Usability Evaluation of English Learning Application Base on Augmented Reality Using ISO 9241

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Abstract. Augmented Reality (AR) technology is one of the educational applications that may be created. AR is a learning tool that may be used to integrate virtual things or objects into a natural environment to engage in real-time. *English* is a foreign language that must be learnt. For language assistance, pupils must acquire a sufficient command of vocabulary via reading and listening exercises. Two factors contribute to the ineffectiveness of oral communication: pupils who do not have enough vocabulary knowledge and students who do not know how to employ vocabulary non their spoken language. One of the learning media that has been developed is the AR-based English vocabulary learning application which was developed in early April 2020 to September 2020. This application aims to help elementary school students (6-12 years) in learning English vocabulary. Where in the current learning which is due to the pandemic thus making distance learning. The purpose of this study is to measure the usability of the application whose vocabulary has been developed from three aspects, namely effectiveness, efficiency and user satisfaction (ISO 9241). The results of the research conducted show that the usability level of this application is 89% effectiveness, 94% efficiency and 91% user satisfaction. So that this learning application can be said to have good usability and can be used as a supporting medium for learning English vocabulary for children aged 6-12 years independently.

1   Introduction

The impact of the Corona virus disease 2019 (Covid-19) pandemic is currently beginning to permeate the education sector [1]. The effect of the expansion of Covid-19 on the global economy is beginning to wane, but it is now being felt in the education sector. By banning all educational activities, several nations, including Indonesia, have compelled the government and relevant organizations to provide alternate educational processes for students who cannot complete the educational process in educational institutions. Previously offline learning processes in schools have become online. The epidemic of COVID-19 has cleared the way for the implementation of digital learning [2]. Online learning is a type of education with comparatively reduced expenditures,

including transportation, lodging, and the total cost of institution-based education [3]. This makes internet education accessible even in distant and rural locations.

Media-based instruction may significantly outperform textbook-based instruction in enhancing students' skills [4]. In previous research, the author has developed an Augmented Reality (AR)-based learning media to help learn English independently [5], especially when online learning requires students to be able to learn more independently from home. Augmented Reality (AR) is a technology that enables computer visuals to be shown in the actual world, with the interface allowing the user to see the real world. At the same time, virtual representations are superimposed over real places and items [6]. Users may see the augmented reality interface as a real-world item on a portable monitor or head-mounted display (HMD). Invisibility and Monitor-based displays are the two primary kinds of displays utilized in augmented reality. Principal augmented reality equipment includes displays, computers, input and tracking devices [7].

AR technology may be employed in learning media applications for youngsters since it can enhance their information perception and comprehension [8]. Age and interaction approach should be the primary factors when building learning apps for youngsters [9]. Usability is one method for evaluating the interaction between users and the system. Usability is the extent to which defined users may utilize a product to accomplish given objectives with effectiveness, efficiency, and satisfaction in a specified context [10]. If an application is highly usable, user happiness, the program's efficacy, and efficiency will all grow concurrently [11]. The purpose of usability assessment is to determine how simple the user application interface is to utilize [12]. The objective of usability assessment is to examine the scope and degree of accessibility of a system's functionalities, evaluate the user experience, and identify system-specific issues [13]. The usability of an application or piece of software is determined by how successfully it can be used by certain people, with specific assistance, to do specific activities in a specific context [14]. Very few studies have examined the efficacy of augmented reality (AR) apps for teaching English to children, particularly kindergarteners [15]. In contrast, most research has been conducted in primary schools and colleges [16]. The following research issues are addressed in this study:

RQ1: What usability issues do children experience when using AR-based English learning apps?

RQ2: What is the preferred usability principle for developing AR-based English learning media for kindergarten education?

There are several ways to evaluate usability [17], including heuristic assessment [18], questionnaire [19], empirical testing [20], and others. A questionnaire is one method for determining the degree of usefulness of an application product. According to ISO 9241-11 [10], three dimensions of usability must be measured: effectiveness, efficiency, and user pleasure. In this research, a matrix based on these three factors is utilized to assess the usefulness of the English vocabulary card learning application.

2. Research Method
2.1 English Learning Application Base on Augmented Reality (AR)

English learning application based Augmented Reality (AR) is an application that have been developed are basic vocabulary consisting of nouns, animals, and fruits. This application has been developed in previous research which aims to help facilitate learning English vocabulary [5]. Natural objects and noises will be shown in the

learning materials, making it simpler for pupils to acquire and comprehend English terminology orally and in writing. Figure 1 depicts the primary menu and interfaces for the English vocabulary card learning system.
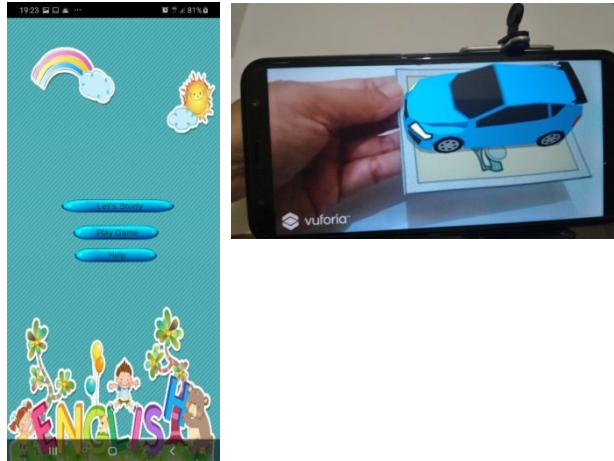

Figure 1. Main menu and display of the english vocabulary card learning

The purpose of the AR-based English vocabulary card learning application is to make it easier for students to learn the beginnings of English which the application can bring virtual objects to the real world with AR technology. In addition, the application also adds a sound spelling of vocabulary correctly and is equipped with a game game that is tailored to its users, is elementary school students.

2.2 Method

The author conducted a questionnaire survey in October 2020. The research targets are students with an educational background at elementary school level. This research measures usability in four steps: (1) determining the context of usage, (2) measuring usability in choosing criteria and context, (3) assessing usability, and (4) conclusions. Figure 2 depicts this investigational process.

At the stage of identifying the context of use, the researcher identified users of the AR-based English vocabulary card learning application that was focused on children aged 6-12 years. In addition, the researcher selects the criteria and setting for measuring the usability elements. Based on ISO 9241[10], there are 3 aspects that are measured, namely effectiveness, efficiency and user satisfaction. The following is the definition of each aspect based on ISO 9241[10]:

a. *Effectiveness* is the precision and thoroughness with which users accomplish their objectives.
b. The proportion of employed resources to the precision and thoroughness with which users accomplish their objectives.
c. Satisfaction is the absence of pain and a favorable attitude toward the product's usage.

The candidate items used as questionnaires were taken from ISO 9241which can be seen in Table 1, which has been modified by the researcher without reducing the

three elements of these aspects. The author employs four metrics to evaluate the four dimensions of usability (effectiveness, efficiency, satisfaction, and usability).

Table 1. 3 Usability aspects base on ISO 9241

| No	Items
	Effectiveness
Q1	This application helps me in learning English vocabulary
Q2	I think this application has features suitable for learning English vocabulary
Q3	When using this application in learning English vocabulary, I don't need another application
Q4	All flipcards work properly when used
	Efficiency
Q5	I am learning English vocabulary faster using this application
Q6	Bookmarked flipcards can be displayed quickly
Q7	Sounds in the application can function properly
Q8	I easily use this application to learn English vocabulary
	Satisfaction
Q9	This system is fun to use
Q10	I want to use this application to help learn English vocabulary
Q11	I would prefer this application to learn English vocabulary
Q12	This app works according to my expectations
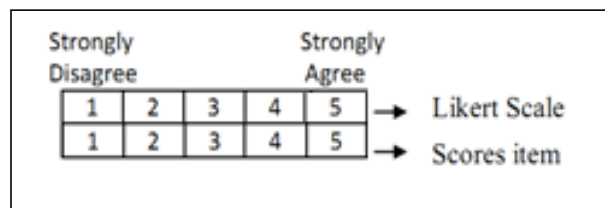
Figure 3. Schematic score questionnaire

After determining the measured usability aspects (effectiveness, efficiency, and satisfaction), the next step is to evaluate the usability of AR-based English vocabulary card learning by distributing questionnaires to 25 participants aged 6-12 years. The questionnaire used can be seen in Table 1. The questionnaire with 12 Likert scale questions (ranging from 1 to 5) was used for subjective evaluation of the application's perceived usefulness (usability). A score of 1 corresponds to "Strongly disagree," while a score of 5 corresponds to "Strongly agree." The questionnaire results will be examined to assess the usefulness of the learning application in terms of efficacy, efficiency, user happiness, and usability. The calculated score ranges from 0-100 (which is the average per item).

3 Results And Discussion

Evaluation of the usability of an application product is very important to ensure whether the product meets the design specifications and user requirements

criteria [21]. Usability evaluation used is a questionnaire based on ISO 9241. Questionnaires were distributed to children aged 6-12 years, by taking a sample of 25 participants. Participants will try to carry out the English learning process independently using the application, then fill out a questionnaire according to the user's experience. Table 2 is the result of the questionnaire data calculation.

Table 2. Result usability evaluation english learning application base on AR

Participants	Items											
	Effectiveness				Efficiency				Satisfaction			
	1	2	3	4	5	6	7	8	9	10	11	12
1	5	4	4	5	4	5	5	5	5	5	4	5
2	5	4	4	5	4	5	5	5	4	5	4	5
3	5	4	4	5	5	4	5	4	4	5	4	5
4	5	5	5	5	5	5	5	5	4	5	4	5
5	5	4	3	5	4	5	5	4	4	5	4	5
6	5	5	4	5	5	5	5	5	5	5	4	5
7	5	4	4	5	5	4	5	5	4	4	5	5
8	4	4	4	5	5	5	5	5	5	5	4	4
9	5	4	5	5	5	4	5	5	5	4	4	5
10	5	4	4	5	4	5	4	5	5	5	4	5
11	4	5	4	5	4	5	4	4	4	4	5	4
12	5	4	4	5	4	5	5	5	5	5	5	4
13	5	4	3	5	5	4	5	5	4	5	5	4
14	5	4	4	4	4	5	5	5	5	5	5	5
15	4	4	4	5	5	4	4	5	5	4	4	5
16	4	5	4	5	5	5	4	5	4	5	4	5
17	4	5	4	3	4	5	4	5	4	5	4	4
18	5	5	4	5	4	5	4	5	5	4	5	5
19	5	4	4	5	5	5	5	5	4	5	5	4
20	5	4	4	5	5	5	4	5	4	5	4	4
21	5	4	4	4	5	4	5	4	5	5	4	4
22	5	5	4	4	5	5	4	4	5	5	5	5
23	4	4	5	4	4	5	5	5	4	5	5	4
24	5	5	4	5	5	5	5	4	4	5	4	4
25	4	4	4	4	5	5	4	5	5	4	4	5
Σ Score Item	118	108	101	118	115	119	116	119	112	119	109	115
average score each item	94	86	81	94	92	95	93	95	90	95	87	92

Participants	Items											
	Effectiveness				Efficiency				Satisfaction			
	1	2	3	4	5	6	7	8	9	10	11	12
average score each aspect		89					94				91	

Three components of evaluation based on ISO 9241 are used to evaluate its usefulness. Figure 5 shows the findings of each of the usability characteristics. According to the computation of the average score of usability assessment using ISO 9241, the efficiency aspect received the highest score, a 94. While the efficacy element obtained the lowest score namely 89, the findings of the evaluation of the other three factors of usability may be described as good.

Table 2 displays the findings of the overall evaluation of respondents. The following are the findings of each aspect's evaluation:

a. The measurement value for the aspect of effectiveness 89. This shows that the AR-based English learning application is very capable of meeting user needs.
b. The measurement value for the efficiency aspect is 94. This shows that the AR-based English learning application is very efficient so it can save time and make it easier to learn English vocabulary.
c. The measurement value for the satisfaction aspect is 91. This indicates that the AR-based English learning application is very satisfying.

3.1. Construct Effectiveness

The question focused on construct usability concentrating on effectiveness which refers to the fact that users believe that learning English application vocabulary can increase its effectiveness especially in this case for children aged 6-12 years. The results showed that this application really helps students in understanding and learning English vocabulary at an early stage, both in terms of pronunciation and writing. The Q1, Q2, Q3, and Q4 indicate the number of questions for each concept, as given in Table 1. In Q1, all students concur wholeheartedly that this application is simple to understand and use. As we can see, they are happy to access using this application because the objects look real. For Q2, an average of 86% of students thought that this application has good features in learning vocabulary. In addition to having vocabulary features in the form of 3D objects and correct pronunciation, this application also has a game feature so that it can attract students' interest when learning English vocabulary at an early stage. On average, 81% of students think that using this application has complemented their needs in learning basic English vocabulary, so they do not need other applications to complete learning. For Q4, an average of 94% of students thought that all the flip cards totaling 70 vocabularies could function properly when a marker was used to bring up 3D objects and correct pronunciation of vocabulary in English. The results of the questionnaire scores for Q1, Q2, Q3, and Q4 are as shown in Figure 4.
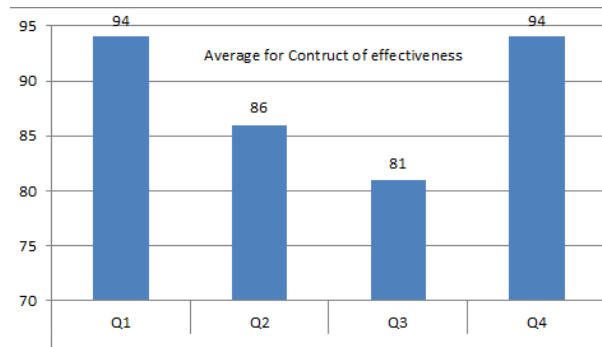
Figure 4. Average for construct of efectiveness

3.2 Construct Efficiency

The second construct is the efficiency construction and refers to Table 1. They believe that learning vocabulary through AR-based English vocabulary learning applications can save time in understanding vocabulary pronunciation and writing correctly. For the first question or Q5, on average they learn English vocabulary faster using this application. So that the display of real objects in the learning application can motivate children to learn or learn something [6]. For the second question (Q6), about 95% of students thought that the marked flip card would quickly display 3D objects for each vocabulary. In the third question (Q7), 93% thought that the sound produced when a 3D object was displayed was clear so that it was easy to understand the correct spelling of English vocabulary. The fourth question (Q8), 95% of students think that this application has the convenience of helping when learning early English vocabulary. The results of the calculations for each of the efficiency constructs are as shown in Figure 5.
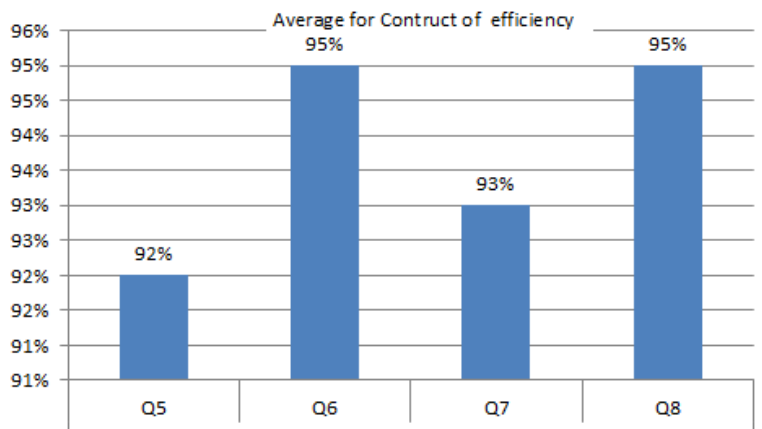

Figure 5. Average for construct of efficiency

3.3 Construct Satisfaction

The third construct is the construct of user satisfaction and refers to Table 1.In the first and second questions, namely Q9, Q3, respectively 90% and 95% of students

stated that this application is fun to use and they want to use the application when learning English vocabulary. This supports that when making learning media applications for elementary school children (aged 6-12 years) they like a real object that appears as an animation in this case is 3D. So they can see the real shape of the object, not just a picture. Besides that, interesting games in learning are also needed to make children happy in learning something [22] and make it easier for children to remember something to learn [23]. The third question (Q11), there are 87% of students stated that they would prefer to use this application in learning English vocabulary than others. The last question (Q12) got 92% saying that this app is working according to my expectation. Where they prefer a fun learning application, real objects and interesting games. The results of the calculations for each of the satisfaction constructs are as shown in Figure 6.
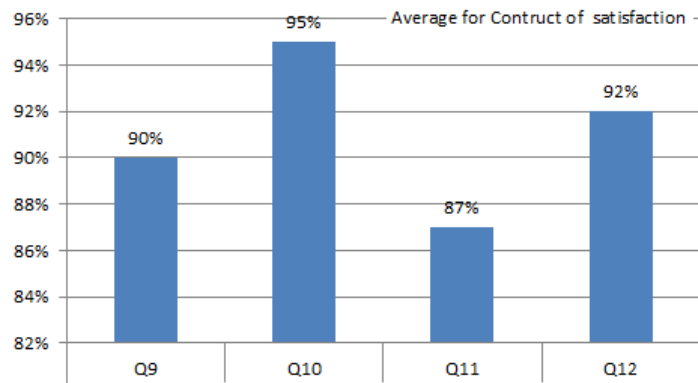

Figure 6. Average for construct of satisfaction

4 Conclusion

Based on the above graph, it can be concluded that students love studying using AR-based English vocabulary learning apps and are eager to utilize them in the future without any issues. Each quiz evaluates the application's usefulness. This application aids pupils, especially ages 6-12 years, in learning basic vocabulary by displaying 3D objects and sounds for the correct pronunciation of English vocabulary, besides this application is equipped with games that test students' memory when they finish learning vocabulary. For future development aimed at enhancing the application, it is recommended that each game feature is equipped in the form of a vocabulary puzzle, so that they can learn to remember the correct written English vocabulary.

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