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Education on Scientific Literacy and *Pandhalungan* Culture through Arduino-Based 3D Up Book Learning Media for Deaf Children at SLBN Jember

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ABSTRACT

Learning media can help improve the quality of education. However, the limitations of learning media can cause problems in learning. The availability of learning media is also needed for children with special needs such as deaf children. The development of increasingly sophisticated technology can be utilized to create science and technology-based learning media. One of them uses the arduino-based 3D Up Book learning media for deaf children. In addition, it contains Pandhalungan culture as a way to introduce culture to students. This community service activity aims to determine the effectiveness of the arduino-based 3D Up Book learning media for deaf children and describe the responses of teachers and students to the PKM-PM program at SLBN Jember. The community service method used is Asset Based Community Development (ABCD) by utilizing the potential of the local community. The results of community service show that 3D Up Book media is effectively used in learning and gets a very interesting response from teachers and students.

Keywords: Deafness, Learning Media, Pandhalungan Culture.

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INTRODUCTION

Education is a long-term investment in human resources that has an influence on the sustainability of human civilization (Susilo and Sarkowi, 2018). In 2018, PISA results showed that students' abilities in science, math, and reading scored lower than the OECD average. The PISA results show that the average mathematics score of Indonesian students is 379, while the minimum PISA mathematics score is 489, so that the average score of Indonesian students' mathematics skills is low (Kamil et al., 2021) In this case, a solution is needed to realize quality education according to the 2030 Sustainable Development Goals (SDGs) agreement in science, mathematics, and reading skills (Rahayu & Suana, 2022). The cause of the low PISA results is that science learning that has been applied is still content-oriented without touching all aspects of science. In fact, one of the keys to success in facing the challenges of the 21st century is science literacy (Alam and Kunto, 2021).

Science literacy is the ability to use science knowledge, identify questions, and draw conclusions according to available evidence to understand and make decisions related to nature and changes in nature through human activities (Syofyan & Amir, 2019). The government has made various efforts to improve the quality of education in Indonesia, especially in the field of science. In fact, the efforts made are not only for children with normal abilities in general, but also for children with special needs, whether blind, deaf, disabled, and so on. Support in the form of the State's constitutional commitment to children with special needs has been guaranteed in Law Number 19 of 2011 concerning the Ratification of the Convention On The Rights Of Persons With Disabilities. One of the children with special needs is deaf children.

Deaf children are children who experience hearing loss so that they cannot hear sounds properly or even cannot hear sounds at all. This condition makes the learning strategy for deaf children different from normal children in general (Sari and Putro, 2021). Teaching deaf children can be done using visual learning media such as photos, videos, letter cards, sentence cards, and objects as props (Nofiaturrahmah, 2018). Learning media is a tool that can be used to assist teachers in delivering material so that it is easily understood by students (Wulandari et al., 2023). Picture media in learning can facilitate teachers in explaining material systematically and interestingly so that it is easier for deaf children to understand (Nurrita, 2018). Based on the results of interviews at one of the institutions for children with special needs in the Jember Regency area, Sekolah Luar Biasa Negeri (SLBN) Jember, teachers experience obstacles in delivering learning materials due to a lack of learning media. Then, science and technology-based learning media is also still lacking. Students have also not been introduced more deeply to the culture in the local area, namely Pandhalungan. So far, learning still focuses on improving communication, numeracy, and literacy. Science and technology-based learning media is also still lacking, especially subject matter that is still abstract and requires visualization. Therefore, it is necessary to have a learning media that can collaborate language, numbers, and pandhalungan culture for deaf children based on science and technology in abstract material to be explained. Learning carried out at SLBN Jember which was previously still focused on teacher explanations and learning companion books can become more innovative and creative learning so as to increase deaf children's understanding of science literacy, numeracy, culture and abstract material.

The rapid development of technology has also presented various innovations in almost all fields, including education. Collaboration between science and technology and education is a unity that can give birth to new innovations so that it can support the learning process. The collaboration of learning media for deaf children that is interesting and can describe something abstract to be more concrete based on science and technology is the 3D Up Book Solar System Based on Arduino. This learning media is equipped with 3 3D media including: Pop Up, Box Up, and Starbook. In addition, this media is also equipped with an arduino-based solar system prototype that is integrated with android devices and interactive games so that it is interesting and can increase the interest in learning and understanding of deaf children. Based on this description, a community service activity entitled "Science Literacy Education and Pandhalungan Culture Through Arduino-Based 3D Up Book Learning Media for Deaf Children at SLBN Jember" was carried out with the aim of knowing the effectiveness of the arduio-based 3D Up Book learning media for deaf children and describing the responses of teachers and students to the PKM-PM program at SLBN Jember.

METHOD

This community service uses the Asset Based Community Development (ABCD) method. ABCD is an alternative method of community empowerment that utilizes assets, namely the potential possessed by the community itself (Maulana, 2019). The stages of the implementation method describe in detail the program to be implemented from the initial stages to the preparation of the final report. Community service activities are carried out offline while still observing health protocols. The type of activity is learning assistance using arduino-based 3D Up Book media.

This community service was carried out at SLBN Jember which is located on Jalan dr. Subandi Gang Kenitu No. 56, Patrang District, Jember Regency. Several activities were carried out as follows: First, the preparation stage is the initial stage which includes observation, data collection, problem analysis, and approval of partner willingness. Data collection was carried out through literature studies on available information and direct interviews with partners related to the problems faced by SLBN Jember. After the data is collected, the next step is to analyze the priority problems of partners, namely the lack of learning media for deaf children based on culture and science and technology, then offer solutions to partners. Solution offering is done by explaining in detail the science and cultural literacy education program, so that it can establish cooperation as evidenced by the approval letter of partner willingness. Second, the implementation stage which includes preparation of tools and materials, making media, media validation by partners, preparation of guidebooks, training in media making and PKM-PM social media accounts, preparation of progress reports. Third, the evaluation stage is carried out as the final stage which aims to review the implementation of activities. Evaluation includes media success evaluation and media functional evaluation. Evaluation of product success is carried out to conclude the results of program implementation. In addition, at this evaluation stage, the final report was prepared. The stages are summarized as shown in Figure 1 below.

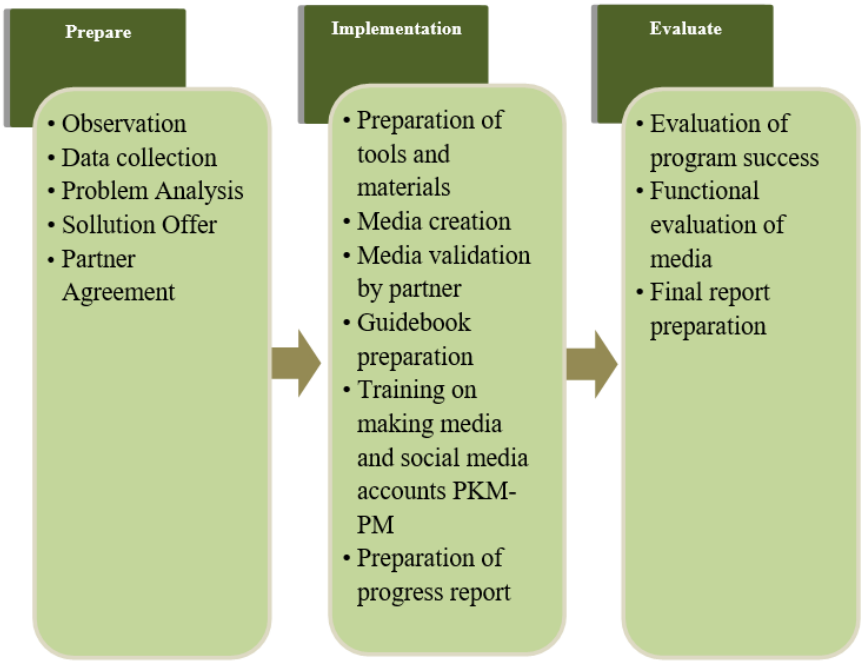

Figure 1. Activity Stages

Data analysis of community service results was obtained by giving test questions before and after the application of the media. The increase in student learning outcomes before and after the test is measured by looking at N-gain. The N-gain value can be calculated through the following equation:

$$N - gain = \frac{skor\ posttest - skor\ pretest}{SMI - skor\ postest} \quad \text{.....(1)}$$

Criteria for N-Gain scores as shown in Table 1 below.

Table 1. N-Gain Value Criteria

Nilai N-Gain	Interpretasi	Tingkat Efektivitas
N-Gain ≥ 0.70	Tinggi	Efektif
0.30<N-Gain0<0.70	Sedang	Cukup Efektif
N-Gain≤0.30	Rendah	Kurang Efektif

The assessment of teacher and student responses to the media was carried out through the distribution of questionnaires. The questionnaire was distributed during socialization and after the application of the media. The following analysis technique is carried out to analyze the total score of the assessment in the form of a percentage as shown in equation 2 below.

$$p = \frac{f}{n} 100\% \quad \text{.....(2)}$$

Description:
p = Percentage of assessment score
f = Score obtained

n = Maximum score (Ernawati, 2017)

Criteria for interpreting the attractiveness of the results of teacher and student responses as shown in Table 3 below.

Table 3. Criteria for Interpretation of Teacher and Learner Acceptability

Penilaian	Kriteria Interpretasi
81%≤p≤100%	Sangat Menarik
61%≤p≤80%	Menarik
41%≤p≤60%	Kurang Menarik
21%≤p≤40%	Tidak Menarik
0%≤p≤20%	Sangat Tidak Menarik

(Mushlihah *et al*., 2018)

RESULTS AND DISCUSSION

This community service activity was carried out for 2 months. The activity begins with making 3D Up Book media consisting of 4 media, namely Pop Up Book, Box Up Book, Star Book, and arduino-based solar system teaching aids. After all the media were made, then held a socialization to teachers before being applied to students. During the socialization, teachers filled out a teacher questionnaire. After that, the media implementation was carried out for 3 days with the division of pre-test, media implementation, and posttest.

The socialization and application of 3D up Book media activities were carried out for three days. The socialization of activities was held on September 15, 2023. This activity was attended by teachers at SLBN Jember. The purpose of this socialization activity is to introduce 3D Up Book media to teachers for learning science and Pandhalungan culture. At the socialization event, teachers were given a program guidebook containing the meaning and steps of using 3D Up Book media. This media socialization activity event was carried out by explaining the contents and how to use the 3D Up Book media. After giving an explanation of the material, discussion and question and answer activities were carried out related to the explanation of the 3D Up Book media that had been given. Teachers also filled out a response questionnaire for the 3D Up Book media which was used as data in this community service. Documentation of media socialization activities as shown in Figure 2 below.

Figure 2. Documentation of Media Socialization Activities

The application of the media was carried out for two days which was attended by deaf students and accompanied by the teacher. On the first day, it was held on September 18, 2023 with activities including: conducting pre-test and providing popup book and starbook media materials. The activities carried out were giving explanations of the material from each media, students reading the contents of the material, students playing the media, and questions and answers. The implementation of the second day of implementation activities was carried out on September 19, 2023 with activities including: providing box up book media materials and arduino-based solar system props, conducting post-tests, and filling out media response questionnaires by students. The second day was also the closing activity of the media application. Media implementation activities as shown in Figure 3, Figure 4, Figure 5 and Figure 6 below.

Figure 3. Application of Starbook Media (a) and Box Up Media (b)

Figure 3. Application of Pop Up-Book (a) and Solar System Tool based Arduino(b)

Pre-test dan Post-test pada siswa dilakukan untuk mengukur efek dan pengetahuan serta pengaruh dari media yang telah dibuat terhadap siswa. Pelaksanaan Pre-test dilakukan sebelum diberikan penjelasan materi dan post-test dilaksanakan setelah penerapan media. Berdasarkan pre-test dan post-test didapatkan hasil N-Gain dan N-Gain persen sebagaimana pada Tabel 3 berikut.

Table 3. Student Pre-test and Post-test Results

PRE-TEST	POST-TEST
50	90
30	70
50	80
70	90
60	90
30	100
30	100
80	100

80	100
90	100
90	100
70	90
70	100
40	90
40	90
30	70

Based on the results of the pre-test, the highest score obtained was 90 and the lowest was 30. The results of the post-test obtained the highest score of 100 and the lowest was 70. From the results of the pre-tet and post-test of students, the N-gain and N-gain percent values can be obtained using the formulas that are available. The N-gain and N-gain percentages are shown in Table 4 below.

Table 4. N-gain and N-gain percent results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_score	16	.57	1.00	.8308	.17313
Ngain_persen	16	57.14	100.00	83.0804	17.31254
Valid N (listwise)	16				

Based on Table 4, it can be seen that the average N-gain value obtained is 0.83. With an N-gain value > 0.70, the 3D Up Book learning media can be interpreted in the high category. Then the N-gain percent obtained a value of 83.08%, this shows that the 3D Up Book media is effective to be used in the learning process of students at SLBN Jember.

Data collection on student and teacher responses was carried out on Wednesday, September 20, 2023 after applying the 3D Up Book media. Based on student responses filled in by 16 children, it was found that the results of the student response questionnaire with an overall average of 89%. This means that the students' response to the 3D Up Book media with very interesting criteria. The highest value of student response was 96% and the lowest value was 84%. Based on the results of the teacher response which was attended by 11 people, it was found that the overall average of the teacher response questionnaire results was 83%. This shows that the teacher's response to the 3D Up Book media is very interesting. The highest response value obtained was 98% and the lowest was 60%. This is confirmed based on the results of interviews with teachers at SLBN Jember. "3D Up Book media is a unique new learning media because it has never been used before in this school and can be used as a support for science learning in the form of the solar system and Pandhalungan culture" said Mrs. Eti, one of the teachers at SLBN Jember.

Based on research conducted by Yusmar and Fadilah (2023) stated that from the data of PISA analysis results from 2014-2022 the science literacy of students is still relatively low and has never reached the standard score set by PISA. The factors causing the results of the analysis are science misconceptions by students, teachers not mastering science literacy, and inadequate infrastructure. Cultural literacy is the ability to understand and behave towards Indonesian culture used in society. (Pujiono & Sahayu,

2021). One of the cultures in Indonesia is Pandhalungan. The values of Pandhalungan culture can shape positive behavior for its people, so the introduction of Pandhalungan culture can be done in learning activities (Arrovia, 2021). This is in line with research Nuraini dkk (2023) that the utilization of local potential as a learning resource is needed in the learning process to improve students' knowledge and competence. Thus, the application of 3D Up Book media to students has an influence on students. Namely, an increase in science literacy and cultural recognition in Pandhalungan in students.

CONCLUSION

Based on the results of the research conducted, it is found that the 3D Up Book learning media has an interpretation greater than 0.7 and is included in the high category and is effective for use in learning. This media can be used for learning science and Pandhalungan culture for deaf children. In addition, the results of teacher and student responses to the media used obtained very interesting results. The average percentage result of the response questionnaire is 89% and the teacher is 83%.

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