Development of FIVAROM-NET: Inclusive Learning Media for Fire Evacuation of Blind Students at SLBN Semarang

Jamal Isnan[1], Erni Suharini[2], Rahma Hayati[3]
[123]Universitas Negeri Semarang, Indonesia
Correspondent: jamalisnan167@students.unnes.ac.id[1]

ABSTRACT: There were 938 cases of fire disasters in Central Java in 2021 and Semarang City was in first place with 162 cases. SLBN Semarang, which is located in the city of Semarang, certainly needs effective learning media to increase disaster knowledge. This research aims to develop Fivarom-net, a braille-based fire disaster evacuation map learning media. The fulfillment of facilities and accessibility is the main urgency to increase knowledge and get to know the space in the school environment. This research uses a research and development approach with ADDIE's development design consisting of analysis, design, development, implementation, and evaluation. Data analysis consists of qualitative and quantitative data analysis. The results of observation of learning media at SLBN Semarang are still minimal and inadequate for teaching and learning activities for visually impaired students in mobility-oriented learning. Fivarom-net learning media was developed to produce a better understanding of space through the concept of maps that adjust the learning characteristics of visually impaired students. The analysis of media effectiveness was calculated by calculating the average assessment of three aspects from media experts obtained a figure of 90.67% and from material experts of 84%. Thus, Fivarom-net media is declared effective for the learning of visually impaired students in understanding the surrounding space, especially evacuation routes. This research can increase literacy and knowledge in the field of learning media that are in accordance with the learning characteristics of visually impaired students. In addition, this research contributes to the world of education for children with special needs.

Keywords: Blind Students, Fire Disaster Evacuation, FIVAROM-NET Learning Media.

INTRODUCTION

Indonesia is one of the countries with the highest level of disaster vulnerability in the world, including 6 disasters that most threaten regions in Indonesia (Wijayanti, 2020). (Fahrudin, 2019), defines disasters as disturbances to human lifestyles, the impact of disasters on humans, impacts on social structures, damage to aspects of government systems, buildings, and others as well as

community needs caused by disasters. Meanwhile, according to (Glago, 2019), there is no such thing as a disaster, an earthquake, hurricane, tsunami, volcanic eruption, landslide, storm, fire, drought, and flood are not considered disasters in themselves. Instead they become catastrophic when they affect human life, livelihoods and property. In Indonesia alone, there were 17,768 fire incidents, especially building or house fires in 2021. According to Djajadiningrat quoted (Herera, 2018), stating that fire is an uncontrollable fire meaning beyond human ability and desire. Most of these cases were caused by short circuits, which was 5,274 cases or about 54 percent (BPS Kota Semarang, 2022). Based on data obtained from (BPS Kota Semarang, 2022), Semarang City is one of the major cities in the territory of Indonesia with a population of 1,656,564 people and an area of 373.59 km2 (7th after DKI Jakarta, Surabaya City, Medan City, Bandung City, Makassar City, and Palembang City). However, the increase in activities in the Semarang City area basically does not always go hand in hand with the awareness of the public about the importance of security and safety from the threat of fire hazards (Motitswe & Mokhele, 2013; Pamphilon & Mikhailovich, 2017).

According to Law No. 8 of 2016, persons with disabilities are any person who experiences physical, intellectual, mental, and/or sensory impairment for a long period of time in interacting with the environment can face obstacles and difficulties to fully and effectively participate with other citizens based on equal rights (Abdurrahman, 2018). disasters, which states that if a disability has been arranged to obtain special rights in disaster mitigation measures (article 55 paragraph 1), the priority right is specifically for people with visual disabilities (Suhardjo, 2011). Data shows that 31% of people with disabilities say they need someone's help when an evacuation occurs in an emergency. According to (UNISDR, 2009)', people with disabilities are four times more likely to die than the general population when a disaster occurs. Because people with disabilities are vulnerable to disasters, it is necessary to have a disaster risk policy for people with disabilities, namely with an inclusive DRR policy. (Sloman & Margaretha, 2018), suggesting that people with disabilities are at disproportionate risk in disasters. Knowledge about disasters and preparedness in anticipating disasters can be introduced through formal education, which in this case is schools (Kamil, Utaya, Sumarmi, & Utomo, 2020). A study by Becker in (Tuswadi & Hayashi, 2014), illustrates the effectiveness of disaster prevention education in schools by stating, children will come home with information about disaster preparedness, and families or parents and children will make plans or prepare resources together for their homes (Bharwani et al., 2021; Cummings, 2023).

The inclusive education program is also supported by several declarations, one of which is the declaration (PUS) or Education for All which takes place in Thailand, the declaration declares that if every individual child has the same rights or obligations and opportunities to receive education according to their individual needs, the program is also supported by Indonesia, which is contained in the Bandung declaration, regarding Indonesia's readiness towards inclusive education (Akbar, 2015). There are many policies and attitudes that the government has tried to anticipate and reduce disaster risk in Indonesia, one of which is using an educational perspective, because education plays an important role in the level of community capacity for disasters (Setyowati, Benardi, & Putro, 2017). Education has always been a priority in UN resolutions for Disaster Risk Reduction (RPB), as stated in the Yokohama strategy, which in its implementation is carried out using a

proactive approach or means in informing, motivating and involving participants in all aspects of disaster risk reduction activities (Ronan et al., 2016).

As a school that accommodates students with special needs in Central Java, SLBN Semarang needs to conduct participatory monitoring and evaluation regarding school preparedness, school safety in its implementation and school policies. Therefore, SLBN Semarang is obliged to make schools disaster preparedness by fulfilling policies, preparedness planning and resource mobilization. This is in accordance with research (Febriyantoko, 2019), regarding policies that are in accordance with the standards of disaster preparedness schools, namely the existence of school agreements and/or regulations, information on knowledge and training on disasters, preparedness planning in schools must be in accordance with standards.

Therefore, considering the threat of disasters and data on fire events in Semarang City, this study contributes to reducing disaster risk, namely by increasing knowledge and recognizing the surrounding space for students at SLBN Semarang, especially visually impaired students. Problem The difference in the experience of participants when in the field or during a disaster can be minimized by applying learning media for visually impaired students (Yohanes, Zulfa, Kahfi, & Irwan, 2019). Behind the shortcomings that blind students have, they have advantages in the form of the ability to feel and hear, so that the learning media that is suitable for visually impaired students is braile-based media.

According to (Tafonao, 2018), learning media is a tool in the teaching and learning process to stimulate the mind, feelings, attention and abilities or skills of learners so that they can encourage the learning process. Learning media for visually impaired students in the form of tactical maps is a vital tool in their education. Tactical maps are three-dimensional representations of space and objects in the surrounding environment, designed to be felt by visually impaired students. This map helps students sense the shape, size, and structure of objects, as well as understand the spatial relationships between them. According to (Rahardjo & Hardoyo, 2018), said that Tactile sensation is a sensation that is felt when the skin comes into contact or experiences direct contact with objects (such as: vibration, pulse, pressure, temperature, size, shape, texture, direction, and altitude), it is used by people with visual impairments to recognize space. By using color contrasts, different textures, and appropriate scales, tactical maps provide a well-rounded and inclusive learning experience for visually impaired students.

Based on these problems, it is considered necessary to pay attention and provide solutions to the problem of the ability to read space through more functional media and facilitate the understanding of visually impaired students at SLBN Semarang. This research was carried out to improve the ability to read the space and evacuation routes of visually impaired students at SLBN Semarang City through FIVAROM-NET (Fire Evacuation Route Map for the Blind). FIVAROM-NET is a braille-based embossed map (three-dimensional) learning media made with materials and topics tailored to the needs of visually impaired students to understand evacuation routes when disasters occur, especially fire disasters. FIVAROM-NET is a development of tactical map learning media that is specifically focused on fire disasters. Therefore, improving students' ability to read space through FIVAROM-NET is considered very appropriate, especially for visually impaired students

(Baharsyah, Kiswanto, Budiyono, & Benardi, 2017). Thus, the question of this research is how to apply FIVAROM-NET to SLBN Blind Students in Semarang City, what are the obstacles and how to solve them. This will allow them to evacuate themselves more quickly and effectively independently in the event of a fire disaster. The conceptual framework of the research in this study is as follows:
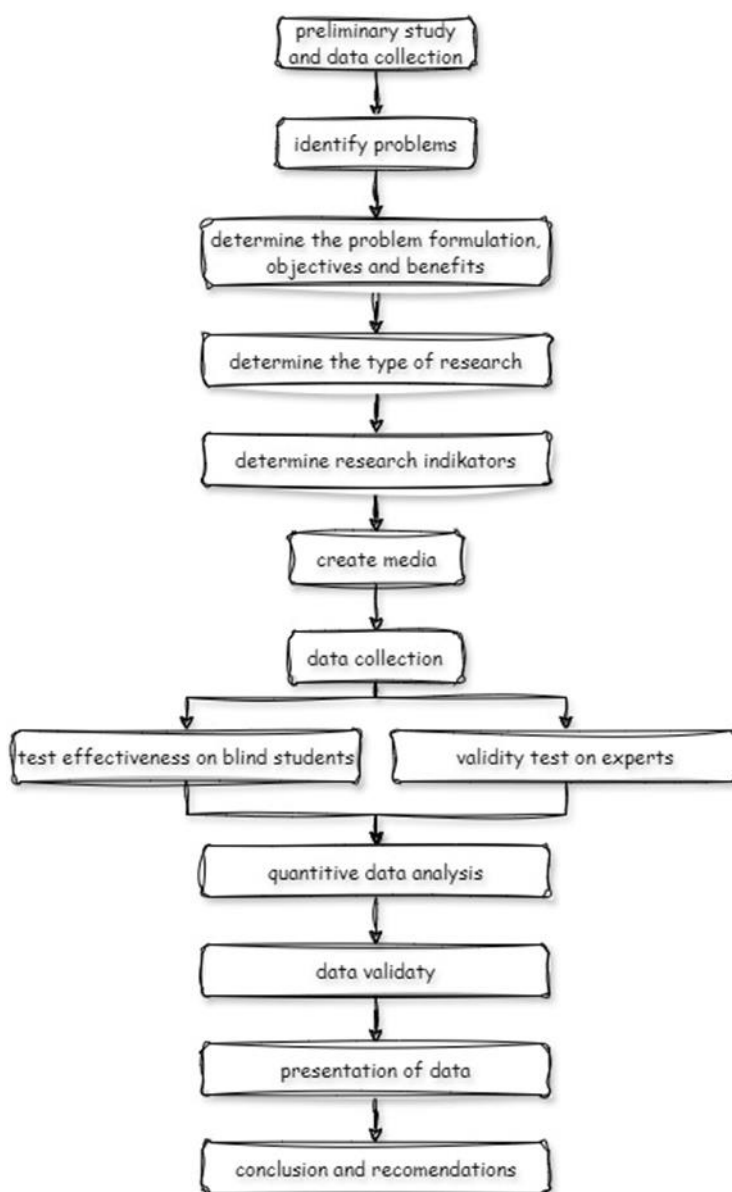

Figure 1 Conceptual framework

METHOD

This type of research is development research (*Research and Development*/RnD). Research and Development Methods are research methods used to produce a specific product, and test the effectiveness of that product (Sugiyono, 2017). The data that will be collected in this study is in the form of quantitative data as basic data and described to clarify the results of the development

of learning media. This research uses the *research and development* (RnD) with the design of ADDIE development which consists of five main stages, namely *analysis, design, development, implementation*and *evaluatio* (Dewi, Sumarmi, & Putra, 2021).

The use of this research design is used because in the implementation of *treatment* There is a control class before being given a game using media, and an experimental class after being given a game using FIVAROM-NET media, then the influence on students is identified so that it can be compared between before and after it is carried out *treatment* aforementioned. *Treatment* In the design of this study, quasi-experiments were used (Shoji, Takafuji, & Harada, 2020).

Quasi-experiment is a type of research design in which the researcher does not have full control over the variables being studied. The main difference between a true experiment and a quasi-experiment is that in a true experiment, the researcher can randomly assign subjects into treatment groups and control groups, while in quasi-experiments, the researcher does not have the ability to randomize or randomly assign subjects.

In quasi-experiments, although researchers were unable to randomly assign subjects into treatment and control groups, they still tried to measure the impact of independent variables (treatments or interventions) on dependent variables (outcomes or responses). However, due to the lack of randomization, there is a risk that other factors outside of the independent variables may affect the results of the study.
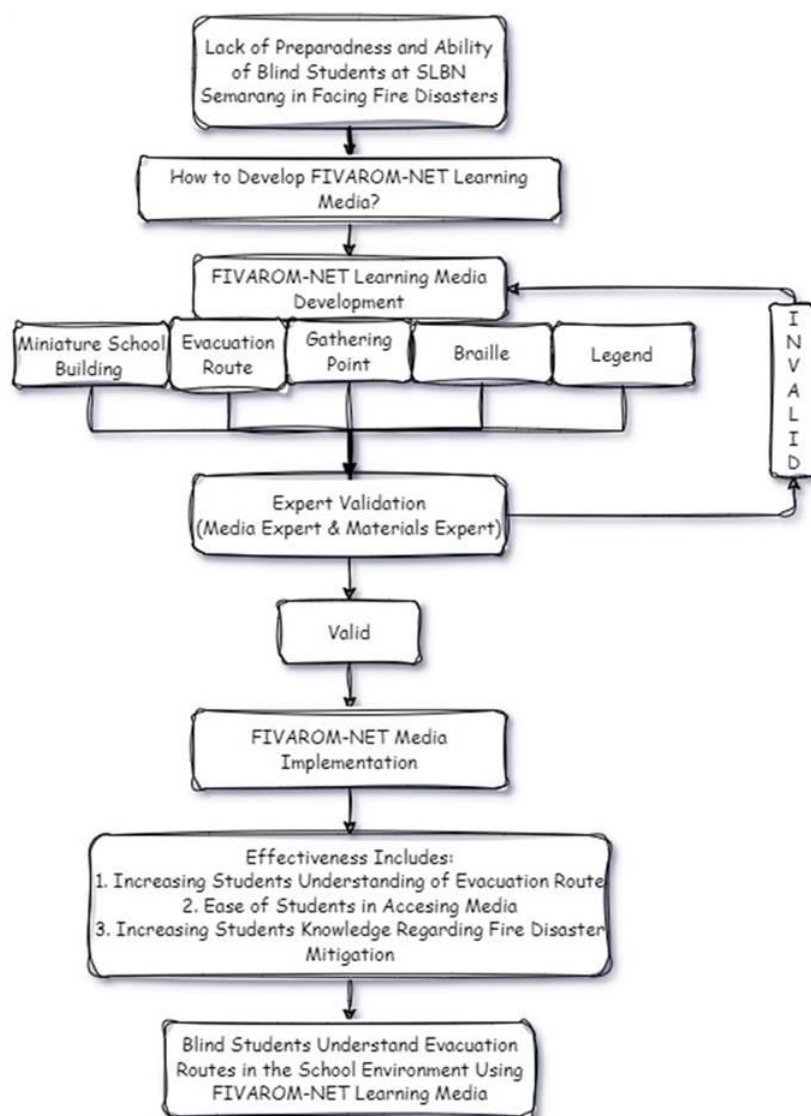
Figure 2 Thinking Framework

The sampling used is the entire population used (Amir, 2015). Thus the members of the population and the sample in this study are the same. According to (Amir, 2015), if all members of the population are used as samples, then the sampling technique used is saturated sampling. The saturated sampling technique is often used if the population in the study is relatively small, the saturated sample technique is often also called the census technique (Pratama, 2020). So, the sample in this study is 26 students with special needs who are visually impaired consisting of 11 elementary school students, 9 junior high school students and 6 high school students at SLB Negeri Semarang Class A.

Data is a collection of letters/words, sentences, or numbers collected through the data collection process. The data is a nature or characteristic of something being researched (Mangarapian, 2021). There are two data in the study, namely primary data and secondary data. The primary data in this study was obtained from the results of interviews and tests with respondents, while the secondary data in this study came from relevant literature sources as data in this study (Glinka, 2008).

RESULT AND DISCUSSION

Potential and Problem

1. Potential
   Facilities that are already decent and can be on par with schools for normal students in general. Starting from classrooms, teachers, to supporting facilities related to disaster evacuation such as gathering points, evacuation route directions, roads equipped with guiding blocks and light fire extinguishers (APAR) are appropriate like schools in general. Infrastructure to support non-academics is also available, such as musical instruments, gamelan, and several facilities that guide students with special psychological needs such as trainings. Learning media is also inseparable from observation, where there are a lot of learning media that are very helpful for teaching and learning process activities. From reading books, practical tools, to media that help students understand a material.

2. Problem
   Often the lecture method for tuning students makes it boring and sometimes difficult to receive material due to lack of understanding of concepts. Students with visual impairments experience limited mobility in their environment. Visually impaired students with their limitations are required to be independent at home, school and society, students must be able to get to know the surrounding atmosphere and the relationship with the environment which is often called orientation. Moving safely and effectively in the environment is also very important, this is called mobility. Therefore, visually impaired students need media in which there are stimuli or stimuli so that students can easily recognize the space in their school as well as be able to move safely and effectively (Tetuko, 2016). The guiding block or guide road which is a facility for people with disabilities, especially the visually impaired at SLB Negeri Semarang, is still incomplete, making it difficult for students to orient their mobility in their school environment.

FIVAROM-NET Media Development

As for the development of the media made, through several stages that follow the guidelines of the ADDIE method (Juhadi, Hamid, Trihatmoko, Herlina, & Aroyandini, 2021). The stages include analysis, design, development, implementation, and evaluation, with the following explanations:

1. Analysis
   Before making media, the initial stage carried out by the researcher is to analyze the problems in the field, and collect several references that can be used as supporting sources in making media. Field situation analysis activities were carried out at SLBN Semarang as the object and subject of research. The results of field situation analysis activities, in the form of learning processes, student learning characteristics and supporting media for learning activities, especially in the field of disasters. The data from the results of the analysis of the field conditions include:
   a. Learning characteristics of visually impaired students at SLB Semarang using braile-based media, tactile maps, and audio (Tetuko, 2016).

b. Learning media for the introduction of space for visually impaired students at SLBN Semarang is still inadequate, even a map that specifically shows the evacuation route from the classroom to the gathering point also does not exist, so it is very important to have media that provides knowledge about space, especially evacuation routes and space introduction considering that in the school there has been a fire caused by many buildings prone to fire disasters and the condition of students who are groups vulnerable.

c. The learning process at SLBN Semarang is carried out separately according to their respective classes. The division of hours is teaching and learning activities at the hour (07.00 – 09.30), break time (09.30 – 10.00), teaching and learning activities at the hour (10.00 – 12.30), finish/go home (12.30)).

2. Design

Creating a basic map display design aims to make it easier for creators in three-dimensional form. The creation of this map is through a digital process with image digitization and graphic design. A digital map made based on field conditions in schools by matching existing plans and adding several gathering points that allow visually impaired students to get a safe place when a fire disaster occurs, as well as determining evacuation routes that adjust guiding blocks so that students can move effectively and efficiently to the gathering point.

Figure 3 Plan of SLB Negeri Semarang

Figure 4 FIVAROM-NET Digital

3. Development

Fivarom-net is a development of a tactical map learning media with an embossed map face (in the form of three-dimensional) based on braile letters intended for the visually impaired. The content of Fivarom-net media contains information on rooms related to the buildings (buildings) in SLBN Semarang accompanied by evacuation routes from each room adjusting the guiding blocks in schools. Braile letters used in Fivarom-net media function to make it easier for visually impaired students to read maps. Research conducted by (Ardi & Julianto, 2019), showing that the use of braille-based learning media significantly improves the understanding and retention of information in visually impaired students. Study by (Kurniawan & Zulkifli, 2020) also expressed a similar opinion that the use of assistive technology such as digital braille keyboards helps visually impaired students in improving their technology skills and access to digital learning materials. Thus, the development of braile-based tactical map media focused on fire disaster evacuation routes is very relevant to previous studies.
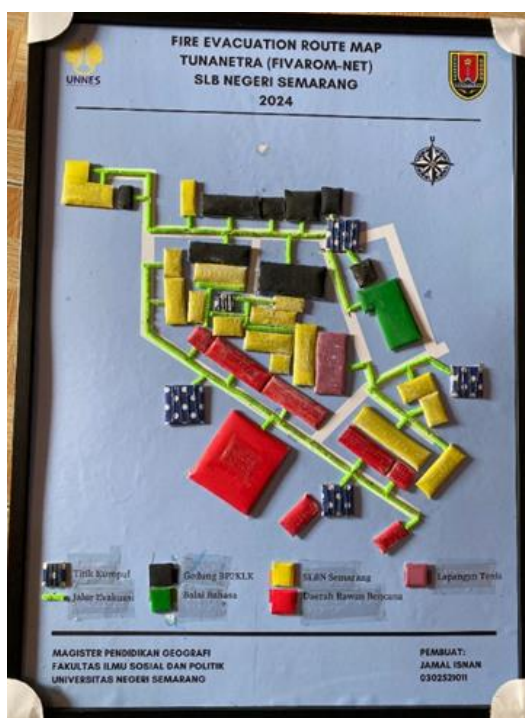
Figure 5 Three-Dimensional FIVAROM-NET

4. Implemented

   The implementation of implementation through FIVAROM-NET media for visually impaired students was carried out jointly between researchers and teachers of the visually impaired class of SLB Negeri Semarang. The collaboration resulted in a better understanding of the space, because there was a synergy between researchers who taught map concepts and blind classroom teachers who were more proficient and understood the learning characteristics of visually impaired students. The treatment of media application in this study was carried out in three stages with two stages of simulation and one stage of learning using Fivarom-net. Treatment in the implementation of this media is:

   a. Treatment 1 (Evacuation Simulation Before Using Media): The first stage of the application of Fivarom-net learning media is simulation. This simulation aims to measure the understanding of visually impaired students in their orientation towards space recognition at school. Visually impaired students from the classroom joined hands and walked towards the gathering point, namely the football field, as if there was a fire so that they could walk quickly to their destination. After going outside the classroom, students were confused and did not know where the field position of the blind classroom was going. Therefore, I helped the student with the direction of the right turn and left turn sound to get to the destination of the gathering point. Arriving at the gathering point, the students were asked to walk back to the classroom. The journey back to the classroom still needs assistance from teachers and researchers so that students walk according to the path that has been provided. Thus, it can be concluded that the first simulation without using media is still low in students' knowledge of space in school.

Figure 6 Evacuation Simulation Before Using Media

b. Treatment 2 (Learning Using Media): The second stage is the learning process using Fivarom-net media. At this stage, students are given mobility orientation learning and braile reading in accordance with the learning tools at SLBN Semarang. Mobility orientation materials are given to elementary, junior high and high school students. The Fivarom-net media that had been provided on the table was then touched using alternating hands by blind students. Junior high and high school students are focused on mobility orientation materials for space introduction at school. Meanwhile, elementary school students are more focused on reading braile in the information in each room or building in SLBN Semarang. When students read the map, the researcher also explained and asked questions so that students were active and understood the content of Fivarom-net.

Figure 7 Learning Using Media

c. Treatment 3 (Evacuation Simulation After Using Media): The last stage of the implementation of Fivarom-net learning media is the final simulation. This simulation aims to measure the understanding of visually impaired students in reading Fivarom-net media that has been applied previously. The application of this simulation is that visually impaired people are asked to walk from inside the classroom hand in hand to hold their shoulders to several gathering points in the school environment, as if there was a fire so that they can walk quickly to their destination. Unlike the initial simulation before using the media, students now understand the path to the field which is one of the closest gathering points from the classroom of blind students. In addition to understanding the direction of the goal, students can also walk faster than before. Thus, it can be said that students have understood the content of Fivarom-net media.

Figure 8 Evacuation Simulation After Using Media

This treatment is carried out based on the characteristics of the learning model that is suitable for visually impaired students. The principle of learning while doing this is implemented through fire disaster evacuation simulations by following evacuation routes that are in accordance with the media. This is due to the principle of *learning by doing* It is related to the principle of learning through real experiences that seeks children who have visual limitations to get the right to knowledge through events or experiences that they have experienced directly (Tetuko, 2016).

5. Evaluation

This study tests the validity to evaluate the Fivarom-net learning media conducted through assessments by experts. The experts who are the validators of the learning media in this study consist of two lecturers who are experts in the fields of disaster education and learning media. The first two lecturers are Dr. Muh. Sholeh, S. Pd, M. Pd as an expert in learning media, the second is Wahyu Setyaningsih S.T, M.T as an expert in disaster education. Two experts

assessed the validity of the media using instruments or validation sheets in accordance with the assessment indicators of learning media for students with special needs. The assessment of expert validators is as follows:

Media Expert Validator Recapitulation

Validation	Assessment Aspects		
	Performance	Research Design	Visual Communication
Total Score	46	43	47
Presented	92	86	94
Installment-installment Presentase	90.66666667		

Recapitulation of Material Expert Validators

Validator	Question Items																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Expert Rating	4	5	5	5	5	4	5	3	4	3	4	3	4	4	4	4	4	5	4	5
∑	84																			
%	84																			

To find out the category or level of each indicator and variable, then the score obtained (in %) is consulted with the following Likert scale analysis criteria:

Name	Percentage	Information	General Conclusion
1. Dr. Muh. Sholeh, S. Pd, M. Pd	90,67%	Very Good	Suitable for further use in learning without revision
2. Wahyu Setyaningsih S.T, M.T	84%	Very Good	Suitable for further use in learning without revision

Based on the table, this Fivarom-net learning media has been declared valid by experts with an average score of 90.67%. All aspects of validity received high scores. The performance aspect obtained an average score of 92%. The design aspect of the study obtained an average score of 86%. Then the visual communication aspect obtained a score of 94%. Thus, experts consider that this Fivarom-net learning media has been declared valid and feasible to be used in learning without revision.

CONCLUSION

Based on the description of the discussion of the research results that have been submitted, it can be concluded that the learning media for the visually impaired at SLB Negeri Semarang that supports mobility orientation, braile reading, and understanding of evacuation routes in the school environment is still very limited and inadequate, so it is very important to provide media that is in accordance with the learning characteristics of visually impaired students. Referring to the results of research that has been carried out during observation activities at SLBN Semarang, FIVAROM-

NET media is a braile-based media where the media is in accordance with the characteristics of learning so that visually impaired students can more easily understand the material presented. The effectiveness of this media is calculated through the calculation of the average assessment of three aspects from media experts who obtained 90.67% and 84% from material experts. Thus, FIVAROM-NET media was declared effective in learning visually impaired students in understanding the surrounding space, especially evacuation routes when a fire disaster occurred in the school environment. The results and discussion of this research are expected to motivate and innovate for schools, researchers, and educational institutions as well as teachers at SLB to develop other learning media that support visually impaired students in understanding the learning materials presented.

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