

The Effectiveness of Interactive Multimedia to Increase Learning Outcomes of Deaf Students in Elementary School Level: A Literature Study

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ARTICLE INFO	ABSTRACT
<p>Article history:</p> <p>Received 25/08/2021 Approved 19/09/2021</p>	<p>Abstract: One of the consequences of obstacles to the hearing ability of deaf children is the difficulty of receiving and understanding verbal or audio learning materials. Thus, the teacher needs to modify the way of delivering material to children by developing visual learning media, namely interactive multimedia. This research was conducted to determine the effectiveness of the development of interactive multimedia that can positively influence the learning outcomes of deaf students at the elementary school level. The research was conducted through a literacy study through Google Scholar with the keyword "the influence of interactive multimedia development for deaf students at the elementary school level," with a range of articles selected from 2015-2021. Based on the literacy study conducted, it was found that various applications were used to develop learning media in the form of interactive multimedia applications for deaf students. However, several interactive multimedia had not been applied to deaf students so that the effect of interactive multimedia on the learning outcomes of deaf students was unknown.</p>
<p>Keywords:</p> <p>Interactive multimedia Special needs kids Special education Deaf student Elementary school</p>	

INTRODUCTION

The condition of deaf children who experience obstacles to their listening abilities, causing children to have difficulty accepting verbalized subject matter, in line with Mudhar & Rafikayati (2017) explaining the consequences of hearing function disorders, namely deaf children have difficulty communicating verbally, either expressively (speaking) or verbally. expressive (understanding other people's speech) this situation creates obstacles for deaf children to communicate with the environment. These problems are not caused by intelligence factors, because deaf children have the same average IQ as normal children. As explained in the research of Mudhar & Rafikayati (2017) that deaf children generally have the same distribution of IQ scores as children who are able to hear. Even if there are difficulties, they are more associated with speaking, reading and writing.

Problems that arise as a result of deafness affect student achievement. Rachmi, Anggreyani, & Ningsih (2020) explained that there are obstacles to the hearing ability of deaf children, which greatly affects the development of children's knowledge. Because the human voice carries language that can inspire thought and place a person in the ranks of intellectual human beings. Reinforced by Rim's opinion (2019) that deaf children have difficulty communicating with the environment orally, because deaf children lack information from the environment. So efforts that can be made to improve children's ability to recognize body parts and the five senses are by using learning media that utilizes the visual function of deaf children. As stated by Abdulrohman (2012) that for deaf children in accessing every incident that occurs in their surroundings using visual aspects, the learning media used in learning activities involve more visual aspects than other aspects.

Teaching media used in the teaching and learning process have benefits as teaching aids in the form of graphics, photographs, or electronics to process and rearrange information both visually and verbally that have been conveyed by the teacher through the use of media. One of the uses of learning media that can be applied is to use interactive multimedia.

Interactive multimedia according to Daryanto (2010) in Nuraini, et al (2021) is a multimedia that can be operated by the user independently, and the user can choose what I need for the next process equipped with a controller. Interactive multimedia can be used in learning in schools because it is quite effective in improving student learning outcomes, especially computers. In addition, interactive multimedia can be used for self-study at home. Interactive media has supporting elements such as audio, animation, video, text, and graphics.

Interactive multimedia has advantages and disadvantages, according to Yudhi Munadi (2012) in Nuraini, et al (2021) as follows: 1) Interactive, meaning that this multimedia program is programmed to be used by students individually (self-study); 2) Provide a climate of affection individually, never forget, never get bored, very patient in carrying out instructions, as desired; 3) Increase learning

motivation; 4) Provide feedback (response); and 5) Because interactive multimedia is programmed for self-learning, the control over its utilization rests entirely with the user. While some of the disadvantages of interactive multimedia are that its development requires a professional team and its development takes quite a long time.

The inhibition of the hearing ability of deaf children results in the delivery of subject matter that is verbalized or in audio form, so teachers need to modify children's learning methods with the help of visual media. In this technological era, visual media can be done by utilizing technology sharing in the form of computers, smartphones, and so on. Not least the development of learning media in the form of interactive multimedia was developed to help deliver material to deaf students, but not least the development of interactive multimedia can be used widely. Therefore, the purpose of the literature study conducted by researchers is to determine the advantages and disadvantages of various interactive multimedia developments that are able to have a positive influence on learning outcomes for the deaf at the elementary school level.

METHOD

The research method applied to achieve the objectives of this research is the study of literacy. The stages of the literacy study carried out were selecting articles, categorizing articles, analyzing studies, and presenting research articles from peer-reviewed journals published in 2015 to 2021 through Google Scholar. The selection of articles was done by searching for articles on Google Scholar with the keyword "the influence of interactive multimedia development for deaf elementary school students" with a research range between 2015 - 2021 and found 117 research articles. And with the keyword "multimedia interactive learning for deaf elementary school" and found 43 research articles. Based on 160 articles, the next step is article categorization. Article categorization is carried out by taking into account the suitability of the articles found with the topic of discussion in the literacy study in this study, which is related to the effectiveness of developing interactive multimedia that is able to have a positive influence on the learning abilities of deaf students at the elementary level. After the article categorization was found to be strictly in accordance with the topic, 15 research articles were determined according to the purpose of this study, then the next stage was study analysis. The analysis of the study was carried out using the best evidence approach, which was based on 13 national articles and 2 international articles selected according to the needs and research questions. Researchers verify and analyze each article. In this process, the researcher analyzes the article based on the research objectives, the advantages of the developed interactive multimedia, the disadvantages of the developed interactive multimedia, and analyzes the findings in the article.

FINDINGS

Fifteen research articles have been reviewed in this article (Table 1). The article reviewed is a research article on the results of the development of learning media in the form of interactive multimedia which is effective as a learning medium for deaf students at the elementary school level, and the interactive multimedia developed can have a positive influence on learning outcomes for the deaf at the elementary school level.

Table 1. Product analysis of the development of interactive multimedia that is able to have a positive influence on learning outcomes for the deaf at the elementary school level

Author(s)	Purpose	Positive	Negative	Findings
Effendi, D., Hardiyana, B., & Gustiana, I. (2016).	Application products can be implemented for deaf children to convey material that cannot be conveyed verbally or events.	System development using a prototype in its implementation using Adobe Flash CS3 professional software based on multimedia. Submission of material on the respiratory system of humans and animals that is impossible to convey verbally or events can be engineered in such a way that they can be presented in detail and very attractively through visuals.	Not yet applied in learning for deaf students	Deaf students need a visual explanation of the material. Because the respiratory system of humans and animals is very complex and complicated to be explained conventionally by teaching teachers, to overcome this problem, to overcome this problem with visual animation and facilitated by sign language. Based on the validation stages obtained through experts, a good system design and program interface is in accordance with user needs.

Zahroh, F., Habibi, H., & Herowati, H. (2017).	To determine the feasibility of the media, to know the activities of students in science learning by using interactive science video media	Product development is carried out based on the characteristics of deaf children, so the product developed is in the form of interactive science video media. How to deliver the material in the video through pictures and video cues and video illustrations. Not only that, in the media there is an evaluation page and a cover in the form of a summary of the material.	The display design (theme selection) is not attractive too dark and boring	<p>1) The feasibility of interactive science video media based on the results of the validator found that the results of the assessment by the lecturer were 94.23% and the SLB teacher for the deaf was 92.30% in the very good category.</p> <p>2) Activities of deaf students in the use of interactive science video media have a percentage result of 82.9% in the good category</p> <p>3) The teacher's response to the interactive science video media used was 90% in the very good category.</p>
Mufidah, S. E. (2017).	Developing interactive multimedia based on total communication that is theoretically feasible based on empirically validated results based on student activities, student responses and evaluations.	The development of interactive multimedia based on komtal which was developed on additive material used as a learning medium for deaf students presents the display of text, images, videos, sounds, animations, addition of cues, both hand and lip signals.	Development is only carried out at a limited trial stage.	<p>1) Based on the results of the feasibility test on the product developed criteria for content, language, and presentation, the percentage range is 86.67% - 100%; 80% -86.67%; 80-93.33% with good and very good criteria.</p> <p>2) Based on the results of observations of student activities, student response questionnaires consecutively obtained a range of 82% - 95%; 80% and 100% and the results of student evaluations showed good results, there was only 1 student who did not meet the KKM and classical completeness of 80% so that the interactive multimedia could be said to be feasible with good and very good criteria.</p>
Aliyah, F. J., & Rofiah, K. (2020).	Developed Siganlong Indonesia digital dictionary based on interactive multimedia	Technology development by developing an Indonesian signalong digital dictionary made using Adobe Flash Professional CS6 software with action script 2.0. Product development is the application of communication methods to help children with special needs who experience barriers to communication such as deaf children, mentally retarded children, and autistic children.	Development is only carried out up to the development stage without being applied to the subject.	<p>1) The digital signalong Indonesian dictionary is categorized as very good with a material validation percentage of 93% and a media validation percentage of 81% with several revisions</p> <p>2) The use of the Siganlong Indonesian digital dictionary can be used by children with special needs who experience communication disorders and Indonesian signalong as a communication method</p>
Septiawati, D., Suryani, N., & Widyastono, H. (2021)	To examine the use of educational games on the	Collecting, processing, and presenting literary sources in the form of national journals and	There is still a lack of game literacy that is played using electronics, most	Educational games developed both in the form of applications and traditional games have benefits in

	vocabulary skills of deaf children	international journals related to the development of educational games in order to improve vocabulary skills for deaf children.	of the games developed are traditional games.	increasing vocabulary and learning motivation in deaf children
Yuliana, D. W., & Suprptono, E. (2016).	Creating appropriate learning media to improve the learning outcomes of deaf students in class V SDLB in Indonesian language subjects	1) Media is made using Adobe Flash application which is able to implement images, text, sound, animation and video as components of learning media that will be used in learning for deaf students. 2) To find out the effect of the media created, the researchers conducted product experiments on students	The media that was developed was only tested for validity with media experts and material experts, but did not carry out validation tests on expert practitioners	1) The developed interactive multimedia is suitable for use as a supporting media 2) The developed media can improve the learning outcomes of deaf students in the basic competence of listening to stories about events around them
Pradana, D., Abidin, Z., & Adi, E. P. (2020).	Produce and find out the feasibility of character building learning animation videos	Media production is done by combining materials using a computer to combine text, audio, video, and animation using Wondershare Filmora9 software.	Video distortion is packaged in the form of a DVD, it would be better if an application program was made. So that it can be accessed easily, and can be accessed at any time.	1) Feasibility of the learning media video learning sub-theme of character formation based on the assessment of media experts and material experts is included in the appropriate category 2) 91% of students are interested in media and the media can be accepted by deaf students and can be used in learning 3) 85.57% of student learning outcomes reached the KKM after the media was applied in learning, while 14.2% had not reached the KKM
Al Irsyadi, F. Y., Puspitassari, D., & Kurniawan, Y. I. (2019).	Develop an application in the form of a learning game about prayer procedures along with prayer readings in Indonesian called ABAS (Let's Learn Prayer)	Aplikasi dibuat menggunakan Construct 2 yang memiliki fitur lengkap dan mudah dioperasikan ABAS dapat digunakan oleh anak-anak tunarungu dan tunawicara di sekolah dasar yang berpedoman bagaimana melakukan gerakan sholat serta berdoa dengan membaca dan bermain sebagai sarana untuk memahami materi yang telah ditunjukkan Permainan ini juga dilengkapi dengan bahasa isyarat pada materi prosedur doa untuk membuat siswa memahami makna materi yang telah diberikan dengan mudah	The application can only be operated with android version 4.1 other than that the application cannot run properly	1) The ABAS application can run as expected 2) Based on the results of the application test for teachers and applications, it shows that the ABAS application can be used as a learning medium that makes it easier for students to learn prayer movements and readings and can increase student interest in learning.

		Game ini mampu mendukung media pembelajaran siswa agar lebih mudah menyerap materi dan menghafal sehingga dapat diimplementasikan dalam kehidupan sehari-hari ABAS dapat dijalankan secara maksimal dengan versi android minimal 4.2		
Aini, N., & Daniah, D. (2020).	This study aims to determine the effect of android-based application media and the SINARU website on knowledge about disaster preparedness mitigation in children with hearing impairments at SDLB Santi Rama.	The content of the SINARU application has some interesting content and has an educational element to make it easy to understand. There are five contents, namely general material, disaster preparedness, videos both disaster response simulation videos and SIBI videos, music and quizzes on the https://sinaru.id/ page. The research was carried out by experimenting with deaf students at the SDLB level and interviewing the research subjects.	It is not stated how many times the intervention was given	After the researchers provided counseling interventions using educational media in the form of the SINARU disaster preparedness mitigation application with content in the form of descriptions of types of disasters, causes of disasters, and impacts of disasters. From the statistical tests conducted, it is known that there is a significant average difference before and after health promotion using SINARU educational media. It can be concluded that the use of interesting application media is very effective in providing and increasing the knowledge of children with hearing impairments.
Riza, L. S., Firdaus, D. S., Junaeti, E., Hidayat, T., Abdullah, A. G., Nandiyanto, A. B., & Abdullah, C. U. (2018).	To develop a concept and implementation of learning media for deaf students	Media design is created according to 24 multimedia characteristics that are appropriate for deaf students	The display is less attractive in the results evaluation section, where there are several questions that are displayed. It would be more interesting if the questions were displayed one by one and immediately gave the answer whether it was right or wrong.	After the media was applied, it was found that students' scores, media perceptions, students' feelings during and after using the media, and the average attention span were very good. Based on the results obtained during the experiment, the developed media proved to have a positive impact on deaf children.
Permatasari, K., Degeng, I. N. S., & Adi, E. P. (2019).	Produce a product in the form of a Living Adaptation learning video that functions as a supplement for deaf students of SLB-B YPLB Blitar in the form of a valid learning video DVD accompanied by a user manual.	1) The media is suitable for delivering science subject matter for the visual learning style of deaf students. 2) The media is validated by experts and tested on students	1) Learning videos can be accessed if we have a learning video DVD 2) For now, it's rare to use DVD	The results of the trial video for Adaptation of Living Creatures show very good results and are suitable for use in the learning process, both in class and independently. The results of the validation by media experts, material experts, and student assessments of this learning video are in the very good category.
Subroto, A. N. F. W. (2019).	This study aims to determine the	To improve the vocabulary of deaf	The Jakarta sign Laguage (AKSL)	Multimedia sign language application has an effect on

	effect of using sign language multimedia applications on increasing the vocabulary of deaf children in class III SLB B YRTRW Surakarta in 2018/201	children, children are given a treatment using multimedia in the form of the Jakarta Sign Language (AKSL) application.	application is a medium used to provide treatment to deaf students in Surakarta. As is known, there will be language differences between the language used in Jakarta and the language used in Surakarta.	increasing the vocabulary of deaf children in class III SLB B YRTRW Surakarta in 2018/201
Chrismanto, A. R., Nendya, M. B., Tampubolon, J. K., Santosa, R. G., Sudarma, W. E., & Hermawan, H. (2020). Inovasi	Testing how effective the user of the DATAlogic learning application is to provide a symbolic logic teaching model compared to conventional learning models	1) Applications are able to help deaf students understand mathematical logic which explores formal logic for mathematics 2) The application is equipped with various features ranging from login requirements, general needs, module requirements, confirmation needs, module questions needs, system results requirements, review page needs and score results needs that are easily accessible by children. 3) The topics taught are: the prohibition of contradicting, capturing the meaning of symbols without sound, logical equivalence using references, reading symbols, reasing information, predicate and quantification, and reading flowcharts. 4) The product is in the form of a web application, making it easy to access anywhere and anytime.	The media developed is less specific to its target users. Are users only targeted at elementary, junior high, high school, or higher education levels?.	There was a greater increase in the ability of symbolic logic determination (I) and an increase in the ability of symbolic natural determination (N) in deaf students. Learning models using the DATAlogic application are also more demanded because deaf students feel happier, easier, more understanding, more concentrated and more creative when using the DATAlogic application.
Irdandi, A., Nasution, H., & Sukanto, A. S. (2017).	Produce multimedia learning applications for the introduction of sign language for deaf students based on android as an alternative sign language learning medium aimed at deaf students who can already read with	1) This android-based application can be accessed by children easily, anytime, and anywhere 2) The sign language displayed in the application has been validated by a CAI expert, so that the sign language displayed is the right standard language for deaf students to know.	The developed media has not yet been applied to students.	Based on the results of validation by CAI, material experts, and media experts, this multimedia application for sign language recognition for deaf students with android luggage is categorized as valid with an RTVTK of 3.59. So that this sign language recognition multimedia is feasible to be used as a sign language recognition medium for deaf students.

	mild and moderate levels of hearing loss			
Techarueangrong, P., Kaewprapan, W., & Suksakulchai, S. (2014).	To explore the application of the storytelling approach and the application of multimedia in teaching deaf students. As well as informing educators that educators need to understand three aspects of research, namely multimedia design, learning design for deaf students, and visual design..	1) The features in the application are very interesting, can involve students to learn actively and enthusiastically, and this application is suitable to be applied to elementary grade deaf students 2) Vocabulary introduction is given by showing illustrations of activities	This application has not been widely applied to deaf students, to determine the effect of this multimedia	Based on the development carried out, the results of the development become guidelines for learning for deaf students.

DISCUSSION

The purpose of developing interactive multimedia for deaf students

The inhibition of the hearing ability of deaf children results in the delivery of verbalized subject matter, so teachers need to modify the method of delivering subject matter that is adapted to the obstacles, abilities and characteristics of deaf students at the elementary school level, namely by delivering visually material. Reinforced by Audria's explanation, (2017) that for deaf students the sense of sight has a very important role in information processing activities during teaching and learning activities which will affect the results of student learning activities. One of the visual learning media that is widely developed at this time is interactive multimedia by utilizing computers, smartphones, and so on.

The purpose of developing interactive multimedia based on literacy studies by researchers is to facilitate the delivery of subject matter to deaf students according to their characteristics in order to improve language skills, increase their understanding of environmental conditions, improve learning outcomes and development is carried out to develop media in accordance with increasingly sophisticated times with utilize various technologies.

In line with the opinion of Rahmat, (2015) that computer-based learning multimedia is useful as a tool to facilitate teachers and students in the learning process as well as a strategy to achieve learning competencies and the learning process becomes more interactive, effective, efficient, interesting, and able to foster learning motivation. student. It is reinforced by Yuliaana's opinion (2016) that interactive multimedia needs to be applied in the teaching and learning process of deaf students with interactive multimedia, which consists of images, text, sound, animation, and video. Of course this will make it easier for teachers to deliver material to children, and children will be interested and enthusiastic to learn. Interactive multimedia is widely used to assist and support the achievement of student learning outcomes. It is strengthened by Suryandanu's finding, (2020) that based on literacy studies, the use of multimedia in learning can increase the effectiveness of teaching and learning activities and student learning outcomes.

The advantages of developing interactive multimedia for deaf students at elementary school level

The product of developing interactive multimedia by utilizing various applications found by researchers based on the results of literacy studies, namely interactive multimedia is very suitable to be developed as a teaching medium for deaf students. Because in developing interactive multimedia as learning media for deaf students can use various supporting elements such as animation, video, text, and graphics. Of course this is very suitable to be used as a learning medium for deaf students who are known as visual people. In line with the results of Yuliana's research, (2016) that the application of illustrated and video elements developed in interactive multimedia in listening to stories to deaf students is feasible to use as a supporting medium and can improve the learning outcomes of deaf students. It is reinforced by the opinion of Gentry, (2004) that the application of interactive multimedia is more attractive for teaching reading comprehension to deaf children.

Nuraini (2021) states that interactive media can support elements such as audio, animation, video, text, and graphics. Of course, the use of the interactive media elements follows the characteristics of deaf children who experience problems in receiving verbalized subject matter. It is reinforced by Rahmy's opinion (2017) that interactive multimedia is very useful to facilitate the delivery of material in vocational programs for deaf students known as visual children. Not only that, interactive multimedia will increase students' learning motivation. Reinforced by the opinion of Nuraini et al. (2021) that interactive multimedia has advantages: 1) this multimedia program is programmed to be used by students independently; 2) Provide a climate of affection individually, never forget, never get bored, very patient in carrying out instructions, as desired; 3) Increase learning motivation; 4) Provide feedback (response); and 5) Because interactive multimedia is programmed for self-learning, the control over its utilization rests entirely with the user.

Disadvantages of developing interactive multimedia for deaf students at the primary school level

In general, interactive multimedia has several shortcomings, as revealed by Munandi (2012) in Husein (2015) that the shortcomings of interactive multimedia are: a) development requires a professional team; and b) development takes a long time. The results of the literacy study conducted by the researchers found several shortcomings in the development of interactive multimedia targeting SDLB deaf students, namely: 1) The product development has not been widely applied to students for deaf students after being declared valid. So that the usefulness of product development becomes a new problem because it has not been applied in learning and the absence of further researchers is aware of the existence of product development that has not been applied to determine the effectiveness of the product. This is not in line with the opinion of Rahmawan, et al (2013) that learning media is a tool used to assist educators in conveying information to students; 2) Storage of interactive multimedia in the form of DVD, whereas nowadays DVD is rarely used because people prefer internet services to download various teaching materials, applications, videos, images, etc. easily and for free. Reinforced by the opinion of Situmorang, (2012) that storage using DVD is an ancient means of data storage, nowadays data storage is carried out using a laptop as a means of storing digital data for learning activities, audio, visualization of learning materials, and packaging learning materials in software programs in the form of application programs; 3) The suitability of the application of development products that have not been implemented, needs to be studied in depth before being applied by further researchers. Of course, it is necessary to pay attention to the suitability of the material, needs, and socio-cultural conditions that exist in the developer's study environment with the environmental conditions that will be given the application of the product by the next researcher. Reinforced by the opinion of Batubara, et al (2019) that the selection of learning media must pay attention to its suitability with the components of the learning system, such as learning objectives, subject matter, learning methods, readiness and needs of students; 4) Applications that do not support some types of android. Reinforced by Batubara's opinion, (2019) that the presentation of learning media can be programmed using the help of learning media so that it can be presented systematically, flexibly, and involves a variety of media; 5) Lack of specific target from users, as stated by Batubara, (2019) that the presence of learning media is important to facilitate student-centered learning activities.

CONCLUSION

The application of interactive multimedia is one of the suitable learning media for deaf students to improve language skills, improve their understanding of environmental conditions, improve learning outcomes and in accordance with the development of an increasingly sophisticated era by utilizing various technologies. However, interactive multimedia has several, namely: 1) Product development has not been widely applied to students for deaf students after being declared valid. So that the usefulness of product development becomes a new problem; 2) Interactive multimedia storage in the form of DVDs, whereas nowadays DVDs are rarely used because people prefer internet services to download various teaching materials, applications, videos, images, etc. easily and for free; 3) The suitability of the application of development products that have not been implemented, needs to be studied in depth before being applied by further researchers. Of course, it is necessary to pay attention to the suitability of the material, needs, and socio-cultural conditions that exist in the developer's study environment with the environmental conditions that will be given the application of the product by the next researcher. 4) Applications that do not support some types of android; 5) Lack of specific target from users

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