorporating learning media into teaching spatial building can improve students' mathematical problem-solving ability, creativity, and overall interest in learning. These findings emphasize the importance of tailoring media selection to individual learning styles for optimal effectiveness. Ultimately, this study underscores the transformative potential of mathematics learning media in improving student engagement and academic achievement.* ***Novelty:*** *This study offers valuable insights into the benefits of media-integrated instruction for spatial building materials and its positive impact on students' problem-solving skills. As educational technology continues to evolve, this study serves as a reminder of the profound influence effective math learning media can have on a student's educational journey.*

## INTRODUCTION

Mathematics is an important subject that students need to master at various levels of education (Rahmi et al., 2023). Mathematics is a subject that can be challenging for many students, but with the right approach, it can be a rewarding and enriching experience. By focusing on building a strong foundation of mathematical concepts and regularly practicing problem-solving, students can develop the skills and confidence they need to excel in this subject. Additionally, teachers and educators can play a key role in creating a positive and supportive learning environment that encourages students to ask questions and engage with the material. With hard work, patience, and a constructive mindset, mastering mathematics is within reach for any student. Therefore, it is important for learners at all levels of education to have a strong mathematical foundation and continue to develop their abilities to become adaptive individuals who can answer various challenges in the future.

According to the National Council of Teachers of Mathematics, math lessons teach about 1) Problem-solving, 2) Logical thinking and reasoning (Reasoning), 3) Mathematical communication (Communication), 4) Mathematical connections (Connections), 5) Mathematical representation (Representation) (NCTM, 2020). Mastering these five aspects of mathematics not only prepares students to tackle a wide range of math problems but also equips them with essential skills that will serve them well in life. By developing their logical reasoning and critical thinking abilities, students

become more adaptable and creative problem-solvers, able to tackle a variety of challenges and situations with confidence and ease. Whether in their academic pursuits or their personal and professional lives, the skills and knowledge gained through mastering mathematics are invaluable assets that can help students achieve success and fulfillment.

Mathematics is the fundamental foundation that underpins technological and scientific progress. Strong math skills allow scientists and engineers to design and build complex and sophisticated systems (Smith, 2023). Moreover, according to Jones, Mathematics is not just about formulas and numbers but also about developing critical thinking and problem-solving skills that are practical in everyday life (Jones, 2022).

The importance of mathematics in human life is responded by the state with the skills that students need to have in facing the 21st century, namely with 4C (critical thinking, collaboration, creativity, communication), which are integrated into learning in schools, including mathematics subjects (Firdaus et al., 2022).

The importance of mathematics in the future is still not in line with students' interest in learning it. This happens because students still consider mathematics to be a scary subject (Permatasari, 2020). Difficulties in understanding mathematical concepts, uninteresting learning methods, and a negative stigma towards mathematics are factors that cause low interest in learning it.

One of the problematic math materials to teach is about building spaces (Fajari,2020). Spatial material is considered difficult by students because 1) it has terms that are not easy to understand in meaning (Fajari, 2020), 2) limited visualization provided by the teacher, 3) weak visual intelligence of students (Purwoko, 2023), 4) limitations of existing learning media (Saputo, 2020).

Teachers are required to be more innovative and dynamic when facing problems in teaching mathematics (Anggreini, 2022). With innovation, teachers can find answers to every teaching problem they encounter, and with a dynamic nature, they can adjust to existing developments.

One component of a teacher's pedagogy is media mastery (Fadila et al., 2023). Media selection must favor students by considering their needs and learning styles. Three learning styles can be distinguished: visual, auditory, and kinesthetic (Derici, 2023). Learners with a visual learning style find it easier to understand information through vision. They prefer to learn by looking at pictures, diagrams, maps, and videos. They also tend to be neat and organized and easily remember what they see. Learners who have an auditory learning style find it easier to understand information through hearing. They prefer to learn by listening to explanations, lectures, and discussions. They also easily remember what they hear and are good at telling stories. Learners with a kinesthetic learning style find it easier to understand information through movement and hands-on practice. They prefer to learn by doing experiments, role-playing, and working on projects. They also easily remember what they do and are good at creatively solving problems.

Effective media can make it easier for teachers to convey material to students. This also applies to building space material; with effective media, material that is difficult because it is abstract can be easily visualized to be more concrete and easily understood by students (Leliavia, 2023). Specifically, when it comes to abstract topics like building space material, the use of visual aids, diagrams, and animations can significantly enhance students' comprehension and engagement. By leveraging such media tools, teachers can create a more dynamic and interactive learning environment that fosters critical thinking, creativity, and problem-solving skills. Ultimately, this can help students develop a deeper understanding of the subject matter, and prepare them for success in their academic and personal pursuits.

There is a research gap focused on the implementation of effective learning media for building space concepts. This area of research holds immense potential for improving students' mathematical proficiency and fostering a positive attitude toward mathematics. Developing effective learning media for building space concepts is an essential area of research that holds immense potential for improving students' mathematical proficiency (Engelbrecht, 2020). By creating engaging and accessible learning environments, this research can foster a positive attitude toward mathematics, boost problem-solving skills, and equip students with critical spatial reasoning skills for future success. By emphasizing the importance of this area of research, educators can work towards creating a more effective and dynamic teaching approach that caters to students' diverse learning styles. With continued research and innovation, we can create a brighter future for students, where they can excel in mathematics and use their skills to tackle real-world challenges.

This literature review article aims to: (1) find out the effective learning media used in the material of building space and (2) find out the effective building space media to improve mathematical problem-solving skills.

## RESEARCH METHOD

This research method is a literature review. According to Borden and Abbott in Manzilati's book (2017), a literature review is a systematic process for collecting and analyzing information from various sources to build knowledge about a research topic.

The steps of the literature review study are: 1) Determine the topic and research question, 2) Searching for literature, 3) Reading and selecting literature, 4) Analyzing and synthesizing literature, and 5) Conclusion.

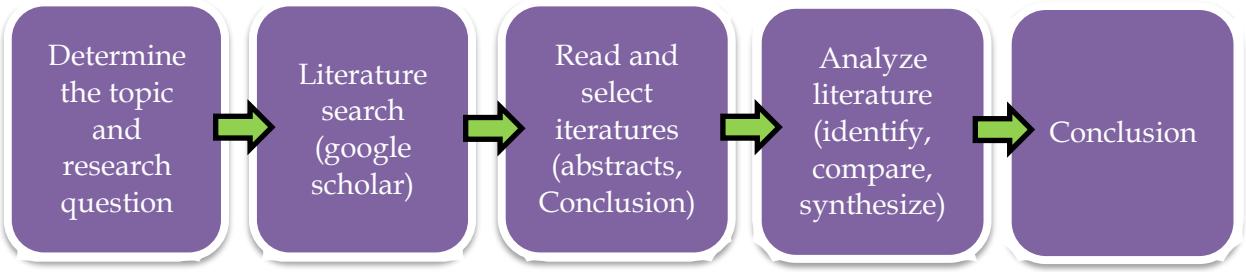


**Figure 1.** Results Literature Review Chart-Flow

**Determine the topic and research question.**
This research topic is the Effectiveness of Using Media in Building Spaces to Improve Mathematical Problem-Solving Ability. The research questions are: 1) knowing the effective learning media used in building space material, and 2) knowing the effective building space media to improve mathematical problem-solving skills.

**Search for literature**
To search for literature that matches the research topic on Google Scholar with the following steps: Open Google Scholar at https://scholar.google.com/, Entering keywords in the search box "buildable media," "mathematical problem solving," Filtering the search by publication year, Browsethrough the search result articles.

**Read and select literature**
The next step is to read the articles (abstracts, conclusions) and select those that are appropriate and relevant to the research.

**Analyzing**
At this stage, we understand the content of the literature, identify information relevant to the research, compare the research results in the journals obtained, and then synthesize relevant information to build arguments and answer research questions.

**Summarize**
At this stage, the researcher summarizes the information analyzed in each literature.

## RESULTS AND DISCUSSION

### Results

**Table 1.** Literature sources

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 1. | Fitrianti & Endah Handayani(2020) | Magic Box | Magic box media assisted by the numbered heads together model effectively improves students' math learning outcomes. | Teachers need to prepare for the use of media. | Effective learning outcomes and understanding of the material jarring-netting of simple spaces. |
| 2. | Dewi R et al. l; (2022) | Media of simple spatial nets assembled with ropes | It makes it easier for students to understand the information because the spatial shapes described can be seen and touched. | Students need to innovate more in modifying the nets of the shapes. | It can be modified in several net shapes so that the insights received by students can be broad. |
| 3. | Arum, S. Et all; (2019) | Building Space Kit | is an adequate standard of expert evaluation that can be used for math learning. | Making the media will be complex for students if they need teacher assistance. | Product Usage The Building Spaces Kit can be used in offline and online classes. |
| 4. | Ulandari et al; (2022) | Jari Baru | Feasible to use as a learning tool on building space material for grade VI SD. | Media details need to be included. | Need a description of how the new finger props are made |
| 5. | Susilawati ; (2017) | Concrete Objects | Facilitate students to think directly | Limited to block and cube spaces. | It can only be applied to classes with characteristics similar to the class that is the subject of this study. |
| 6. | Yulia, M. (2022) | Polyomino Media | Students will be allowed to be creative in finding shapes according to their wishes; this learning experience will help them solve surface area problems. | Students must observe each teacher's steps, consistent with classroom learning. Not suitable for online classes. | Polyomino media and other concrete media will significantly increase interest and motivation and improve learning outcomes. |
| 7. | Sunyiati, S. (2021) | Manipulative Media | Guided inquiry models using manipulative media can improve students' mathematics learning activities and results. | When bright students and other students dominate the discussion are noisy, some students are still passive. | Using a guided inquiry model and manipulative media can make it easier for students to find and understand concepts to make learning |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 8. | Al Ikhsan, I et al., (2022) | Augmented Reality | Improving students' mathematical reasoning skills | Some features that require internet access to download and practice questions that cannot be updated | Need to develop media by considering input from media experts and material experts to improve its quality and effectiveness. |
| 9. | Pramestika, L. A. (2020) | Power Point | Easy and quickly understood by students, it streamlines time in delivering lesson content and attracts students' interest and attention to the material presented. | Too much Animation, graphics, sounds, and so on can distract students, It takes a long time to make. | Please pay attention to how it is used, avoid using too much Animation and graphics, and choose a background color that could be brighter. |
| 10. | Mashuri, D. K. (2020). | Animated Video | It can be applied in various learning conditions, both large and small scale, and supports independent learning | Limited supporting items available in the manufacturing process, so educators need to find or provide images from other sources | Teachers need to pay attention to the availability of the necessary supporting items such as laptops, projection screens, and projectors, rather than just relying on these media. |
| 11. | Diu et al., (2020) | Interactive Multimedia | Can increase student activity, stimulate curiosity, and accelerate understanding of the material, creating an exciting and innovative learning atmosphere. | This can lead to student dependence on technology, lack of social interaction between students, and the possibility of technical glitches. | It is recommended that technology be continued integrated into the learning process to improve student engagement and understanding of the material. |
| 12. | Rohma, A., & Sholihah, U. (2021) | Audio Visual | Makes it easy to create any design, presentations, and graphics, but there are limited teaching resources (teachers) to utilize them optimally. | Might be misused by people without design knowledge | It needs to be continuously developed and optimized to support face-to-face and online learning. |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 13. | Umardiyah, F. (2020) | Object media concrete | Allows students to learn the properties of spatial shapes and how to make them through media observation. | A limited variety of media may be used, making it difficult to teach more complex concepts. | It is suggested that teachers develop constructivist learning using concrete objects on other materials based on the results of the improvements achieved in the building space's material geometry. |
| 14. | Wilda et al., (2023) | Wordwall Educational Game | It can be used on their respective devices without having to open a laptop or computer because it has media elements such as text, graphics, audio, video, and games. | There are still some students who are not entirely using this media | Continue to develop and improve GAULL (Wordwall Educational Game) media as teaching materials and learning tools in other schools. |
| 15. | Alyusfitri et al., (2020) | Macromedia Flash 8 | Advantages in visualizing abstract mathematical concepts and helping | Not everyone learns best visually | Valid and practical for use as a medium for learning mathematics in elementary schools |
| 16. | Sari et al., (2023) | Flipped Classroom | Has an attractive appearance, is easy to use, and makes it easier for students to understand math lessons, which can help improve the quality of math learning. | It requires additional time and effort for teachers to create or compile interactive content suitable for students. | We should continue to implement the Flipped Classroom model assisted by interactive media in learning mathematics in grade V elementary school because it is practical and effective, with a high percentage of practicality for both teachers and students. |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 17. | Wati, W. R. A. (2022) | GEOGEBRA APP | Produce geometry drawings quickly and thoroughly compared to using a pencil, ruler, or term, provide a more precise visual experience, facilitate students in solving math problems | Not all students have computers or laptops, so using GeoGebra is less than optimal, and not all schools in Indonesia have computer laboratories. It is recommended that GeoGebra applications be integrated into | It is recommended that GeoGebra applications be integrated into mathematics learning in elementary schools. The use of GeoGebra can increase students' interest and learning achievement and help them visualize abstract geometry material. |
| 18. | Audhiha et al., (2022) | Adobe Animate CC | Practical, efficient, effective, good presentation, high readability, valid graphical, and valid program components. | Many educators still have not mastered the proper use of Adobe Animate CC. | Develop the media further by paying attention to the practicality and validity aspects of the product. |
| 19. | Khairin, U., & Ariani, Y. (2022) | Blender Software | Improve the quality of education, provide creative and innovative space for teachers, and assist in the delivery of learning materials effectively. | Requires stable internet access for optimal use and potential dependence on technology, which can reduce social interaction between teachers and students. | Continue developing Blender Softwere-based learning media by paying attention to practicality, validity, and effectiveness in the development process. |
| 20. | Bata, J., & Anggipranoto, E. V. B. (2023) | Virtual Reality Apps | The media has advantages regarding excellent technical quality, with a percentage reaching 93%. | Lack of understanding of the use of Virtual Reality Applications for learning | Improve the ease of accessing the user interface menu and tutorial instructions in the media |
| 21. | Sari et al., (2023) | Augmented Reality | Designed specifically for elementary school students to increase interest in learning mathematics more interestingly and interactively, increasing students' interest in learning. | Availability of stable internet access and adequate devices to run the application, as well as the possibility of lack of direct supervision and guidance from teachers | It is recommended to consider developing interactive and engaging learning media applications using augmented reality technology. |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 22. | Anawati, S., & Isnaningrum, I. (2020) | Manipulative | Can present mathematical concepts in a more concrete and natural way, help students understand complex concepts, and create creative and relevant ideas for students. | It requires more time and intensive preparation, requires considerable storage space, and can be expensive. | Choosing manipulative media that is appropriate to the level of readiness and maturity of students, the media presents mathematical concepts concretely and relevant to students |
| 23. | Sinabutar, F. (2022) | audiovisual | Audio Visual Media has advantages in increasing motivation and student learning outcomes. | Requires considerable costs for the production and maintenance of equipment and requires specialized skills in its use | It is suggested that teachers use audiovisual media as a learning aid. |
| 24. | Khasanudin et al., (2020) | Audiovisual based Animation | Presents good models and examples for students, presents programs that can be understood by different ages and levels, and can save teacher and student time by recording broadcasts of lessons taught that can be played back if needed without having to do the process again | It only presents one-way communication, does not provide opportunities for message comprehension according to students' individual ability levels, and the teacher needs to have the opportunity to revise the movie before broadcast. | Using audiovisual animation video-based learning media in the classroom learning process is recommended to improve learning effectiveness and facilitate students' understanding well |
| 25. | Irmayanti et al., (2022) | Augmented Reality | Facilitate interaction between teachers and students so that learning will be more effective and efficient, making the learning process more transparent, more interesting, and more efficient in time and energy. | It is difficult, requires a high understanding of making the media, and must be supported by adequate facilities. | Continue to develop 3D space-building learning media applications by paying attention to application appearance, marker images, and application distribution. |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 26. | Khotimah, K., & Satiti, W. S. (2019) | Augmented Reality | High validity, practicality, and effectiveness, students reach the learning completeness criteria score. | It is difficult, requires a high understanding of making the media, and must be supported by adequate facilities. | Teachers can be more innovative in making various learning media by mathematics learning. |
| 27. | Fiah, R. M., & Amaliah, N. R. (2021) | Geometry's Game | The advantage of Android-based Geometry Game learning media is the attractiveness of learning multimedia packaging. | The disadvantage of Android-based geometry Game learning media is that the game has no sound, so it requires additional sound. | It is recommended that the Geometry Game application be enhanced with sound and that pictures of real concrete objects be used in the match-up game to strengthen learners' understanding. |
| 28. | Cahyani et al., (2023) | 3-Dimensional Animation | Interactivity, ease of use, clear presentation with image illustrations and 3-dimensional presentation that increases the curiosity of students, as well as a systematic and structured presentation of the material | Not everyone learns best interactively or visually | It is very feasible to use these media in classroom learning without revision. Therefore, it is recommended that they be implemented in learning building spaces, especially cubes and blocks, in elementary schools. |
| 29. | Rachmawati et al., (2023) | MAR (Math Augmented Reality) | Validity, practicality, and effectiveness, and MAR Exploration teaching materials are suitable for use in mathematics subjects. | It takes more time to develop the media so that it can be used properly, and there is still a lack of understanding of how the media is made. | MAR Exploration teaching materials are suitable for use in mathematics subjects |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 30. | Mahardita, I. G. L., & Japa, I. G. N. (2022) | Learning Video | Facilitate students in learning math with a fun learning experience; facilitate students in understanding learning concepts quickly. Increase enthusiasm for learning math. | Teachers' lack of expertise in using technology in learning can make learning activities conventional and less attractive. | We continue developing and using video learning media for volume in mathematics learning. This media has been proven to increase the enthusiasm for learning and facilitate understanding of mathematical material. |
| 31. | Khoir, A. K. (2021) | STEAM-based Antique Bear | Learning effectiveness in students can improve student learning outcomes and has been proven to impact student activity significantly. | It is still challenging to instill the concept of memetics using the media because learning mathematics to be well received by students is still done using the TCL method. | To continue to develop and use media, it has been proven effective in improving student learning outcomes and critical thinking, collaboration, and communication skills. |
| 32. | Mursyidah, D., & Saputra, E. R. (2022) | Augmented Reality Based Application | More interactive, Fun to use Can be widely implemented in various media, | Simple object modeling as it only displays a few objects, sensitive to perspective changes, not many creators, and installed devices require much memory | The recommendation that can be given is to utilize Augmented Reality (AR) based learning media such as the application "Bangun Ruang AR" in learning mathematics. |

| No | Author | Media Type | Advantages | Disadvantages | Recommendation |
|---|---|---|---|---|---|
| 33. | Adhiyah (2023) | Concrete Object Media | Messages so as not to be too verbal, overcome the limitations of space and time, create a spirit of learning, direct interaction between students and teachers, allow students to be independent according to their talents and abilities, and make learning more meaningful. | The disadvantage of Concrete Object Media is that it takes a long time to determine what objects suit the material to be taught. | Concrete media can help students get meaningful learning, explore their own knowledge, make learning more interactive, and allow students to be independent according to their talents and abilities. |

## Discussion

### *Media by Type*

Based on the data in the research table, the media used in learning the material of building space can be grouped into 2 types: physical or concrete media and digital media. Ten journals are used in concrete media, and 23 journals are used in digital media.

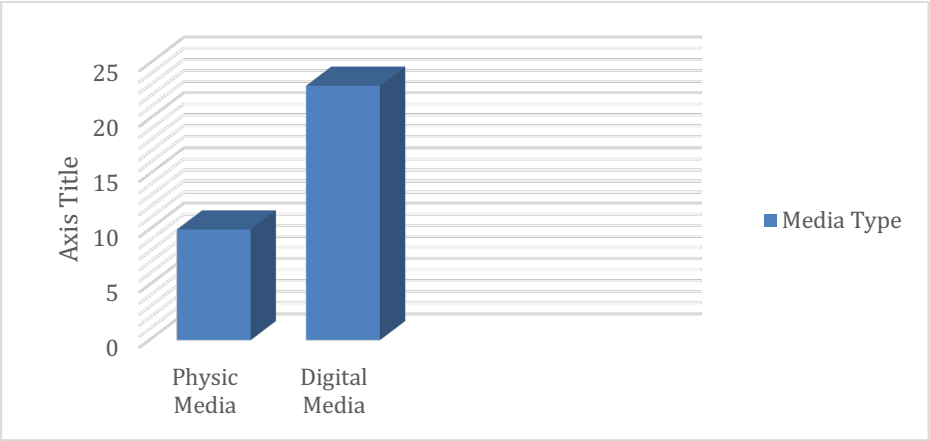


**Figure 2.** Graph of Media Types

Based on the data above it shows that the use of digital media is more widely used because it has advantages: 1) Digital media is by the spirit of preparing students to keep pace with and keep up with the times (Gazali et al., 2021); 2) Digital media is better able to present a more dynamic learning situation, attract students' attention, and encourage their active participation (Prihatni et al., 2023). With interactive simulations, animations, and gamification elements, abstract mathematical concepts can be transformed into engaging visual experiences that stimulate students' enthusiasm and make learning fun and effective; 3) Digital platforms can provide flexibility to tailor instruction to the needs of individual student preferences (Iskandar et al., 2023); 4) Digital resources are easily accessible anytime, anywhere in various situations and conditions (Kartika et al., 2024);

5) Digital media can build collaboration and interaction between teachers and students both in the form of exchanging ideas and direct feedback (Novelita et al., 2023); 6) By presenting digital media in the classroom, it will build a digital culture (Arianto, 2021).

In addition to the advantages, digital media has disadvantages, among others: 1) Excessive digital media can make students dependent on technology and less develop critical thinking and problem solving skills independently (Ramdhani et al., 2023); 2) Digital media generally does not provide the same physical interaction as concrete media such as manipulatives or natural objects (Ripai et al., 2023); 3) The use of digital devices in the classroom can increase the potential for distraction and disruption, distracting students from learning and disrupting focus (Abidin et al., 2023); 4) The gap arises because not all students have equal access to digital devices and stable internet connections (Putri et al., 2024); 5) Digital media can sometimes limit students' creativity in exploring mathematical concepts (Hertina, et al., 2024); 6) Students who are not able to use digital media in the classroom can be distracted; 7) Students who have kinesthetic or auditory learning styles may find it difficult to understand mathematical concepts only through visualization on the screen (Ananda et al., 2023); 8) Implementation of digital media in learning can require significant costs for hardware, software, and teacher training (Muammarulloh et al., 2023); 9) Excessive use of digital screens can cause eye fatigue, headaches, and vision problems in children (Wirawan et al., 2023); 10) Learning with digital media can reduce social interaction between students and teachers, as well as between students and students (Murtado et al., 2023).

In addition to digital media, concrete (physical) media is still widely chosen by teachers in teaching building space to students. The selection of concrete media aligns with the developmental level of elementary school children, namely the concrete operational stage (Murni et al., 2023).

The advantages of concrete media are: 1) Concrete media can help students understand abstract mathematical concepts more quickly and interestingly and encourage active participation, exploration, and discovery (Unaenah et al., 2023). This aligns with the opinion of Piaget, a developmental psychologist, that at elementary school age (6-11 years) is in the concrete operational stage of thinking. At this stage, they begin to understand abstract concepts by connecting them to their concrete experiences (Nasution et al., 2023); 2) Activities with concrete media, such as folding, cutting, and building blocks, can help improve students' fine motor skills (Susiana: 2023); 3) Students are more interested in learning and participating in learning activities that involve direct manipulation and exploration (Saksono et al., 2023); 4) Concrete media allows students to learn through various senses, such as vision, touch, and kinesthetic (Hastutiningtas et al., 2023); 5) Students can see how building space is used in everyday life, which makes learning more relevant and meaningful (Ardiyanti et al., 2024); 6) Activities with concrete media, such as building structures, can encourage students to work together and collaborate with their classmates (Purwanti, 2022); 7) Concrete media can encourage students to be creative and find their solutions in solving problems (Hasanah et al., 2022); 8) Concrete media can help students develop spatial thinking skills, such as visualizing objects in three dimensions, rotating and flipping objects, and understanding object relationships (Widasari et al., 2023); 9) Concrete media can make learning building space

more fun and exciting for students (Alwasi et al., 2023); 10) Concrete media can help students with learning difficulties by benefiting from direct manipulation and exploration with concrete media (Novitasari et al., 2022).

In addition to advantages, concrete media has disadvantages: 1) Concrete media cannot always represent all spatial shapes on an actual scale; 2) Concrete media may not be able to represent complex spatial shapes with sufficient detail; 3) The use of large amounts of concrete media can require considerable storage space (Damayanti et al., 2023); 4) Concrete media made from perishable materials, such as paper or cardboard, can be easily torn or broken (Syahruddin et al., 2022); 5) Effective use of concrete media may require good manipulation skills from students; 6) Effective use of concrete media often depends on clear guidance and direction from the teacher (Magdalena: 2024); 7) Concrete media may limit students' creativity in exploring the concept of building space; 8) Interesting and colorful concrete media can distract students (Ikmal: 2023); 9) Concrete media must be cleaned and maintained correctly to keep it in good condition.

**Media Based on Sensory Experience**

The results of this study are classified into three categories based on the sensory experience of the media: visual, auditory, and tactile.

**Table 2.** Types of Media Based on Sensory Experience

| | Visual | Auditory | Tactile |
|---|---|---|---|
| Number of Media | 27 | 3 | 13 |

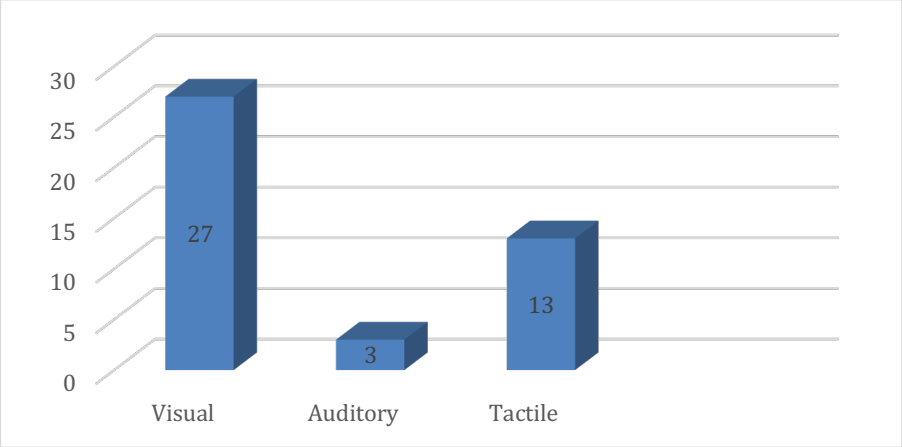


**Figure 3.** Graph Types of Media Based on Sensory Experience

The media used based on sensory experience shows that 27 media provide sensory experience, three provide auditory sensory experience, and 13 provide tactile experience to students. This shows that every use of media must be attentive and in accordance with students' learning styles (Dewantara et al., 2021).

Individual learning style is the way students process and process information. Student learning styles include visual, auditory, and kinesthetic (Putri et al., 2021). Students' visual learning style makes it easier to absorb information through pictures, diagrams, or videos (Karin et al., 2024), and students' auditory learning style makes it

easier to absorb information through sounds and words (Himami et al., 2023), and students' kinesthetic learning style is more accessible to receive information by touching directly (Hayati et al., 2023). Understanding students' learning styles will make it easier for teachers to determine the appropriate media type and create an effective learning process.

Based on the advantages and disadvantages of the results of this literature study, the author can recommend that: 1) It is necessary to combine the use of digital media and concrete media to get more effective results; 2) Each media has its advantages and disadvantages so that it needs to be considered in its selection and use; 3) The use of media is adjusted to the characteristics of students, considering students' learning styles (visual, auditory or kinesthetic); 4) There is an evaluation of the use of media periodically. The selection and use of the suitable media will make it easier for teachers to deliver material, and students will more readily accept the subject matter.

Mathematical problem solving

Problem-solving is the process of maturing individuals and interacting with their environment. Problem-solving skills become a quality social process for learners. Problem-solving skills are essential for learners (Berlinda, 2023). According to George Polya (1957), mathematical problem-solving is a process consisting of four steps, namely: 1) understanding the problem, 2) planning the solution, 3) implementing the solution, and 4) looking back at the solution (Putri, 2022).

The first step, understanding the problem, is done by reading and understanding the problem carefully, including identifying the information given and what is asked; the second step, planning the solution, is done by thinking of various strategies and approaches to solve the problem; the third step is done by implementing the chosen strategy carefully and carefully; and the fourth step, looking back at the solution is done by checking the solution obtained, ensuring that it is correct and complete, and considering alternative solutions.

Utilizing learning media and paying attention to the steps of mathematical problem-solving makes teaching media effective for improving students' mathematical problem-solving. The use of media with the right building material will improve students' mathematical problem-solving skills and increase creativity and interest in learning. Due to different learning styles and also materials that are quite difficult, it is necessary to choose the suitable media to help convey the material of building space (Putri, 2024). One of the media that teachers often use to convey the material of building space is the net of building space, either in the form of concrete objects, audiovisual, virtual realism (VR), or augmented reality (AR).

## CONCLUSION

**Fundamental Findings:** This study found that teachers use various media to teach building materials, namely physical or concrete and digital media. Digital media is more widely used than physical media because it offers several advantages, such as being more engaging, dynamic, and flexible. However, digital media has some disadvantages, such as the potential to distract students, disrupt their concentration on the material, and limit their creativity. Physical media can help students understand abstract concepts more quickly and encourage active participation. However, physical media can also be bulky, expensive, and difficult to store. The study also found that teachers should consider students' learning styles when choosing media. Students with visual learning styles prefer media that use pictures, diagrams, and videos. Students with auditory learning styles prefer media that use sounds and words. Students with kinesthetic learning styles prefer media that allow them to manipulate and explore objects directly. **Implications:** The implications of this study require teachers to 1) use a combination of digital and physical media to teach building materials; 2) consider the advantages and disadvantages of each type of media when choosing media for learning; 3) consider students' learning styles; 4) evaluate the effectiveness of their media use periodically. **Limitations:** The limitation of this study is the small sample size; further research is needed to explore how different types of media can be used to teach the material to students with different learning styles effectively. **Future Research:** Future research that needs to be done involves a broader range of subjects to investigate the use of media in teaching spatial building materials in a broader range of schools and grade levels, conduct longitudinal studies to assess the impact of different media use strategies on student learning outcomes, investigate how different media types can effectively teach spatial structures to students with different learning styles, and develop and evaluate new media-based learning materials to teach spatial structures

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***Hadi Purnomo (Corresponding Author)**
Master Study Program, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Lidah Wetan, Lidah Wetan, Kec. Lakarsantri, Surabaya, Jawa Timur 60213
Email: hadi.22038@mhs.unesa.ac.id

**Tatag Yuli Eko Siswono**
Master Study Program, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Lidah Wetan, Lidah Wetan, Kec. Lakarsantri, Surabaya, Jawa Timur 60213
Email: tatagsiswono@unesa.ac.id

**Wiryanto**
Master Study Program, Faculty of Education,
Universitas Negeri Surabaya,
Jl. Lidah Wetan, Lidah Wetan, Kec. Lakarsantri, Surabaya, Jawa Timur 60213
Email: wiryanto@unesa.ac.id