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Application of Three-Dimensional Media of The Shape of The Earth's Surface for The Learning of Visually Impaired

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ABSTRACT

Blind students cannot use their senses properly; they can learn by relying on their senses of touch and hearing. For this reason, it is necessary to have teaching media that depend on the importance of communication or hearing to recognize material on the shape of the Earth's surface. This research aims to increase the learning interest of blind students in the fabric of the Earth's surface in social science subjects. This research method is pre-experimental, with blind students being treated with 3D media and observing their responses. The application of 3D media in the form of the Earth's surface in learning for blind children involved eight students. It was implemented in three junior high schools in East Java, Indonesia. These schools include Special Schools in Bojonegoro, Surabaya, and Sidoarjo. The results of the application of 3D media show that using 3D learning media in the form of the Earth's surface in the teaching and learning process can generate new desires and interests, generate motivation, and stimulate learning activities, even bringing psychological influences on blind students. 3D learning media can also help improve students' understanding, present data excitingly and reliably, facilitate data retention, and obtain information about the shape of the Earth's surface.

***Keywords**:*

Three-Dimensional Media, Earth Surface, Visually Impaired

ABSTRAK

Siswa tunantetra tidak bisa menggunakan indera penginderaan dengan baik, mereka dapat belajar dengan mengandalkan indera peraba dan pendengaran. Untuk itu perlu adanya media pembelajaran yang mengadalkan indera peraba atau pendengaran untuk mengenal materi bentuk muka bumi. Tujuan penelitian ini dalah meningkatkan minat belajar

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siswa tunanetra pada materi bentuk muka bumi mata pelajaran ilmu pengetahuan social. Metode penelitian ini adalah praeksperimen, dengan prosedur siswa tunanetra diberi perlakuan dengan media 3D kemudian diobservasi responnya. Penerapan media 3D bentuk muka bumi dalam pembelajaran bagi anak tunanetra melibatkan delapan siswa dan dilaksanakan pada tiga Sekolah Menengah Pertama di Jawa Timur, Indonesia. Sekolah tersebut antara lain: Sekolah Luar Biasa di kota Bojonegoro, Surabaya, dan Sidoarjo. Hasil penerapan media 3D menunjukkan bahwa pemakaian media pembelajaran 3D bentuk muka bumi dalam proses belajar mengajar dapat membangkitkan keinginan dan minat yang baru, membangkitkan motivasi, dan rangsangan kegiatan belajar, dan bahkan membawa pengaruh-pengaruh psikologis terhadap siswa tunanetra. Media pembelajaran 3D juga dapat membantu siswa meningkatkan pemahaman, menyajikan data dengan menarik dan terpercaya, memudahkan penafsiran data, dan mendapatkan informasi mengenai bentuk muka bumi.

***Kata kunci**:*

Media Tiga Dimensi, Bentuk Muka Bumi, Tuna Netra

1. Introduction

One of the five senses important in forming knowledge in learning is the sense of sight. Even though the way the eye works is limited by space, the look can observe the world around it, not only on its shape (on two-dimensional objects) but also on observations of three-dimensional objects, colors, and dynamics (Soemantri, 2006). The use of the sense of sight will increasingly feel the benefits in the material of the dominant form of the Earth using the sense of presence in learning. However, for blind students, the limited purpose of sight is the main obstacle to fully understanding the material on the shape of the Earth's surface in geography lessons (social science).

Learning geography on the material of the Earth's shape usually requires more observations in forming specific knowledge and concepts. Geography does not only consist of a collection of various knowledge or facts that can be memorized but consists of an active process of using the mind to study phenomena on Earth that cannot be explained (Bundu, 2017). Therefore, it requires specific ways and media to convey materials on the shape of the Earth's surface in the Geography subject.

According to Kirk et al. (2015), three principles must be considered in the learning of blind students: concrete experience, unification between concepts, and learning by doing. Likewise, geography teaching on the material of the Earth's surface cannot be separated from the idea of form that must be observed, observed, and analyzed using the sense of sight to obtain information through these sensing activities.

The visually impaired disorder occurs in a person's vision in the form of complete or partial blindness, causing the sight to malfunction. Therefore, it is necessary to have exceptional learning and media used in the learning process so that what is conveyed by the teacher can be adequately channeled and students can understand the material presented. The problem of learning in education for blind students is a problem of adjustment. Learning is still in the curriculum content, so in delivering material, the teacher only pays attention to which ones you want to convey in their entirety without changing and which ones have to be modified.

Visually impaired children have difficulty completing visual tasks but can learn through other senses, such as touch and hearing. However, these two senses must comprehensively provide information about color, size, and space. In obtaining information, children must make direct contact with the objects they are learning about, so for things that are too far away, such as the sky and stars, objects that are too large such as mountains, and objects that are too fragile such as small animals, or dangerous things such as fire, they are difficult to access. Moreover, obtain information because it is challenging to study with the sense of touch (Prasetya et al., 2021).

In learning, especially material regarding the shape of the Earth's surface, students with visual impairments often find it challenging to understand the forms of the Earth's surface, such as mountains, hills, rivers, lakes, and others. Due to limited vision, blind students never directly see the formation of the Earth's surface; they know information about the planet's forms through other people's explanations. Through this 3D media, blind students will have new experiences by touching directly on how the representation of the Earth's surface is reduced.

With the conditions in people with visual impairments, it is natural that the learning achievement of material on the shape of the Earth's surface in blind children is not optimal because they cannot absorb information visually. Unfortunately, the potential of blind children cannot develop only because teachers and students can use no media to support teaching and learning activities. If it is reviewed the media and teaching aids available for the learning of blind children, the conditions are very concerning because the numbers are limited, and sometimes not all of them can be used by blind children; this is due to, among other things, their manufacture they often do not pay attention to the obstacles that exist in blind children.

Difficulty recognizing objects in blind students is due to the lack of media used in the learning process; the media used must follow the shortcomings experienced by students, namely not being able to see objects (the shape of the Earth), but requires media that can be touched directly by students. Therefore we need media that can support the learning process, which is three-dimensional media.

Based on these problems, in such conditions, it is not surprising that the understanding of blind children on the material of the Earth's surface is not optimal. For this reason, it is necessary to use media or teaching aids to make it easier for students, especially blind students, to take geography lessons; this is intended so that the process of educative communication interactions

between teachers and blind students can take place effectively and efficiently. One of the media that can be used in the lesson's introduction on the Earth's shape is 3D media which represents the diversity of forms of the Earth's surface.

2. Methods

This research is a pre-experimental study with a one-shot case study design (Tuckman, 1999). The research subjects (host students) were treated with 3D media in the form of the Earth's surface on IPS material. After being given treatment, blind students were asked to respond or respond to the learning that had been carried out. The data was collected through a response instrument in the form of a Likert scale. Data analysis was concluded in the form of percentages to be then explained descriptively.

X → O
Where
X: Treatment in the form of 3d media with the shape of the Earth's surface
O: Observation in the form of blind students' responses

The research subjects were selected purposively, namely special schools at the junior high level with blind students in class VII.

The application of 3D media in the form of the Earth's surface in learning for blind children involved eight students and was carried out in three junior high schools in East Java, Indonesia. These schools include Special Schools in the cities of Bojonegoro (2 students), Surabaya (4 students), and Sidoarjo(2 students). The activity will be carried out between April-May 2022 for 35-40 minutes.

In this study, blind students experience visual impairment with the categories of total blind and low vision. Blind students are in the variety of total blindness, namely students who cannot use their images for learning activities.

Therefore, blind students use their sense of touch and hearing to receive information in learning activities (Prasetya et al., 2021; Lewis et al., 2003). According to Sitompul & Sihombing (2016a) While blind students in the low vision category are students who can still use their vision even though it is minimal. Low-vision students can still read letters using their sense of sight at a very close distance.

3. Results and Discussion

3.1 Three-dimensional media of the shape of the Earth

One type of media that can be developed in Geography (social science) lessons in junior high schools, especially on the material of the shape of the Earth's surface, is three-dimensional (3D) media. 3D media is a group of media without projections whose visual presentation is three-

dimensional. This media group can be tangible as natural objects, living and dead, and concrete as imitations representing the original. When the actual thing is to be used as a learning medium, it can be brought directly to the classroom, or students in the class are mobilized now to the real world where the original object is located. If the initial thing is challenging to bring to class or the class cannot be exposed directly to where the object is found, the imitation object can also be an effective learning medium. Another understanding of three-dimensional visual media, which can be enjoyed with the sense of sight, has length, width, and height so that the media has volume (in the form of content). At the same time, the media does not need to use a projector but can be seen directly.

3D media is a miniature of the Earth's shape; the 3D media developed is expected to increase the interest of students' attention and avoid students' misconceptions (Wibawa, 2018). 3D media can also overcome the limitations of space, time, and observation, considering that not all objects, objects, and events can be brought into the classroom. The use of 3D media is expected to facilitate students in studying social studies, especially on the material of the shape of the Earth's surface. Media that provides three-dimensional illustrations are designed with an appearance close to reality, through reduced sizes, to make it more practical to use so that students can easily understand the characters and shapes of the Earth's surface and present material from the abstract to a more concrete direction. This 3D media is designed to facilitate more substantial and meaningful learning activities.

3D media is a visual medium for presenting spatial objects on the Earth's surface. According to (Levitt & List, 2017), visual-based media are essential for processing information about objects' spatial location and characteristics such as shape, background, texture, weight, and size. According to Natarajan (2017), development planning gives rise to theoretical knowledge in visual media about the interaction between the location and the space formed. According to Sitompul & Sihombing (2016), 3D model media can be applied as a demonstration method to enable students to understand the conditions in space. Applying an active learning model using media has advantages over conventional learning models without media. The selection of media models that provide three-dimensional illustrations makes them look real, with the appearance of the size being reduced so that it is easy to understand the shape and characteristics of objects on the Earth and change the abstract subject matter to be more accurate. Prasetya et al. (2018) state that 3D media are artificial forms (landscapes, buildings, buildings, ships, and others) from wood, clay, and others. 3D media is generally used to explain conditions or represent the actual state to the state that will be created or created.

Students with visual impairments can find material in the natural form in 3D mockup representations, increasing students' interest in learning and getting better learning outcomes than before. This 3D mockup media will be an innovation for teaching materials in Junior High Schools to study geography (social science) subjects on the fabric of the Earth's shape. So that blind students can know firsthand the form of representation of the actual situation. Three-dimensional media product specifications:

(1) The media developed is a 3D mockup of the Earth's shape material.
(2) 3D media is made of fiber using a wireframe, so the media is lighter and more durable.
(3) Size, length 120 cm x width 80 cm with a weight of 3 kg. With this size and weight, the media is proportional and not too heavy.
(4) The 3D media also contains river flow patterns combined into a media, so the 3D mockup media is practical in storage or display.
(5) 3D media for the shape of the Earth's surface contains features, including mountains, valleys, hills, rivers, and lakes.
(6) Color. Green for vegetation, blue for rivers and seas, dark brown for sedimentation, and green-brown for deforested areas.

Figure 1. Three-dimensional media is the shape of the Earth's surface
source: research documents (2022)

3.2 Media Usage

Three-dimensional media can facilitate students with visual impairments to feel, touch, and feel the shape of the Earth's surface directly. Media Three-dimensional models are essential visual media in presenting spatial objects on the Earth's surface. According to (Prasetya, 2018), Visual press is critical for processing information about the spatial location of things and object characteristics such as shape, size, weight, and texture.

This three-dimensional learning media can help increase students' understanding of recognizing the phenomena of the Earth because it makes learning material from abstract to concrete. This three-dimensional learning media is beneficial for students with special needs, especially for students with visual impairments, because blind students are not just imagining the shape of the Earth's surface. Still, through three-dimensional media, blind students can touch, feel, and feel directly. Directly how mountains, hills, rivers, lakes, and others form. The need to understand the material on the shape of the Earth's surface requires appropriate media and tools. Explains the three guiding principles in the education process for blind children, including:

(1) Concrete experiences, authentic experiences for blind children through vision, are limited or non-existent. Students need the opportunity to sense the outside world with the senses of others by moving objects around them so that they know the shape, size, and texture of things.
(2) Unity of experience, for example, when looking around the classroom. People with vision have complete knowledge of the school, as there are tables, chairs, blackboards, and others. So that blind children have a comprehensive experience, they are invited to explore their surroundings.
(3) Learning by acting and learning for blind children emphasizes the active involvement of students in practice. Blind children have limited vision; therefore, teachers and the people around them must develop learning or understanding with their other senses. Especially for understanding colors, mountains, the sun, and other things. Their other purposes must be trained to carry out their daily activities independently.

3.3 Developing Learning Strategies for children with visual impairments

The learning process for students with visual impairments goes well when using learning media that supports the opportunity for the teacher to provide subject matter to students through three-dimensional media. The following are the steps for using three-dimensional media for the shape of the Earth's surface for students with visual impairments:

(1) Needs Analysis. In great schools, conducting needs analysis, especially concerning the material to be taught to children with special needs or visual impairments, the teacher prepares material that has been recorded using a recording application and uses audio and teaching materials that rely on the sense of touch to help students understand the material to be taught. Given. Apart from distinguishing the fabric that will be delivered to blind students, the teacher builds communication and collaboration with student's parents to help students in their learning process at home so that learning can be understood by students meaningful.
(2) Prepare media and materials. From the explanation above, it is essential to use media for learning for blind students. Still, the reality on the ground rarely uses media in the learning process for blind children. Because apart from the limitations of the tools, there is also limited time to teach students. In addition, blind students experience orientation when doing mobility in the learning process, coupled with the teacher's limitations in brailed literacy. Thus, the solution is to maximize media use to support the learning process. Supporting media for blind students, especially those who apply the senses of touch and hearing. 3D press of the Earth's shape is one of the media that uses the sense of touch to help blind students in mastering geography material.
(3) Implement proper treatment. One form of learning service for children with special needs is providing treatment so that learning difficulties and barriers experienced by students with special needs can be overcome. Through appropriate learning services, students with special needs can optimally develop their potential. Various kinds of treatment can be done to overcome learning difficulties in blind children, including using media as a learning aid. The role of the media is significant in learning, considering that the media can help convey

information from learning to teaching subjects effectively. One form of learning service for children with special needs is providing treatment so that learning difficulties and barriers experienced by students with special needs can be overcome. Through appropriate learning services, students with special needs can optimally develop their potential. Various kinds of treatment can be done to overcome learning difficulties in blind children, including using media as a learning aid. The role of the media is significant in learning, considering that the media can help convey information from learning to teaching subjects effectively.

3.4 Benefits of 3D Media for Teachers

In teaching blind students, teachers need several strategies to deal with blind students in the classroom (Sarahmboshi, 2018). The inability of blind students to accommodate some visual teaching media requires social studies teachers to know how to use appropriate strategies in teaching the shape of the Earth's surface to blind students. So, teachers must be creative and have good preparation in training the body of the planet to blind students. 3D media is one of the media that can be used to teach the shape of the Earth's surface more optimally.

Before, the three-dimensional media of the Earth's shape was applied to the learning of blind students. After about a year, the three-dimensional media of the body of the Earth's surface first received feedback from junior high school teachers in East Java as many as 20 people. Information collection activities are carried out through Forum Group Discussion (FGD).

Based on the results of the limited response to the Association of Social Science subject teachers in East Java who have participated in FGD activities, Social Studies teachers were asked to fill out a perception questionnaire to find out their opinion on the attractiveness of the media. This media assessment of social studies teachers aims to determine teacher interest in the media to be used in social studies learning. The results of the social studies teacher assessment in the perception questionnaire on the attractiveness of the media get a percentage value of 86%, so it is included in the perfect criteria. The developed 3D face-shaped media can attract teachers' attention and is suitable for use in the learning process of social studies material in junior high school.

Based on the response of social studies teachers regarding the use of 3D media to convey messages in social studies learning activities, in general, they respond very well when 3D media is used for social studies learning. Further explained by Sun & Cheng (2007), bahwa perlakuan dalam pembelajaran akan mempengaruhi pengalaman belajar. That the treatment in learning will affect the learning experience, the more abstract treatment in learning, for example, with lectures that use symbols or learning by reading, affects the learning experience gained could be better. With the use of media in the learning process that leads to direct activities, the learning experience will be obtained maximally.

Social studies teachers responded that three-dimensional learning media would be able to increase student interest and learning outcomes because it is made to make abstract material concrete. Concrete material through three-dimensional media is also beneficial in the learning

process for students in general, especially for blind students. According to Spreitzer et al. (1997), blind students must learn by other sensory means; feeling, touch, smell, and listening.

3.5 Benefits for students with visual impairment

Visually impaired students are similar to other standard students; they can understand the material discussed and even mention the data in the material. In addition, blind students can also express how the shape of the Earth's surface is given through the sense of touch using three-dimensional media.

Soemantri (2006) explained that "blind children are individuals whose sense of sight (both) does not function as a channel for receiving information in daily activities as well as sighted people." learning. Furthermore, what is no less critical for a social studies education teacher is to have a positive attitude and provide motivation that visual impairment is not a problem that cannot be solved.

In everyday life, blind students cannot directly witness the shape of the Earth's surface in the universe. Due to limited vision, they can only imagine the actual composition of the Earth's surface, making it very difficult to learn. Such conditions indicate that learning media in three dimensions in teaching and learning activities is essential. The developed three-dimensional media in miniature forms of the Earth's surface is expected to attract students' attention and avoid misconceptions. Three-dimensional media can also overcome the limitations of space, time, and observation because not all objects, objects, and events can be brought into the classroom. The use of three-dimensional media is expected to make it easier for students to study Social Sciences, especially on the material diversity of the Earth's surface.

The following requirement is good learning for blind students. Teachers must consider several things in organizing good elementary science learning for blind students. Things that must be considered include the principles of learning, the learning environment, and the stages of learning for blind students. According to Rutherford (2020), learning geography must develop students' knowledge and understanding of the main processes through concrete experiences.

These learning principles can be implemented in a good learning environment for blind students (Setiawan et al., 2020). According to Sunanto (2015), These learning principles can be carried out with the support of a good learning environment for blind students. The visual environment related to lighting is adjusted to the student's condition, some students need bright lighting, and some do not. The sound environment when learning takes place must also be conducive because optimizing the sense of hearing is also dominantly done to convey information to students other than the sense of touch as a substitute for the dysfunction of the student's sense of sight.

The tactile environment is related to the comfort and flexibility of students to move independently. Classroom arrangements should be made based on students' knowledge and an

agreement between the teacher and students (Zebehazy & Wilton, 2021). Classrooms are arranged according to students' comfort related to the safety factor of students moving. The last thing that needs to be considered in learning for blind students is the stages of learning. The learning stage starts from the preparation stage related to analyzing student needs. Analysis of student needs is the essential thing that must be done in preparing learning activities. Jacobsen et al.(2009) stated that it is at this preparatory stage that teachers try to find out the character and needs of their students. After the teacher understands the needs and characteristics of students, then determines the curriculum related to learning materials, methods, and others, which is poured into a Learning Implementation Plan (LIP), which will be implemented at the implementation stage. The implementation stage involves apperception, core activity, and closing.

Implementation activities are based on the plans designed in the previous preparation stage. The learning activities carried out are adjusted to the conditions and needs of students. The learning of visually impaired students relies more on the senses other than the sense of sight. The senses that are more often used are the sense of hearing and the sense of touch. The sense of hearing can be maximized by discussing and communicating well between teachers and students, utilizing student experiences that are ultimately linked to learning materials. Meanwhile, the sense of touch can be maximized by using concrete objects as media in learning.

3.6 Outcome

At the beginning of learning, the teacher gives students learning materials, telling stories about the diversity of forms of the Earth without using media. After that, students are allowed to feel and observe the appearance of the reliefs displayed in the 3D learning media of the Earth's shape. Blind students using 3D learning media have direct experience when feeling the relief of the Earth's shape; then, students can reason and get a clear picture of when they feel.

Based on the learning experience through 3D media of the shape of the Earth's surface, students are asked to explain again how the diversity of the Earth's shape is understood. As a result, eight blind students (100%) were able to explain how the diversity of the Earth's forms, such as; mountains, mountains, hills, highlands, valleys, rivers, and lakes. It can be concluded that using 3D media for the shape of the Earth's surface can provide understanding for blind students in mastering the material of the shape of the Earth.

3D media in the form of the Earth's surface that uses the sense of touch for blind students is beneficial in mastering learning materials. As stated by Pradopo (2017), blind children understand learning material by feeling using their fingers as a substitute for sight because the senses of the eye cannot see, so as a substitute, hearing and touch are used instead.

After blind students learn to use 3D media in the form of the Earth's surface, they are also asked to fill out responses using media. In filling out the responses, a questionnaire was used. The researcher reads one by one to the students regarding the variable aspects of the assessment in the student's responses. The researcher fills in the scores according to what the students convey, and the

results of the student's responses to the use of learning media are obtained. The student response questionnaire shows a total percentage of 94.28%. As seen in the Likert scale table (Riduwan, 2015), the assessment results of student responses to using 3D learning media are referred to as perfect criteria.

Based on the response in Table 1 for using 3D media in the form of the Earth's surface, it can be concluded that students are very interested in using media in the form of the Earth. They have never used 3D media to recognize the shape of the Earth's surface. So far, blind students can only imagine what the Earth's shape will look like based on the teacher's explanation. Through 3D media, blind students are allowed to handle objects directly. They can feel how the natural face of the Earth is more concretely and can become motor-kinesthetic feedback in learning.

Table 1. Student Responses to the use of 3D learning media

No	Question	value	percentage
1	I am more interested in learning social studies with 3D learning media.	100	100%
2	3D learning media makes it easier for me to understand the material presented.	100	100%
3	Social studies learning becomes fun.	100	100%
4	Social studies learning becomes more apparent and more attractive.	100	100%
5	3D learning media motivates independent study.	85,7	85,7%
6	Completeness of 3D learning media materials	100	100%
7	The appearance of the relief of the shape of the Earth's surface is easy to understand.	100	100%
8	3D media has shown conformity with the diversity of forms of the Earth's surface directly.	71,4	71,4%
9	Components in the media are interrelated.	100	100%
10	Ease of using 3D learning media	85,1	85,1%
	Total Percentage %		94,28%

Making students interested in phenomena in space and time is essential in learning geography (Alberts & Niendorf, 2017; Sitepu et al., 2020). Teachers need to make geography lessons interesting for students, especially blind people. Learning using three-dimensional media with an original imitation causes students' interest in learning to be higher than learning only verbally. Following Sadiman's (2014) opinion, what is meant by three-dimensional visual media is media that can be enjoyed with the sense of sight and has length, width, and height so that the media has volume (in the form of content). While the use of the media does not need to use a projector, we can immediately see the relationship between the research carried out with the theory above; we can see from the background of the problem in the teaching and learning process at the research location most teachers use verbal illustrations will cause learning to look monotonous, many students are not interested in learning, students become bored in learning. So in the learning process using three-dimensional media, students absorb learning material more quickly by directly touching the media used by teachers in teaching and learning so that students will be more interested in object recognition material, and the interaction between teachers and students increases.

4. Conclusion

3D media can be used for students with visual impairments who struggle to distinguish the various forms of the Earth's surface. Based on the results of this study, it can be concluded that students with visual impairments have difficulty completing visual tasks. However, they can learn through their visual senses by using various special teaching media. The learning process on the material of the Earth's shape can be carried out correctly and efficiently if the implementation is carried out using learning media with 3D media to help blind students understand the lessons.

The teacher assists in facilitating students to maximize the use of media as support in learning the material of the Earth's shape. Amid limitations and the ability to see clearly, students need 3D media to support the teaching and learning process; this will help students understand what the teacher teaches. The success of using 3D media can be seen in the ability of blind students to re-explain the diversity of forms of the Earth after they receive material from the teacher, accompanied by using 3D media through their sense of touch.

In addition to increasing understanding of the material on the Earth's surface, 3D media for blind students received a perfect response because it became a new experience for using 3D media by optimizing the sense of touch. Blind students will recognize the shape, position, size, and surface differences through the sense of touch. Using 3D learning media in the form of the Earth's surface in the teaching and learning process can generate new desires and interests, generate motivation, stimulate learning activities, and even psychologically affect blind students. 3D learning media can also help students improve understanding, present data attractively and reliably, facilitate data interpretation, and obtain information about the shape of the Earth's surface.

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