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The Usability Testing of AR BACA-MV-SindD Courseware: Assessing Effectiveness Construct

Roslinda Ramli[1,*], Siti Zaharah Mohid[2], Sazanah Binti Md Ali Author[3], Hafiza Abas[4], Siti Fadzilah Mat Noor[5]

[1,2,3] Fakulti Multimedia Kreatif dan Komputeran, Universiti Islam Selangor, Bandar Seri Putra, 43000 Kajang, Selangor, Malaysia
[4] Faculty of Artificial Intelligence, Jalan Sultan Yahya Petra, Universiti Teknologi Malaysia, 54100 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur, Malaysia
[5] Pusat Kajian Teknologi dan Pengurusan Perisian, Fakulti Teknologi Sains Maklumat, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

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ABSTRACT

Usability testing is a method used to assess how effectively and efficiently users can interact with a product to achieve their goals. This process involves observing real users as they perform specific tasks, aiming to identify any usability issues and ensure the software meets user needs and expectations. Implementing usability testing is vital for enhancing the design, evaluation, and anticipation of user interactions with new technologies, particularly for learners with Down syndrome. This process ensures that educational tools are tailored to meet their unique needs and capabilities. Augmented Reality (AR) stands out as a promising technology in this context, as it seamlessly integrates digital elements with the physical environment, offering real-time, interactive, and three-dimensional experiences that can enhance learning engagement and comprehension. This study focuses on the usability testing of the Augmented Reality Basic Reading Courseware (AR BACA-MV-SindD), an AR-based prototype designed to facilitate basic reading skills in the Malay language for learners with Down syndrome. The AR BACA-MV-SindD was developed using augmented reality technology to introduce students with Down syndrome (DS) to a novel learning environment for acquiring basic reading skills in the Malay language. This study employed purposive sampling to select 15 participants from a school in Selangor, all of whom had no prior experience with augmented reality technology. Effectiveness was the primary construct employed to evaluate usability in this study. The findings revealed consistently high mean scores, indicating that AR BACA-MV-SindD holds promise as an effective learning strategy for enhancing basic reading skills among students with Down syndrome.

* *Corresponding author.*
E-mail address: roslinda@uis.edu.my

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1. Introduction

Down syndrome (DS) students are unique in comparison to normal students since they are different in various aspects, such as language, cognitive, personal and social characteristics, and motor as well as physical abilities [1]. Apart from having a shorter concentration span, DS children also have a lower level of motivation. In completing a given task, DS children would typically require more time to finish the task. Computer technology is capable of impacting students with learning disabilities at all levels of their study [2,3]. The use of multimedia applications will increase motivation and enhance learning as it they combine text, graphics, audio, video, and animation [4]. To date, many previous studies have discovered good feedback from students with learning disabilities when technology was used in their learning process [4,5]. Augmented reality (AR), which is the latest technology, has shown great potential and has been widely used in education to improve the learning experience of students [6]. According to Azuma and Ronald T [7], augmented reality is a combined interaction of reality and virtual objects inside an interactive environment, and it integrates things in three dimensions into the real world [8]. Therefore, an early reading educational software called Augmented Reality Basic Reading Courseware ("AR BACA-MV-SindD") was developed for students with Down syndrome disability to help them in learning to read. Nevertheless, the usability evaluation was carried out to make the courseware more effective.

This paper aims to discuss the use of usability evaluation on the effectiveness of the AR BACA-MV-SindD with students with Down syndrome on learning how to read. The usability of the AR BACA-MV-SindD was performed to observe the results of effectiveness on a sample of Down syndrome students as the participants. Only one Down syndrome student was selected since each Down syndrome student has unique and distinctive characteristics. This sample was involved as a case study in the development and usability of the courseware. The testing performed during the evaluation phase involved another sample of 14 Down syndrome students as the participants from an integrated school of students with learning disabilities. Due to the contraints of time, a truly effective educational application to cater for a group of special needs elementary students could not be developed. The Down syndrome student was suitable as the participant of this study since the courseware uses a user-centered software engineering methodology that makes the Down syndrome student an active user in the design and development process.

2. Literature Review

As discovered in the review of the literature, DS students have disabilities in terms of speech and language acquisition, cognitive (as mentioned earlier), fine and gross motor skills, and sensory perception and processing. In developing software for DS students, consideration must be made regarding their impairment problems. Therefore, usability must be considered when designing learning courseware. Hence, the researchers have applied usability testing on the "AR BACA-MV-SindD". As interface designers, their aim is to produce a system with good usability. The quality of a product can be determined based on its usability since the usability evaluation can be used to improve the interfaces [9,10], as well as to ensure the effectiveness of the courseware for the target users. According to Suryaman *et al.,* (2020) [11], the teacher must evaluate the effectiveness of students in the learning process for the latter to obtain optimal results [12].

Usability is related to quality. It is used to assess the software design process, as well as the ease of use of the interface design. Thus, usability is a significant factor in determining whether each software supports the outcome of the learning process [13]. Usability according to Agarwal *et al.,* (2002) [14], originated from the field of human computer interaction (HCI). Essentially, the usability

evaluation method can be divided into two types: with users and without users [15]. Between the two, usability testing that includes the users is more commonly known. The participants are selected as a representative of the product's user base, as well as being observed in performing tasks aimed at demonstrating the functionality of a product. Usability testing for user acceptance was carried out during the iterative development of "AR BACA-MV-SindD" in one sample of DS studied. Besides one target sample student as a case study, an additional sample of 14 DS students were also selected. To perform the usability testing, according to Nielsen and Jakob [16], the number of samples taken from 3 to 5 people is sufficient since the overall usability of as much as 80% may already be detected from only three testers. The use of a larger sample will not only prolong the testing process, but will also increase costs [14].

3. Methodology

3.1 The AR BACA-MV-SindD Courseware

The AR BACA-MV-SindD was developed as a teaching and learning aid in helping DS students to maintain their motivation during reading lessons. To achieve this goal, the functionality of ease of use for the courseware was designed. The study was conducted within the daily environment of the students' school life and consisted of five modules namely *Mendengar Cerita, Belajar Membaca, Baca Perkataan, Baca Faham Ayat and Belajar ABC* as shown in Figure 1. The students with DS used the AR BACA-MV-SindD courseware with AR learning environment that consisted of a computer notebook, a microphone, and a webcam camera.

In AR BACA-MV-SindD, learning takes place in the student's daily environment, as shown in Figure 2. AR BACA-MV-SindD integrates AR in the module of *Baca Faham Ayat* as depicted in Figure 3. Users have to interact with the system, for example holding the marker in front of a webcam to view virtual objects then rotate, tilt and shake the marker to view objects at different angles. Users can also zoom into and out from the virtual object by moving the marker closer or further away from the camera. The AR BACA-MV-SindD used markers printed on a hard paper as a tangible interface that serve as a physical handler in interacting with a virtual object in AR environments. Using AR technology, users can interact with the virtual objects as they would with an object in the real world. This provides a natural and intuitive mechanism to view and understand potentially complex three-dimensional objects.

The learning environment produced through the use of AR technology is different from computer-based educational applications such as conventional multimedia. Therefore, to examine whether the developed educational application can meet the needs of elementary students with DS, a summative assessment through usability testing was implemented. An evaluation was conducted with one student with DS. The AR BACA-MV-SindD was developed after considering the needs and problems of this particular student. Usability testing was conducted to obtain feedback about the effectiveness of the courseware. Additional evaluations were performed with 14 more students with DS from Sekolah Kebangsaan Jalan 6, Bandar Baru Bangi, Selangor. All students had limited reading skills with mild intellectual disabilities.

Fig. 1. Main menu

Fig. 2. Module of "Belajar Membaca"

Fig. 3. Module of "Baca Faham Perkataan"

3.2 The Usability Evaluation of AR BACA-MV-SindD

This paper focuses on the usability evaluation of AR BACA-MV-Sind, which is performed at the end of its development. It is also called as summative evaluation. The aspect assessed at this stage was the effectiveness of the application. The usability testing of the effectiveness construct was performed on the target student with DS under study, and also fourteen (14) other elementary school students.

3.3 Research Instrument

The usability evaluation data of the AR BACA-MV-SindD were collected using instruments that included modules consisting of Mendengar Cerita, Belajar Membaca, Baca Perkataan, Baca Faham Ayat and Belajar ABC, a schedule of interviews, a checklist, and video and screen recording. This courseware was developed using a web-based environment. In this study, the specifications of the hardware are AR markers, webcam and multimedia computer. Figure 4 shows the AR marker as a paddle.

Fig. 4. Marker in the form of a paddle

A summative assessment based on the usability testing of the AR BACA-MV-SindD application was made based on the effectiveness construct of the application as evaluated by the elementary students. To determine the effectiveness of the AR BACA-MV-SindD educational application in the learning process, a pre-test-based semi-experimental research method, prior to the use of the AR BACA-MV-SindD application, and a post-test, after the use of the AR BACA-MV-SindD application, were implemented.

3.4 Data Collection

A summative assessment based on usability testing was conducted using a purposive sampling procedure. The respondents had the same background in terms of basic knowledge related to basic reading in Malay language. The summative evaluation was performed based on the usability testing of one (1) elementary school student with DS involved in the detailed design and development process of the application. It also involved fourteen (14) other elementary school students with DS, who were only involved in the implementation and evaluation process. The quantitative data from the items in the instrument were descriptively analyzed using the SPSS software. To determine the effectiveness of the AR BACA-MV-SindD application, the differences between the pre- and post-scores in using the AR BACA-MV-SindD application were analyzed.

4. Findings and Discussion

This section discusses the findings of the usability testing of the AR BACA-MV-SindD educational application. The data were used for the purpose of analyzing the descriptive information using the SPSS 20.0 software. In particular, the evaluation testing for the AR BACA-MV-SindD educational application was implemented in a partial experimental method. A total of fifteen (15) respondents consisting of seven (7) male elementary students with DS and eight (8) female elementary students with DS were involved in usability testing of the AR BACA-MV-SindD educational application. The age range is between 9 to 12 years old. A flow chart showing the analysis of the evaluation data of the effectiveness construct is shown in Figure 5. First, the elementary students answered a set of pre-test questions. Upon completion of answering the pre-test questions, a set of post-test questions was administered. The post-test was administered to one (1) elementary school student who was involved in the detailed process of the design and development of the application, and to fourteen (14) other elementary school students after they received the information and guidance on how the

educational application was used. The participants were given time to try out the AR BACA-MV-SindD educational application for 30 minutes, then they were given time to use the application for the purpose of learning basic reading for three (3) months. Upon completing the three-month usage, the elementary students were engaged in testing the usability of the AR educational application. Next, a debriefing process was conducted in determining the satisfaction of the elementary students towards the application. The completion of the pre- and post-test process was made within three (3) months.

The usability testing questionnaire instrument (SSK AR BACA-MV-SindD) was used as the main instrument to assess the usability of the AR BACA-MV-SindD educational application. The AR BACA-MV-SindD application usability testing instrument utilized the 5-level Likert scale, with 'Strongly Disagree' (SD = scale 1), 'Disagree' (D = scale 2), 'Not Sure' (NS= scale 3), 'Agree' (A= scale 4), and 'Strongly Agree' (SA = scale 5). The instrument consisted of five (5) constructs and 21 items, which are interface (5 items), interaction (4 items), effectiveness (4 items), learnability (5 items), and attitude (3 items).

The content validity of the questionnaire as the test instrument was evaluated by a panel of experts that included five (5) people in the related fields. Based on the comments and feedback from the panel of experts, some editing and improvements were made to the instrument. Table 1 illustrates the content validity assessment of the AR BACA-MV-SindD educational application usability testing based on five (5) constructs. The data analysis was obtained from the Questionnaire instrument for Usability Testing (SPK-AR BACA-MV-SindD).

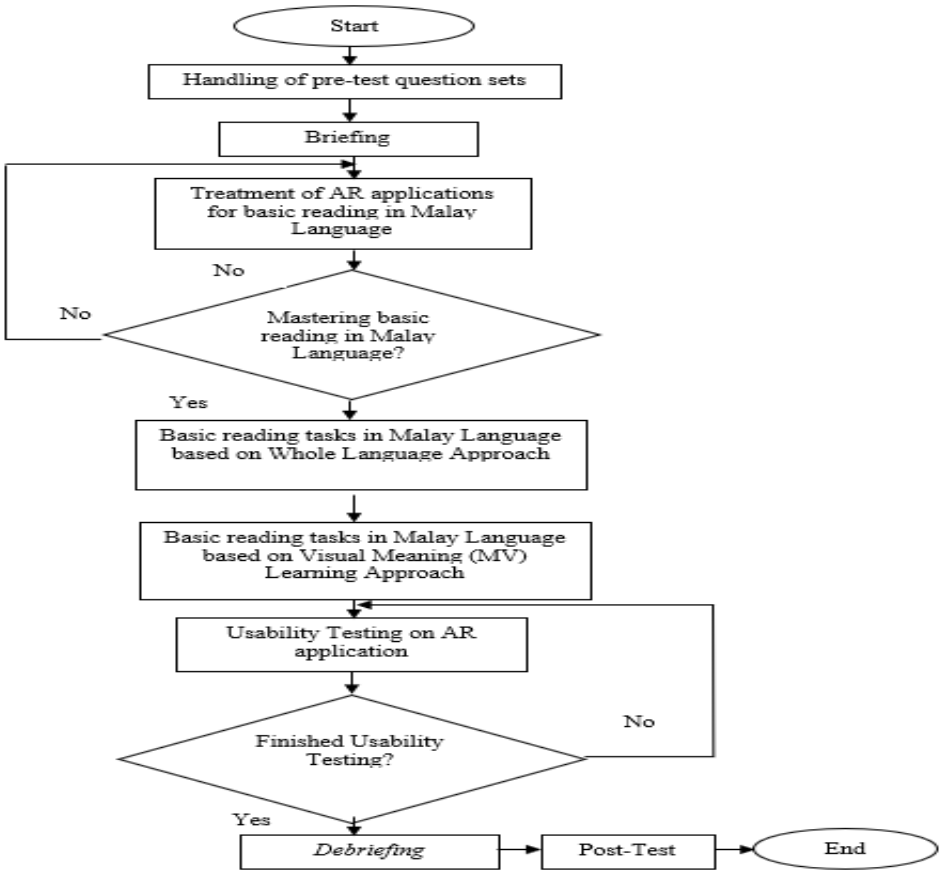

Fig. 5. Usability testing flowchart for AR BACA-MV-SindD application

Table 1
Example of content validity assessment based on the constructs in the AR BACA-MV-SindD usability assessment questionnaire instrument

No	Aspect	Comment/Suggestion	Amendment
1.	Interface	Put more exit buttons.	An exit button was placed on each screen.
2.	Interaction	The last screen cannot be connected to the main menu.	Has been corrected.
3.	Attitude	The content of this application is suitable, fits the same aspects in the interface.	Has been corrected.

4.1 Usability Testing: Effectiveness Construct

Usability testing for the effectiveness construct was performed to evaluate the effectiveness of using the AR technology and the visual meaning learning approaches in developing the AR BACA-MV-SindD educational application. The effectiveness testing was conducted based on a case study through partial experiments, using a set of pre- and post-test questions, as well as the usability questionnaire instrument (SPK-AR BACA-MV-SindD) for the effectiveness construct, was conducted on the one (1) elementary student (DSa) who was actively involved in the design and development process of the application, as well as fourteen (14) other SD students. The AR BACA-MV-SindD effectiveness construct was measured based on four items in the usability questionnaire (SPK-AR BACA-MV-SindD) conducted on the sample of elementary student, as well as fourteen other elementary students. The findings of the study can be seen in Table 2 and Table 3.

Table 2
Example of content validity assessment based on the constructs in the AR BACA-MV-SindD usability assessment questionnaire instrument

Item	1 SD (%)	2 D (%)	3 NS (%)	4 A (%)	5 SA (%)	Mean
Students know and are able to complete tasks	0 0	0 0	0 0	0 0	1 100	5.00
The use of AR and multimedia technology helps students' understanding	0 0	0 0	0 0	0 0	1 100	5.00
3D AR objects can help engage students to learn	0	0	0	0	1	5.00
The displayed text in color helps students to recognize the words as they read	0 0	0 0	0 0	0 0	100 1	5.00
	0	0	0	0	100	5.00
Total percentage	0	0	0	0	100	5.00
1-Strongly Disagree (SD), 2-Disagree (D), 3-Not Sure (NS), 4-Agree (A), 5-Strongly Agree (SA)						

Table 3
Descriptive analysis of usability testing of the AR BACA-MV-SindD application based on the effectiveness construct for other fourteen (14) Down syndrome students

Item	1 SD (%)	2 D (%)	3 NS (%)	4 A (%)	5 SA (%)	Mean
Students know and are able to complete tasks	0 0	0 0	2 14.3	4 28.6	8 57.1	4.43
The use of AR and multimedia technology helps students' understanding	0 0	0 0	2 14.3	6 42.9	6 42.9	4.29
3D AR objects can help engage students to learn	0	0	0	4	10	

The displayed text in color helps students to recognize the words as they read	0 0	0 0	0 3	28.6 5	71.4 6	4.71
	0	0	21.4	35.7	42.9	4.21
Total percentage	0	0	12.5	33.9	53.6	4.41
1-Strongly Disagree (SD), 2-Disagree (D), 3-Not Sure (NS), 4-Agree (A), 5-Strongly Agree (SA)						

Based on Table 2, the findings of the study show that the DS student who were actively involved in the design and development process of the application (DSa) can use and learn the AR BACA-MV-SindD application effectively based on an overall percentage of 100%. Thus, the findings of the study show that the AR BACA-MV-SindD educational application that was developed based on the AR technology and visual meaning learning approach was found to be effective for one DS student based on the overall mean score of 5.00. Based on Table 3, the findings of the study show that fourteen (14) other DS students (53.6%) demonstrated the effectiveness of the AR BACA-MV-SindD application. Thus, the results of the study show that the educational application of the AR BACA-MV-SindD that was developed based on the AR technology and visual meaning learning approach (VM) was effective for fourteen (14) other DS students based on the overall mean score of 4.41.

To test the effectiveness of the AR BACA-MV-SindD educational application based on the learning improvement of one DS student or DSa and fourteen (14) other DS students, a one-group pre-test-post semi-experimental method was implemented. Effectiveness testing was performed only on one group of students, without using a control group. The pre-test was conducted on a group that was then treated using the AR BACA-MV-SindD educational application. Next, post-test was performed on the same group to obtain the difference in score achievement in the two tests. The One Group-based Pre-Test Post-Test design was used in this study because the differences in the knowledge of elementary students before and after using the application against the same group of students could be assessed more fairly. The set of questions in the pre- and post-tests are equivalent in terms of their level of difficulty, covering the basics of reading and equivalent activities, as well as those presented in the AR BACA-MV-SindD educational application modules. The pre-test and post-test question sets consisted of 17 questions with a total score of 100 marks. The pattern and level of questions between the two sets of questions are not much different. The pre-test was completed by the elementary students before using the AR BACA-MV-SindD application. Meanwhile, the post-test was conducted after the elementary students went through learning sessions using the AR BACA-MV-SindD application.

Table 4 shows the results of the pre-test and post-test scores, as well as the increase or decrease of percentage in scores for the DS student who was actively involved in the design and development process of the application (DSa). Figure 7, on the other hand, shows the findings for fourteen (14) other elementary school students with DS. The differences in the scores between the pre-test and the post-test can be seen in the table under the heading of improvement, representing the level of achievement of the elementary students.

Table 4
The results of effectiveness testing for DSa student

Module	Pre-test (percentage %)	Post-test (percentage %)	Improvement (percentage %)
Mendengar Cerita	30	70	40
Belajar Membaca	40	80	40
Baca Perkataan	35	100	65
Baca Faham Ayat	35	75	40
Belajar ABC	35	80	45
Maximum value			65

Overall, Table 4 shows the target of one DS student showing an increase in scores in questions related to the AR BACA-MV-SindD educational application modules. The percentage of marks obtained by the single student based on the post-test is 70% and above, and exceeded the marks of the modules in the pre-test. 100% marks were successfully obtained by the DS student in questions related to the *Baca Perkataan* module. Hence, the single DS student has successfully developed learning outcomes to recognize easily identifiable words by using the educational application of AR BACA-MV-SindD. This is the basic reading skill that elementary students need to acquire. The findings of the study also illustrate that the incorporation of multimedia-fusion material processing measures, AR technology, application of the Whole Language Philosophy approach, visual meaning learning approach (VM), and elementary students' learning measures as proposed by Oelwein and Patricia Logan [17] and, Broun and Leslie Todd [18] have successfully helped the single DS student in learning basic reading effectively.

The findings of the study also show that a significant increase of 65% was obtained based on questions related to the Baca Faham Perkataan module. This is because, the module comprehensively implemented coaching strategies (scaffolding), errorless learning, and visual meaning learning (VM) approaches that facilitated the elementary students' learning process. This module provided a meaningful and effective experience where the elementary students had to be active and think while performing each activity and exercise in the module. The training and experience had successfully helped and supported the elementary students in solving problems when the post-test was implemented.

Figure 7 shows the findings of the usability testing: effectiveness construct on fourteen (14) other DS students with representations from DS1 to DS14. The table shows the scores of the pre- and post-tests, and the difference in scores (improvement) of the tests. There was improvement in the basic reading literacy achievement of the elementary school students when compared to the pre- and post-tests after they gained experience using the AR BACA-MV-SindD educational application. The findings of the study show an average significant improvement for fourteen (14) elementary school students in the Baca Perkataan module with 52.14. If a comparison is made between Tables 5 and 6, it is shown that one SD student (DS3, DS4, DS5 and DS6) showed higher pre-test scores than a single DS (DSa) student with 35% for questions related to the Mendengar Cerita module. DS students (DS6, DS10) showed the same pre-test scores as the single student (SDa) with 40% for questions related to the Belajar Membaca module. Next, DS students (DS3, DS6, DS7 and DS10) obtained the same pre-test scores as the single student (DSa) at 35% for the Baca Faham Perkataan module.

Furthermore, it can be observed that the DS student (DS11) obtained a higher score than the single DS student (DSa) with 40% for the Baca Faham Ayat module. The DS students (DS6 and DS10), on the other hand, obtained the same pre-test scores as the single DS student (DSa) of 35% for questions related to the Baca Faham Ayat module. Only six DS students (DS1, DS2, DS8, DS9, DS13 and DS14) have not obtained the same or higher percentage of marks than the single DS student (DSa) for all questions related to all modules in the AR BACA-MV-SindD application.

Figure 7 shows the findings of the difference in the percentage of the scores for the pre-test and post-test for questions related to the five (5) AR BACA-MV-SindD application modules, namely the module of *Mendengar Cerita*, module of *Belajar Membaca*, module of *Baca Faham Perkataan*, module of *Baca Faham Ayat* and module of *Belajar ABC*. Overall, the findings of the study show that fourteen (14) elementary school students showed a high improvement in solving questions related to the module of Baca Faham Perkataan, with an average score increase of 52.14%, and a maximum score increase of 65% compared to questions related to other modules. This illustrates that the findings of the study for fourteen (14) DS students are the same as the findings of the study for the single DS student (DSa) where both showed a high percentage increase in marks in the questions

related to the module of *Baca Faham Perkataan*. Next, the wilcoxon test based on the partial experimental design of a Group Post-Test Pre-Test was implemented as can be seen in Figure 6. The wilcoxon test was used to analyzed the two data to determine the existence of a difference between them.

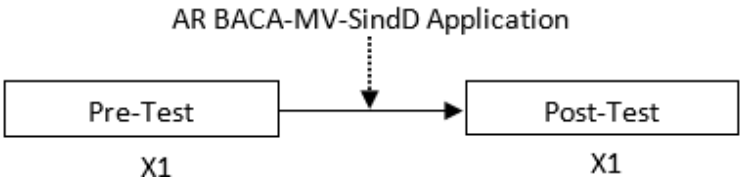

Fig. 6. The findings of the effectiveness test for the single DS student (DSa)

Based on the analysis, the Wilcoxon test was performed with a pre-mean of 28.0%, and a post-mean of 58.33%. The findings from Table 5 of the Wilcoxon Signed Rank Test Output, then the value of Z is found to be -3.431 with a significant value of 2-tails, the value of p is p <0.005, which is p = 0.001. These findings indicate that the mean values between the pre-test and the post-test are significantly different. This indicates that the findings of the hypothesis rejected H0, or there is a significant increase in achievement between the pre-test and post-test for the elementary students after using the AR BACA-MV-SindD application.

SD student	Module	Pre Test (percentage %)	Post Test (percentage %)	Improvement (percentage %)
SD1	Mendengar Cerita	20	55	35
	Belajar Membaca	30	70	40
	Baca Perkataan	25	70	45
	Baca Faham Ayat	20	60	55
	Belajar ABC	20	60	40
SD2	Mendengar Cerita	30	50	20
	Belajar Membaca	25	65	55
	Baca Perkataan	20	80	60
	Baca Faham Ayat	15	70	55
	Belajar ABC	20	60	40
SD3	Mendengar Cerita	35	60	25
	Belajar Membaca	25	75	50
	Baca Perkataan	35	90	65
	Baca Faham Ayat	20	80	60
	Belajar ABC	20	60	40
SD4	Mendengar Cerita	35	55	20
	Belajar Membaca	25	70	45
	Baca Perkataan	15	65	50
	Baca Faham Ayat	15	65	50
	Belajar ABC	20	65	45
SD5	Mendengar Cerita	35	60	25
	Belajar Membaca	25	80	55
	Baca Perkataan	20	65	45
	Baca Faham Ayat	10	55	45
	Belajar ABC	20	60	40
SD6	Mendengar Cerita	35	60	25
	Belajar Membaca	40	70	30
	Baca Perkataan	35	90	55
	Baca Faham Ayat	35	75	40
	Belajar ABC	30	60	30
SD7	Mendengar Cerita	30	70	40
	Belajar Membaca	30	70	40
	Baca Perkataan	35	100	65
	Baca Faham Ayat	20	60	40
	Belajar ABC	15	55	40
SD8	Mendengar Cerita	20	60	40
	Belajar Membaca	20	60	40
	Baca Perkataan	30	70	40
	Baca Faham Ayat	30	50	20
	Belajar ABC	30	60	30
SD9	Mendengar Cerita	15	60	45
	Belajar Membaca	30	55	25
	Baca Perkataan	30	75	45
	Baca Faham Ayat	25	50	25
	Belajar ABC	20	50	30
SD10	Mendengar Cerita	35	60	25
	Belajar Membaca	40	70	30
	Baca Perkataan	35	90	55
	Baca Faham Ayat	35	75	40
	Belajar ABC	30	60	30
SD11	Mendengar Cerita	30	70	40
	Belajar Membaca	30	70	40
	Baca Perkataan	30	90	60
	Baca Faham Ayat	40	80	40
	Belajar ABC	30	60	30
SD12	Mendengar Cerita	35	55	20
	Belajar Membaca	25	70	45
	Baca Perkataan	15	65	50
	Baca Faham Ayat	15	65	50
	Belajar ABC	20	65	45
SD13	Mendengar Cerita	15	50	35
	Belajar Membaca	20	60	40
	Baca Perkataan	25	70	45
	Baca Faham Ayat	25	50	25
	Belajar ABC	20	55	35
SD14	Mendengar Cerita	20	60	40
	Belajar Membaca	30	70	40
	Baca Perkataan	25	70	45
	Baca Faham Ayat	20	60	55
	Belajar ABC	20	60	40
Average SD1-SD14	Mendengar Cerita	28.9	63.6	31.07
	Belajar Membaca	28.2	68.2	41.43
	Baca Perkataan	26.8	77.9	52.14
	Baca Faham Ayat	23.2	63.9	42.86
	Belajar ABC	22.5	59.3	36.79

Fig. 7. The findings of effectiveness testing for fourteen (14) other elementary students

Table 5
Wilcoxon signed rank test output

Test Statistics[a]	
	pasca1 - pra1
Z	-3.431[b]
Asymp. Sig. (2-tailed)	.001

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks

5. Conclusions

The AR BACA-MV-SindD was developed using the augmented reality technology to provide DS students with the exposure to new environment in learning basic reading in the Malay language. To ascertain the AR BACA-MV-SindD's efficacy for DS students, usability testing was conducted. In conclusion, the findings show that DS students can learn by using the AR technology, which can create effective learning and motivate the students in learning basic reading, as shown in the improvement in performance of the pre- and post-tests. By using the AR BACA-MV-SindD, DS students can learn and repeat their lessons visually and effectively based on their cognitive capability. The AR BACA-MV-SindD has considered all the requirements of the DS students in fulfilling their specific learning needs.

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