

## Research Article

# 3D Hologram: An Alternative Media for Learning Science in Elementary School in the Post-COVID-19 Period

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The spread of COVID-19 shifted school classes from offline to online. Online learning caused saturation in students. Innovative teaching methods help teachers make students play an active role in learning. A 3D hologram is a visual technique that utilizes reflecting objects or glass so that objects seem to be in the real world. This research aimed to develop a 3D hologram that is effectively used in the post-COVID-19 period by obtaining feasibility and response scores from users. This medium was designed using the Borg and Gall development model's Research and Development (RnD) method. The population of this study was sixth graders of SDN Pasirhuni for a limited trial. The data collection techniques used were observation, interviews, media and material validation questionnaires, and responses from teachers and students. The length of the manufacturing process and the expensive manufacturing costs were refuted in this study by producing 3D hologram media that is easy to make, utilizing used goods, and fairly cheap. So that teachers, students, and the community can try to create and use their hologram 3D media at home or school. The results showed that 3D hologram media can be an effective learning medium used in the post-COVID-19 learning process.

**Keywords:** 3D Hologram, Learning Science, Post-COVID-19

## 1. INTRODUCTION

The intensity of the use of technology in human life is even higher when the outbreak named Covid-19 comes. Coronavirus Disease 2019 first spread in Wuhan City, Hubei Province, China at the end of October 2019. Millions of people died from the virus in just under two months. The Minister of Education and Culture endorsed the distance learning policy during the Covid-19 emergency as stated in SE Mendikbud Number 4 of 2020 that learning is transferred to online learning [1]. Aisyah and Kurniawan predicted that online learning is learning that utilizes an internet connection to access and distribute learning materials [2]. An educator must make a learning strategy so that learning continues to take place properly. Parents of students must facilitate their children with

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adequate communication tools to support the learning process. For students, they must also remain enthusiastic about learning even though they are at home, most learners who are not facilitated by smartphone by their parents as a supporting tool for online learning (in the network) ignore the learning process, but many learners walking long distances just to participate in learning and understand the material that the teacher conveys through communication tools. This situation lasts long enough that education will experience setbacks if it does not take advantage of access to technological facilities to support the learning process.

The development of technology and communication science today increasingly requires humans to continue to develop. One of them is the field of visual communication design which is being hotly discussed and studied because it is always related to human life. The advancement of information technology and visual communication is due to the latest technological discoveries in the digital world both in the form of hardware and software. This change in conditions slowly affects various human lives that are required to always interact with technology ranging from the economy, health, entertainment, food, lifestyle, and even education [3]. Information technology and visual communication cannot be separated in education precisely in the learning process [4]. The use of information technology and visual communication is needed to increase the effectiveness and efficiency of the learning process, thus making learners more active, creative, productive, and innovative. Visual reality, augmented reality, and holograms are examples of technological developments that are being hotly discussed today. Many researchers developed 3D holograms and applied them in filmmaking, information technology, and other communication sectors [5]. Curriculum 2013 (K-13) is one of the curricula that demands the learning process by utilizing information technology and visual communication [6]. Prasetyo, Puspita, & Nuralmasari said that currently teachers are required to master and include technological elements in the learning process to create effectiveness of learning with learning purposes [7].

The use of technology in the learning process causes new habits in society. Rapidly evolving technology is needed to make it easier for humans to keep interacting. Technology is now not only based on two dimensions (2D) but there are also no dimensions (3D) even the latest development is four-dimensional technology (4D) that makes visibility and objects more real. Three-dimensional technology (3D) is an object that can be observed from any direction of view and has physical characteristics of having a length, thickness, and [8]. The three-dimensional (3D) image that appears next we call a hologram. Holograms use the principles of interference and diffraction [9]. Holograms are a product of holography. Holograms are derived from the Greek "holos" meaning

whole and “gram” meaning display. Holography is a technique in which light is reflected from a recorded object and then reconstructed so that the object will have the same appearance as the recording media.

Media is linguistically derived from Latin, which is a medium that means introduction or intermediary. Media understanding according to terms is all things used to convey information derived from the sender to the recipient [10]. Learning media is a medium that contains messages or instructive information so that it can be used in the learning process [11]. Brett & Schmindbauer classifies learning media into three elements: image, motion, and sound. Learning media can be used as a tool to attract the attention of learners. The use of learning media is one way to achieve learning goals, especially in science subjects [12].

In addition to facilitating the delivery of information, the benefits of using learning media in IPA subjects are to provide feedback both directly and indirectly to students. The feedback that learners feel is a direct enrichment experience. The use of learning media is also used to clarify the subjects conveyed, encourage students to be more active, and provide the same stimulants, experiences, and observations to all students [13]. Dewi, Azmi, and Nasution media become very important because it becomes a tool in learning in the classroom. Learning media can be used as a wayokam successful or not learn [14]. The use of learning media is adjusted to the subject matter to be conveyed. Hologram 3D media was selected in the presentation of the subject matter about the solar system on theme 9 exploring space. Solar system material can be explained using image media or video but researchers want to develop the latest learning media by utilizing technology.

In this lesson, one is the lack of understanding of concepts in students. Good conceptual understanding is difficult to achieve if learning is only oriented toward routine and procedural problems [15]. Learning media that is monotonous and not by the era of use can also be a factor in the setback. Learning media that are widely used in SDN Pasirhuni are image media and videos reconstructed using projectors. The intensity of the use of learning media is very little, not all teachers use media in the learning process. The lack of media use in the learning process is caused by inadequate facilities and infrastructure in the school.

Research on “Using 3D Hologram in Distance Education” conducted by Tonguç and Özkara states that the use of hologram 3D media can minimize the saturation of students studying at home. The problems found are problems with student interaction and content that affect student satisfaction in the distance learning process. Based on the analysis of problems and previous research similar to the research conducted.

Researchers are interested in conducting a study entitled “3D Hologram: An Alternative Media on Science Learning in Elementary School in The Post-Covid-19 Period” to describe the design of hologram 3D learning media developed in solar system materials in science learning. Researchers are interested in analyzing the application of hologram 3D media to solar system material with the form of Holbox media in the post-pandemic period.

## 2. RESEARCH METHOD

This research uses a mixed approach, namely the quantitative approach (quantitative approach) and the qualitative approach (qualitative approach). The research method used in this research is the research and development (RnD) research method. Research and development are research used to produce a particular product and test the effectiveness of that product. Development research aims to develop products based on trials to then be revised until they produce a viable product [16]. The data collection techniques used are observation, interviews, media, material validation questionnaires, and student and teacher response questionnaires. The instruments used are observation guidelines, interviews, and questionnaires. Quantitative data is obtained from the results of media validation and observation sheets while qualitative data is obtained from interview results. The product will be observed by test subjects aimed at improving the developed hologram 3D media. Validation is carried out by experts in their fields. Researchers use primary data sources using observation and provide instrument sheets to learners, giving questionnaires to class teachers and expert validators.

The material and media expert validity questionnaire test on the development of hologram 3D learning media can be done by comparing the number of ideal scores given by validators ( $\sum R$ ) with the number of ideal scores that have been set in the validation questionnaire (N).

The formula used is as follows [17]:

Information:

$p$  = Percentage of the sought-after score (the result is rounded until it reaches an integer).

$(\sum R)$  = The number of answers given by the validator.

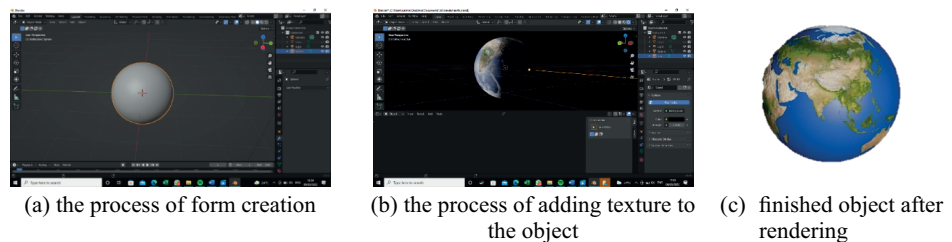
N = The ideal number of scores.

### 3. RESULTS AND DISCUSSION

The stage of creating a hologram 3D animation consists of several stages. The first stage is concept creation, in this stage researchers take steps to create hologram 3D learning media. The second stage is object design, at this stage, it is done using a 3D blender application by creating a storyboard as an illustration of the animation display design flow. A storyboard is used as a reference to make this animated video. The creation of planetary 3D objects requires images, planetary texture icons, and audio. Figure 1 is one of the materials in the form of textures to make planet Earth.



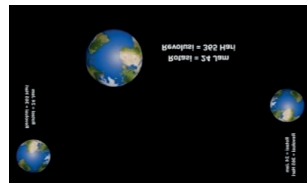
**Figure 1:** Textures for planet earth.



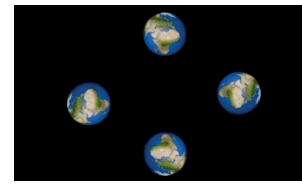
**Figure 2:** 3D object creation process using blender 3D application.

The results of this research product are in the form of a hologram 3D-based learning media consisting of three parts, namely (1) animation of the solar system and its characteristics; (2) a hologram pyramid made of glass the size of a laptop; and (3) pyramid displays made of rigid mica (PVC) 0.30mm thick with smartphone size.

The animation of the solar system and its characteristics were developed using 3D Blender 3.0 software and kinemaster. This medium is used to assist learners in studying the material of the solar system IPA payload theme 9 exploring space class VI sub-theme 1 amazing regularity. Animations are loaded with mp4 mirror format so that when paired with the pyramid display the loaded writing can be read clearly. The animated video



(a) pyramid display laptop version with 3 sides

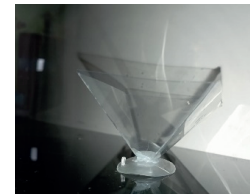


(b) pyramidsmida displays the smartphone version with 4 sides

**Figure 3:** Animation layout used.



(a) pyramids display the laptop version



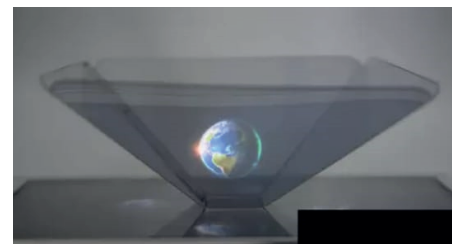
(b) pyramids display smartphone version

**Figure 4:** Types of display pyramids used.

contains explanations ranging from galaxies, the solar system, planets belonging to the solar system, and other celestial bodies such as asteroids, comets, and meteoroids.



(a) the result of the laptop version



(b) the final result of the smartphone version

**Figure 5:** The final result of the 3D object is displayed on the display pyramid.

Media feasibility tests are conducted to measure the quality of the media and materials developed. Media and material feasibility data is obtained through the assessment questionnaire of a media expert and a material expert. Parameters for measuring the quality of media feasibility consist of 5 aspects, namely (1) characters, (2) coloring, (3) animation, video, and sound, (4) display design, and (5) ease of view. While the parameters for measuring the quality of material feasibility consist of 3 aspects, namely, (1) curriculum, (2) material content, and (3) learning. Sources: [18] and [19] have been modified. The results of the assessment of the usefulness and ease of use of the media are obtained from the responses of teachers and learners.

Based on the results of the material validity test by material experts obtained an overall percentage of 97%. Based on the results of the calculation of learning media

worth trying in the classroom but with some revisions. Here is some feedback from material experts.

TABLE 1: Material expert input.

Suggestion	Repair
The image is enlarged to make it easier for students to understand the material presented	Planetary objects that are presented in the animation are enlarged
The exposure of matter must be disclosed slowly, there is a lag between explanations between planets and other members of the solar system.	The exposure of matter is not so fast that it is imagined the planet it is describing.

The results of the media validity test by media experts obtained an overall percentage of 91%. Table 3 shows data on the results of the analysis of each aspect of the media validation questionnaire by media experts. Based on the calculation of product validity of 91% then 3D hologram media is categorized as very feasible to be tested in schools but with some constructive advice from media experts.

TABLE 2: Media expert input.

Suggestion	Repair
Complete the temperature of each planet by writing	Added temperature description to each explanation
The distance of each planet to the sun is raised	Bring up an animation of the distance between the planet and the sun to make it look far away
The word planet is simply omitted	Simply write down the name of the planet directly
At the conclusion stage of each solar system mentioned appears its writings or pictures.	In the conclusion appeared the object of the solar system mentioned
Make LKPD steps following scientific syntactic so that LKPD is structured	LKPD by scientific syntactic which consists of observing, questioning, collecting data, associating, and presenting

The results of the field trial were conducted on learners and teachers to see the response to the use of hologram 3D learning media in the classroom. Field trial data identified that small group trials obtained a percentage of 92% for teacher response, this suggests that hologram 3D media is very well used in class. Responses were also made to learners to see how interested they were in using this hologram 3D media. The small group trial was conducted on 10 learners with the average percentage obtained is 95%. The data shows that this media is very well applied in the classroom.

Based on the average percentage of material experts, namely 97%, media experts get a score of 91%, teacher responses by 92%, and student responses are obtained by 95% so the average score obtained for hologram 3D learning media is 93%. Based



TABLE 3: Combined count table of hologram 3D learning media.

No	Aspects	The average percentage of scores	Qualitative Categories
1	Material expert	97%	Very Worthy
2	Media expert	91%	Very worthy
3	Teacher's response	92%	Excellent
4	Student response	95%	Excellent
	<b>Average</b>	<b>93%</b>	<b>Excellent</b>

on the acquisition of this value, it can be concluded that hologram 3D media is very feasible for use in the learning process.

The development of hologram 3D media is supported by the acquisition of validation values media and materials. Validation is an activity carried out to obtain eligibility from the media that has been consulted [19]. Validation is a validation of the content of materials and products that will then be conducted in small group trials for it requires approval from validators before a small group trial is carried out. Validation of materials and media is carried out to find out the products developed while small group trials to find out the practicality and effectiveness of the media and materials used. Practitioner practicality is trialed to the classroom teacher and the effectiveness of the media is tested on the learners in the classroom. The results of the study, provide advice and responses from experts that can be used to find out the feasibility of 3D hologram media made by researchers.

Analysis of the development of 3D hologram-based learning media was found to be very good, this is blinded by expert validation questionnaires of materials and validation of media experts. This research is reinforced by the research "Using 3D Hologram in Distance Education" conducted by Tonguç and Özkara stated that the use of hologram 3D media can minimize the saturation of students studying at home [20]. Attractive media views create new experiences for the student. The motivation of learners becomes increased due to the use of media by loading images of animated 3D objects that make students enthusiastic about seeing them. Holograms are a product of holography. Holograms are derived from the Greek "holos" meaning whole and "gram" meaning display. Holography is a technique in which light is reflected from an object recorded and then reconstructed so that the object will have the same appearance as the recording media. This image that appears in three dimensions (3D) is what we call a hologram. Holograms use the principles of interference and diffraction [9].



The results of the study were also obtained that this media is effectively applied to learning, this can be seen from the results of excellent response questionnaires from teachers and learners and strengthened by obtaining student values in the student activity sheet (LKPD). Researchers found several findings related to hologram 3D media made, the findings are in the form of lack and advantages of hologram 3D media after being validated and applied in the classroom. The shortcomings of 3D hologram media of the solar system include, (1) the size of the media is less large, (2) the use of media must be supported by speakers so that planetary explanations can be heard more clearly, and (3) the process of making animated videos that take a long time. The lack of media is not a very crucial problem, because hologram 3D media also has many advantages, namely, (1) the process of making display pyramids that are easy to make, (2) materials to make media easy to find, (3) the use of media that is easy to simply place the display pyramid on a smartphone or laptop screen, (4) media is easy to carry anywhere, (5), the use of media attracts the attention of learners because it combines the real world with technology and (6) hologram 3D media is included in environmentally friendly media because the display pyramid can also be made from the head of a clear mineral water bottle. So it can be concluded that hologram 3D media is very effective in the post-pandemic learning process as a motivation and encouragement for students in fighting learning saturation.

#### 4. CONCLUSION

Hologram 3D media is the latest technological breakthrough in the world of education that can be an alternative media in class VI in the solar system material charged by IPA after the pandemic. This media can also be used for other materials simply replaced by the animated video content it presents only. Learners can observe objects from all sides and get the information as a whole. Hologram 3D media also overcomes student saturation in the post-pandemic period as it is now. In 3D media, holograms can be said to be very good with an average percentage of 93%. 97% for the total percentage of material experts, 91% for the total percentage of media experts, 92% for the responses given by teachers, and 95% for the total average response given by students. There are some weaknesses in this medium but they can be corrected. The weaknesses that many suggestions are found in hologram 3D objects that are less large, it is necessary to add writing that supports the explanation, and the animation of each object must be adjusted to the explanation of the voice actor. Based on the results of validation and response carried out by the development of 3D media technology hologram IPA

material can be an alternative learning media in IPA materials in elementary schools post-covid-19.

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