JURNAL PENDIDIKAN DAN PENGAJARAN
Volume 55 Nomor 2 2022, 377-386
E-ISSN: 2549-2608; P-ISSN: 2301-7821
DOI: http://dx.doi.org/10.23887/jpp.v55i2.46729

E-books as Assistive Technology for Children with Learning Disabilities

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Abstrak

Kurikulum sekolah umum belum sepenuhnya memberikan konsep pembelajaran bagi anak berkebutuhan khusus seperti anak dengan ketidakmampuan belajar. E-book adalah bahan ajar sebagai teknologi bantu, yang dirancang khusus untuk siswa dengan ketidakmampuan belajar. Penelitian ini mengembangkan bahan ajar berupa e-book sebagai alat bantu belajar bagi anak berkesulitan belajar. Penelitian ini dilakukan berdasarkan kebutuhan dan gaya belajar siswa. Oleh karena itu, pendekatan penelitian dan pengembangan (R&D) digunakan dalam penelitian ini. Subjek dalam penelitian ini terdiri dari pengujian ahli dan pengujian pengguna produk terbatas, dalam hal ini siswa. Pemilihan sampel subjek uji dilakukan secara purposive sampling. Model yang dikembangkan menggunakan ADDIE. Tahap validasi ahli dilakukan terhadap ahli kurikulum, media, dan praktisi pendidikan. Uji coba dilakukan pada siswa pada berbagai tingkatan, (1, 3, 5, dan 7) dengan jumlah 25 responden. Teknik pengumpulan data menggunakan kuesioner dengan skala Likert. Hasil penelitian menunjukkan bahwa pengembangan teknologi bantu untuk e-book dengan konsep dasar seni mendapat respon yang baik, dapat dipahami, terlihat menarik, dan efektif atau layak untuk digunakan. Siswa mencapai tingkat sosialisasi yang lebih baik, berhasil mencapai sebagian besar tujuan program rencana pelajaran seperti motorik, bicara, bahasa, membaca, menulis dan pengembangan memori.

Kata kunci: *Teknologi bantu; buku elektronik; mempelajari ketidakmampuan.*

Abstract

The general school curriculum has not fully provided the concept of learning for children with special needs such as for children with learning disabilities. E-books are teaching materials as assistive technology, specially designed for students with learning disabilities. The aims of this study developing teaching materials in the form of e-books as learning aids for children with learning disabilities. This study is carried out base on the needs and learning styles of students. The subjects in this study consisted of expert testing and limited product user testing, in this case students. The sample selection of the test subjects was carried out by purposive sampling. Therefore, the research and development (R&D) approach was used in this study. The model developed using ADDIE. The expert validation stage is carried out on curriculum experts, media, and education practitioners. The trial was carried out on students at various levels, (1, 3, 5, and 7) with a total of 25 respondents. The data collection technique used a questionnaire with a Likert scale. The results showed that the development of assistive technology for e-books with the basic concept of art received a good response, was understandable, looked attractive, and was effective or feasible to use. Students achieve a better level of socialization, successfully achieved most of the lesson plan program goals such as motor, speech, language, reading, writing and memory development.

Keywords: Assistive technology; e-book; learning disabilities.

History:
Received : March 24, 2022
Revised : March 28, 2022
Accepted : May 09, 2022
Published : July 25, 2022

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1. INTRODUCTION

The general school curriculum has not fully provided the concept of learning for children with special needs such as for children with learning disabilities (Anastasiou et al., 2015; Guille et al., 2016). Teachers typically use a range of educational methods and techniques such as task analysis and repetition to support students with learning disabilities (Bjekić et al., 2014). Although this practice is beneficial for some students, some of them fail in school and teachers choose more creative ways to support it, one of which is the use

of Information and Communication Technology (ICT). Due to advances in technology, teachers have access to a wide range of devices that are used as learning tools in the classroom (Hanik, 2020; Valverde-Berrocoso et al., 2021). Despite the last two decades the use of ICT to support students with special needs including students with learning disabilities increasing, some countries still have not integrated ICT as a tool to support the educational needs of students with learning disabilities (Barletta et al., 2017; Pheeraphan, 2013). Education policies continue to be optimized as an effort to support the education of students with special needs (Gucyeter & Erdogan, 2020; Karpagavalli et al., 2021; Laabidi et al., 2014). However, the use of technology is still not maximally used in learning for children with learning disabilities (Laabidi et al., 2014; Wu et al., 2014). In addition, most students with learning disabilities have difficulty in continuing their education to the next level (Barnes & Fuchs, 2008; Torgesen, 1991). The limited understanding of students who have learning disabilities can result in obtaining scores below the criteria for completeness. Therefore, a tool is needed that can be used by students with learning disabilities (Perelmutter et al., 2017; Wu et al., 2014). Tools that can be used anywhere and easy to understand. This study aims to develop teaching materials in the form of e-books to help students with learning disabilities. FlipHTML5-assisted e-books are teaching materials as assistive technology, specially designed for students with learning disabilities. Designing assistive technologies for children with learning disabilities requires a user-centred design that focuses on the entire cycle of the technology used. Starting from analysis, design, development, implementation, and product evaluation. This e-book is made according to the characteristics of users, namely students with learning disabilities as well as for general student users. As an assistive technology application designer, it takes extra effort to understand and gather input from various parties responsible for raising children because every caregiver has their goals and expectations around assistive technology.

There are some related previous study, one of them is study aimed at understanding learning dissabilities better includes studies comparing students with learning disabilities with their undiagnosed peers through quantitative and large-scale tests and listing what students with learning dissabilities cannot (Kincaid et al., 2017; Whiting et al., 2021). It is found that there are very few studies examining student understanding in detail focusing on conceptual knowledge (Huijsmans et al., 2020). It is also supported by other previous study that state experimental and qualitative studies that take into account individual differences and conduct detailed analyses, the aims of previous study was important for understanding students with learning disabilities better (Andersson & Östergren, 2012). The result found that development research is expected to provide convenience for students with learning disabilities.The aims of this study developing teaching materials in the form of e-books as learning aids for children with learning disabilities. This research is important because through the development of teaching materials made by teachers, it is possible for students with learning disabilities to be given information about the material that needs to be studied so that students can follow lessons like other students. Research with the development of e-book teaching materials can also be used in other places with cases of students with learning disabilities.

2. METHODS

This type of research and approach uses Research and Development (R & D), with the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model. Where the approach with the ADDIE model has the advantage of having an evaluation at each stage so that it can minimize the error rate or product shortage at the final stage of this model. Procedures or research steps are carried out first to analyze the need for the product to be

developed, starting from the curriculum, materials, student characteristics, teacher characteristics, and infrastructure that will support product development. The next step is to design or design a product that will be developed according to needs. The third step is the development of the design that has been made, product development in this study using Ms.Word, then converted into PDF format for further upload using the FlipHTML5 application. After the development is complete, it is then validated by validators, including media experts and education practitioners, in this case lecturers. After being validated and revised according to expert advice, the fourth stage is carried out, namely implementation by testing it on a limited scale. Limited scale trials were carried out in one class with 25 students. Questionnaires were given to 25 high school students to determine the usability of the products that have been developed. The next stage of evaluation is the final stage where product evaluation is carried out after testing the 25 students. The evaluation stage is carried out with the aim that the developed product can be used not only on a limited scale with various revisions according to suggestions and input. The research method for developing teaching materials based on FlipHTML5 is shown in Figure 1.

Figure 1. Research Method of The Study

The test subjects in this study consisted of expert testing and limited product user testing, in this case students. The sample selection of the test subjects was carried out by purposive sampling. Purposive Sampling is a sampling technique used by researchers if the researcher has certain considerations in taking the sample or determining the sample for a particular purpose (Laabidi et al., 2014). In this study, the sample selected was 3rd, 5th, and 7th semester students, who had studied the basic concepts of art before during ordinary learning using existing teaching materials. Data collection was carried out through the stages of observation, questionnaires, tests and documentation, which were then analyzed qualitatively. To determine the quality of the teaching materials used in the study, a validation test of material experts, technology and readability tests was carried out (Sugiyono, 2018). Questionnaire instrument for experts/validators and for students is show in Table 1.

Table 1. Validator and Student Instruments

No	Aspect	Indicator	Scale
1	Quality of content/material	1. Material truth 2. Material accuracy 3. Display balance 4. According to the characteristics of students 5. Compliance with Basic Competencies 6. Suitability with learning objectives 7. In accordance with the learning model	1 – 5 1= Very less 2= Not enough 3= Enough 4= Well 5= Very well
2	Teaching material design	1. Multimedia design (visual and audio) can help improve learning 2. Attractive media display 3. Color harmonization is appropriate 4. Writing can be read clearly	
3	*Interaction Ussabillity*	1. Easy Navigation 2. Predictable interface	

No	Aspect	Indicator	Scale
		3. Quality helpful interface	
		4. Animations and images in media	
		5. Visual (layout design, typography, colors)	
4	Usabilitas (Reusability)	1. Easy to use by low or high grade students	
		2. Communicative, according to the material	
		3. Clear navigation in media operation	

The use of this FlipHTML5-based e-book was developed according to the needs and understanding of children with learning disabilities and made very simply. E-books created have a low learning curve. This is due to a tendency to use complex applications which will result in children tending to not use them anymore.

3. RESULTS AND DISCUSSION

Result

The teaching material developed is an e-book based on FlipHTM5 which can be made by taking into account the needs of children with learning disabilities. Educators and students who want to use this Flip HTML-based e-book of basic art concept materials just need to open the link and it can be accessed easily using a mobile phone, laptop, tablet, or PC. In accordance with the main purpose of making and developing this e-book teaching material, it is to provide convenience for students, especially students with learning disabilities.The e-book-based teaching materials developed were validated by the validator. Validation is carried out on the content/material (concepts and facts) and teaching (concern for the formation of attitudes and skills) by material experts. Presentation (systematics and illustrations) by media experts. *Analysis of data from material expert validation* Data from material expert validation consists of two aspects, namely learning aspects and content/material aspects. The learning aspect and the content/material aspect were each rated 4 (very good criteria) by the two material expert teams. The results of the validation of the basic concept art e-book based on FlikHTML5 are presented in Table 2.

Table 2. Validation Results of E-Book-Based Teaching Materials by Material Experts

Aspects of assessment	Average score			
	Material expert 1	Material expert 2	Average	Criteria
Learning aspect	4	4	4	Very good
Aspects of content/material	4	3	3.75	Very good
Average	4	3.5	3.75	Very good

The values written in Table 2 are the values given by the two material experts after carrying out a series of validation activities (which is a cyclical process). The activity (validation-revision) is repeated until an agreement is reached where each validator has stated that the basic concept art e-book based on FlipHTML5 that was developed is valid by giving each aspect a value of 3.75 (very good criteria). The criteria for the value given by each validator for each aspect assessed are 1 = not good, 2 = not good, 3 = good, and 4 = very good. During validation, each material expert validator assessed the basic concept art e-book based on FlipHTML5 which was developed with five assessment components (suitability of the material with learning objectives, correctness of concepts, correctness of facts, correctness of procedures, and use of language) for content/material aspects. And five components for the learning aspect (training process skills, supporting the implementation of

student-centered learning, inviting further student curiosity, supporting the application of daily life (contextual), and supporting the implementation of learning colored by learning to know, do, be yourself, and live together.

Media expert validation data analysis

Data from media expert validation consists of three aspects, namely the aspect of appearance, presentation, these aspects are 4 (very good criteria). The validation results are presented in Table 2.

Table 2. Validation Results of the Basic Concept Art E-Book Based on Fliphtm5 by Media Experts

Aspects of assessment	Average score			
	Media expert 1	Media expert 2	Average	Criteria
Display aspect	4	4	4	Very good
Presentation aspect	4	4	4	Very good
Programming aspects	4	4	4	Very good
Average	4	4	3	Very good

The values written in Table 2 are the values given by the two media experts after carrying out a series of validation activities the same as the material experts. During validation, each media expert validator assesses the e-book-based teaching materials developed for the three aspects, namely the display, presentation, and programming aspects (image display, font/writing type/size, use of color, use of language, use of animation, and practicality). After the assessment in the first stage was completed, a discussion was held between the research team and the validator team for improvement. After the discussion was over, the researcher immediately revised the teaching materials according to the results of the discussion. On the aspect of the suitability of the material with the learning objectives, both validators have agreed, it's just that there is a change in the order of the teaching materials that must be replaced. On the aspects of the truth of concepts, the truth of facts, and teaching and learning activities, the validator suggests changing, replacing, and eliminating some words because they can lead to misunderstandings or doubts. For the image display aspect, there are several image replacements, because the existing images do not show the events that occurred, while these components are very important to explain the concept. As for the type/size of letters/writing, the use of color, and the use of language, there are also some things that need to be improved, for example the use of less contrasting colors on one side so that it is difficult to distinguish from the other side so that one must be replaced with a contrasting one, as well as with the use of the type/size of letters/writing on some slides it must be replaced because the size and type of the letters are too large and some are too small so that they are not compatible with the appearance of the device. For the use of language, there are also improvements because there is language that is too difficult for students to understand, so it is replaced with simpler language so that it is easier to understand.

Discussion

This research is a development research in the form of a tool for children with learning disabilities. The tools developed are adapted to the characteristics of children with learning disabilities, simpler, more detailed instructions to make it easier for children to operate, and are equipped with lots of pictures compared to writing. This is because children with learning disabilities have limitations in understanding a reading. Children with learning disabilities must learn gradually, unlike children in general (Andersson & Östergren, 2012; Florez et al., 2019). Their understanding of the material takes a long time. Therefore,

assistive technology is needed in helping children with disabilities such as children with learning disabilities (Huijsmans et al., 2020; Rapp et al., 2018). Many other studies on this matter have been carried out, such as in this research (Benmarrakchi et al., 2017; Bose & Heymann, 2020; Hansen & Wass, 2022; Kulkarni, 2018) which shows that assistive technology can provide assistance to facilitate children with disabilities or children with needs such as children with learning disabilities. Aids in the form of audio can be made simply through various applications, but still need to pay attention to aspects of the characteristics of students with learning disabilities (Lewandowski et al., 2016; Lindström & Lemons, 2021; Nees & Berry, 2013; Parr, 2012). Therefore, teachers must continue to develop their competencies through various trainings (Hukkelberg et al., 2019; Olokundun et al., 2018; Sharar & Nawab, 2020). This effort is in accordance with technological developments and as a form of responsibility in developing four 21st century skills, namely critical thinking and problem solving, creative and innovative, cooperative, and able to communicate well (Sahin, 2009; Turculeţ, 2015; Valtonen et al., 2021; Voinea & Pălăşan, 2014). In the end, everything that teachers do as well as of course parents, as well as the community cannot be separated from the role of the government with its support in learning (Fayomi et al., 2019; Herman & Shantz, 1983). Many studies on the benefits of assistive devices have been carried out with the same goal, namely realizing humane education, especially for those with various obstacles, one of which is learning disabilities in order to get proper and equal learning with other children (Cha et al., 1988; Fidan & Oztürk, 2015; Lersilp, 2016; Sahin, 2009). This research has an impact on the learning of students with barriers to aspects of learning difficulties (Steruska et al., 2019; Zhu & Mitcham, 2020). Research results can be used as a source in learning by making tools such as books simpler, using more detailed instructions. Aids in the form of this book also need to pay attention to the type of letters, completeness of pictures as a tool to motivate students to have more interest in the learning process. It is supported by previous study that found that children with learning disabilities had different characteristics from other children in general (Bjekić et al., 2014; Dardzińska-Głębocka & Zdrodowska, 2021). Moreover previous study also state the use of computers as a tool in the manufacture of teaching materials or learning tools can be encouraged by providing training to teachers as adults who have interactions in the classroom (Isaila & Nicolau, 2010; Stein et al., 2019; Wang et al., 2021). Through the research that has been done, it is hoped that all children will have the same service. And for recommendation the children should be given the understanding that e-books are not the only learning tool. The use of this application also needs to be watched out for because excessive use can have an impact on children's behavior which leads to gadget addiction. It is hoped that further research can develop e-books into other applications.

4. CONCLUSION

This research explore further the potential of software technology to provide tools for children with learning disabilities in the form of an e-book based on FlipHTML5. This FliHTML5-based e-book helps students understand the subject matter because it is equipped with pictures and instructions as well as a simple presentation of the material. E-books are developed with portable media or devices, such as mobile phones, tablets, laptops, PCs, and have a low learning curve. These teaching materials are designed to help children learn gradually into a series of activities which are divided into three levels of difficulty. The selection of simple basic colors and the use of real images have proven to be effective in keeping children focused on their activities. Children also understand the subject matter better. Although this FlipHTML5-based e-book can help, assistance from educators and parents is still needed.

5. ACKNOWLEDGMENTS

We would like to thank Dikti as a contributor in this research. This assistance in the form of grants is one of the government's efforts, especially the Ministry of Education in motivating lecturers to carry out their duties and responsibilities in the Tri Dharma of Higher Education. We also express our gratitude to all the leaders of Pakuan University and the Dean and staff. Hopefully the support provided can continue to motivate us in developing competencies to continue to carry out the duties of the Tri Dharma, especially in the fields of research and community service.

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