A DUAL PERSPECTIVE: TEACHERS AND STUDENTS' PERCEPTIONS OF AUGMENTED REALITY FLASHCARDS APP

Ni Luh Putu Ning Septyarini Putri Astawa
Information System Study Program, Primakara University
ning@primakara.ac.id

ABSTRACT

This qualitative case study investigated the perceptions of teachers and students regarding the implementation of an Augmented Reality (AR) flashcard application namely "Fruit Troduction" in a fourth-grade classroom in Denpasar, Bali. Through questionnaires and interviews with 22 EFL students and two teachers, the study sought to understand how the teachers and students perceived learning that integrates AR technology into elementary education. Data analysis revealed positive responses from both teachers and students. The quantitative data which were taken from students' questionnaires showed an average of 91.56% positive response towards the app implementation. Moreover, qualitatively, the teachers' interview results supported the quantitative data that highlighted the AR app's effectiveness by providing new learning experiences, active, and independent learning activities. Besides the benefits, this research also found that limited internet access and differences in iOS and Android processors can be obstacles in the implementation of this application in learning.

Keywords: Fruit Troduction App, augmented reality, teachers' perception, students' perception, English for elementary education

INTRODUCTION

Augmented Reality (AR) has emerged as a powerful tool with the potential to revolutionize the educational landscape. By overlaying digital information onto the real world, AR creates immersive and interactive learning environments that can significantly enhance student engagement, motivation, and understanding. Through AR, students can visualize complex concepts, explore virtual simulations, and interact with digital content in a way that is both engaging and meaningful (AlGerafi et al, 2023; Koumpouros, 2024; Siricharoen, 2023; Pranata et al, 2024; Pratista et al, 2024). This technology offers a departure from traditional, passive learning methods, providing students with opportunities for active exploration, experimentation, and problem-solving (Lin et al, 2023 & Serrano-Ausejo & Marell-Olsson, 2024). As AR continues to evolve, it holds the promise of transforming education into a more dynamic, personalized, and effective experience for learners of all ages (Al-Ansi et al, 2023 & Romano et al, 2023). By providing students with opportunities to interact with virtual objects and environments, AR also can foster a deeper understanding of complex concepts and make learning more enjoyable and memorable (Kaminska et al, 2023; Olim et al, 2024; Putra et al, 2020).

Furthermore, AR can enhance students' motivation. Studies have shown that AR can increase student interest and motivation in learning, leading to improved academic performance (Amores-Valencia, 2023; Jdaitawi et al, 2023; Ozeren & Top, 2023). The excitement of AR can make learning more enjoyable and engaging, encouraging students to take an active interest in the subject matter. Moreover, AR can support the development of higher-order thinking skills (Dewi et al, 2020; Haryadi, & Pujiastuti, 2023; Lespita et al, 2023; Saidin et al, 2024). By providing opportunities for exploration and experimentation, AR can help students develop critical thinking, problem-solving, and creativity skills. Students can use AR to experiment with different variables, test hypotheses, and analyze the results, fostering a deeper understanding of the material and preparing them for real-world problem-solving (Angraini et al, 2023).

However, there is a need for more research to understand its effectiveness and potential challenges in the use of AR especially in the early education stages. One area of particular interest is the use of AR in language learning. While AR has been shown to be effective in

teaching subjects such as science and mathematics, there is limited research on its use in language classrooms. Researching to investigate student and teacher responses as users of a learning medium is a crucial step, particularly at the final stage of developing an application or learning media (Astawa et al, 2023 & Boari et al, 2023). By understanding the responses of teachers and students as users, researchers can provide recommendations for improvements in the learning process, ensuring that the developed learning media is truly suitable for use in a learning context.

Therefore, this study investigates the perceptions of teachers and students regarding the implementation of an AR flashcard application, "Fruit Troduction" in a fourth-grade classroom in Denpasar, Bali. The application uses AR technology to enhance the learning of English vocabulary and grammar through interactive flashcards. The Fruit Troduction app is an augmented reality-based educational tool specifically designed to introduce young elementary school students to various fruits. Developed through rigorous scientific research as outlined by Kabata et al. (2023), this application provides a comprehensive learning experience for both students and teachers. The app offers a multimodal approach to fruit recognition, incorporating written, auditory, and visual elements. The selection of fruits featured within the app is carefully aligned with the curriculum and textbooks commonly used in early elementary education. To facilitate understanding, the app provides descriptive text as well as verbal explanations via integrated voice recordings. Furthermore, the app employs visually appealing and interactive 3D models of fruits, allowing users to manipulate and explore the virtual representations at their own pace. By examining the perspectives of teachers and students, this research seeks to shed light on the potential benefits and challenges associated with incorporating AR into elementary education.

METHOD

This study employed a mixed-method study to investigate the perceptions of teachers and students regarding the implementation of the AR flashcard application. The participants in this study were 22 EFL students in a fourth-grade elementary class in Denpasar, Bali, and two English language teachers who taught the class.

Data were collected through questionnaires and semi-structured interviews. The close-ended and interview were administered to both teachers and students to gather quantitative and qualitative data about their perceptions of the AR flashcard application. The interviews were conducted with the two teachers to gain deeper insights into their experiences and perspectives on using AR in the classroom.

RESULT & DISCUSSIONS

The results and discussion in this paper will be divided into two sections: the students' perceptions and the teachers' perceptions regarding the utilization of the AR-based learning application Fruit Troduction in English language teaching for fourth-grade elementary students.

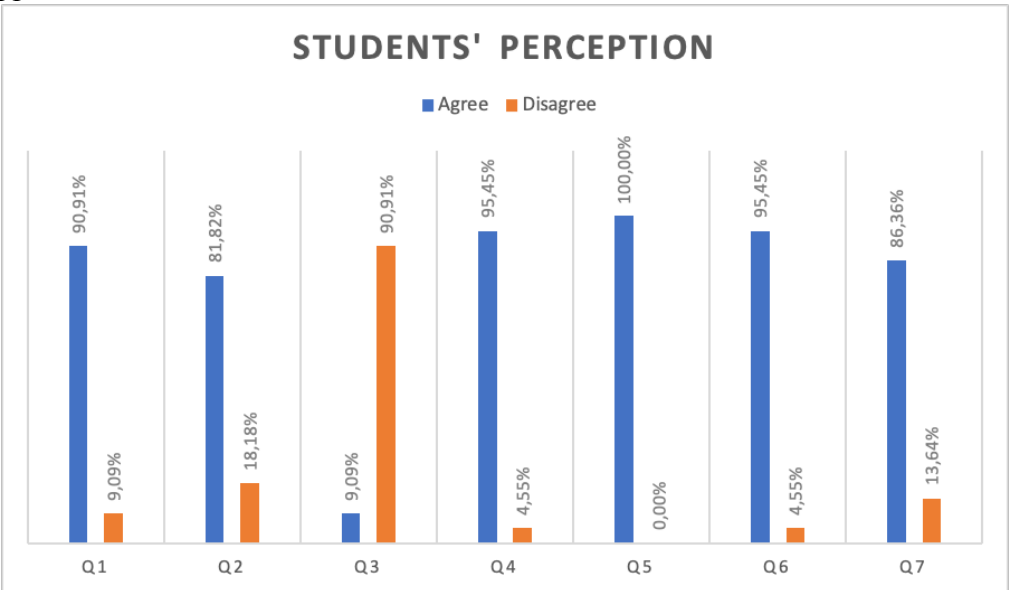
a. Students' perceptions on integrating the Fruit Troduction AR app in English language class

To ascertain students' perceptions regarding the implementation of the Fruit Troduction AR app, a seven-item yes/no questionnaire was administered. Given the limited abilities of fourth-grade elementary students to answer complex questions and complete a lengthy questionnaire, a simplified response format was deemed appropriate to facilitate their participation.

Tabel 1. Questionnaire of Students' Perception on the Fruit Troduction AR App Implementation

Question No	Item	Response	
		Agree	Disagree
1	Curiosity surged with the app		
2	Improved comprehension with the app		
3	Students find the app boring		
4	Independent learning with the app		
5	User-friendly AR app		
6	Students enjoy the app		
7	The app offers feedback.		

A seven-item questionnaire was administered to all 22 fourth-grade students at an elementary school in Denpasar, Bali. The questionnaire focused on assessing students' curiosity about the application, their perceived increase in understanding, engagement with the application, ability to engage in independent learning, ease of use, enjoyment of the application, and the perceived quality of feedback provided by the application. The result of the questionnaire shows an average of 91.56% of positive responses towards the implementation of the apps.



Picture 1. Result of Students' Perception on the Fruit Troduction AR App Implementation

In the first questionnaire item, the researcher focused on how the Fruit Troduction application stimulated students' curiosity. Of the 22 students involved in the study, 20 (90.91%) agreed that using this AR-based application heightened their curiosity. A high level of curiosity is crucial for students as it serves as an intrinsic factor in boosting motivation, which in turn can support the learning process. Previous research has also shown that the implementation of AR-based learning media can increase student motivation. Tsai (2020) demonstrated in their study that utilizing AR-based learning media can enhance student motivation in language classrooms.

Furthermore, the second item explored how the AR-based Fruit Troduction application could assist students in improving their cognitive abilities, particularly in English language learning related to fruit vocabulary. Based on the questionnaire data, 18 students or 81.82% agreed that the implementation of this application could support their understanding of the subject matter. Learning media should serve as a tool to help students deepen their

understanding and move closer to their learning objectives. Other research has corroborated these findings. Chang et al. (2020) found in their study that the implementation of AR-based learning media can enhance student performance, especially in English language learning.

Thirdly, the study aimed to determine the perceived attractiveness or boredom of the application among students. Of all students, only 2 (9.09%) found the application boring. Conversely, 20 students (90.91%) reported that the application increased their engagement with the learning material. Engaging educational media can benefit both teachers and students in the teaching-learning process. By utilizing interesting and non-boring educational media, the intensity of learning can be enhanced, and student participation can be increased. Wen (2021) found similar results in their research, suggesting that AR-based learning media implemented in a collaborative learning setting can enhance student engagement during the learning process.

Furthermore, the AR-based Fruit Troduction application was found to promote students' independent learning. Based on the data, nearly all students, specifically 21 (95.45%), stated that the application had stimulated their independent learning activities. Students could use the application anytime and anywhere, given that most households have at least one smartphone that can be used to operate the application. Additionally, observations revealed that all students spontaneously and alternately tried the application with excitement, without any coercion from the teacher. Ebadi & Ashrafabadi (2022) also found similar results in their research, indicating that the implementation of AR-based learning media can increase student activity in English language reading. Moreover, utilizing AR-based learning media can enhance students' autonomous learning.

The next questionnaire item focused on the ease of use of the Fruit Troduction application. The results showed that none of the students reported any difficulties in using the application. This was evidenced by the questionnaire data, which indicated that 100% of students agreed that the application was user-friendly. The ease of use of educational media can have a significant impact on the effectiveness of the application itself (Nasution et al., 2022). User-friendly applications can increase the likelihood of students engaging in independent learning.

Subsequently, the questionnaire aimed to determine if students found the application enjoyable to use in the learning process. Of all participants, 21 students (95.45%) agreed that they found the implementation of the application enjoyable. When using this educational media, students could perform various actions, such as zooming in and out on the 3D images. This feature was one of the factors that made the application appealing to students. Students' enjoyment in using AR-based educational media was also found in research conducted by Liao et al. (2024). By integrating AR-based educational media into English language learning in elementary school classrooms, they demonstrated a significant increase in student enjoyment. Consequently, this increased enjoyment was shown to positively influence student motivation and achievement.

The final questionnaire item sought to determine whether the application provided adequate feedback. After data analysis, the researcher found that 19 students (86.36%) agreed that the feedback provided by the Fruit Troduction application was sufficient. However, 3 students (13.64%) felt that the application needed to provide more feedback to enhance the efficiency of the educational media. It is important for educational media to be designed to provide feedback to students (Nugraha et al., 2021).

b. Teachers' perceptions on integrating the Fruit Troduction AR app in English language class

To administer the interview with the teachers, the researchers adapted the interview list from Wardani & Munir (2023). The interview was done towards 2 teachers as research participants by questioning 3 points, those were; (1) how the teachers perceive the use of Fruit Troduction AR app, (2) the obstacle found during the Fruit Troduction AR app implementation,

and (3) how the students' learning engagement during the Fruit Troduction AR app implementation.

For the first question, the researchers asked how the teachers perceive the implementation of the apps. Below are the results of the first interview questions.

Teacher A:

"*Aplikasi ini sangat mudah untuk digunakan oleh siswa sekolah dasar kelas 4. Instruksi pengoperasian yang ada di dalamnya sangat mudah untuk di ikuti oleh siswa. Hanya dengan menunjukan kamera ke kartu yang sudah disediakan, siswa sudah bisa melihat tampilan AR yang menarik."*

"This application is very easy to use for fourth-grade elementary students. The operating instructions within the app are very easy for students to follow. Simply by pointing the camera at the provided card, students can see an engaging AR display."

Teacher B:

"*Menurut saya aplikasi ini sangat berguna. Di dalam aplikasi tersedia gambar yang menarik, tepat untuk pembelajaran anak usia dini. Selain itu, terdapat penjelasan tentang buah-buahan dalam bahasa Inggris yang sangat bisa digunakan untuk pembelajaran vocabulary. Aplikasinya juga menyediakan tombol yang bisa di klik oleh siswa yang berisi audio pelafalan serta detai dari objek buah yang ditampilkan. Cukup menarik karena isi penjelasan lain misalkan seperti kandungan yang ada di dalam buah dan deskripsi warna dan rasa dari buah yang ditampilkan. Yang pasti aplikasi ini memberikan pengalaman baru kepada siswa khususnya dalam pembelajaran bahasa Inggris"*

"In my opinion, this app is very useful. It provides attractive images, perfect for early childhood learning. Additionally, there are explanations about fruits in English that can be used for vocabulary learning. The app also provides buttons that students can click, containing audio pronunciations and detailed information about the displayed fruits. It's quite interesting because it includes other explanations, such as the nutritional content of the fruits and descriptions of their colors and taste. Certainly, this application provides a new experience for students, especially in English language learning."

Based on the answers obtained above, it was found that the implementation of the Fruit Troduction AR app is a learning application that is easy to implement. Its simple instructions make it easy for fourth-grade elementary students to operate. Additionally, teachers also believe that this app can provide a new learning experience for students. The information provided in the app not only focuses on the vocabulary of the fruit objects being studied but also contains interesting information for students, such as descriptions of fruits that explain their taste, color, and nutritional content. According to research conducted by Meriyati et al (2024), they found the same thing: there is a positive influence between the use of AR in learning on students' learning experiences. Additionally, the use of AR in learning has also proven to change students' ways of thinking. In their research, they also found that the use of AR can facilitate the teaching process carried out between teachers and students in the classroom.

The second question was administered by the researcher to ask about the obstacles that were faced by the teachers during the app implementation. Below are the results of the second question.

Teacher A:

"Saya pribadi tidak menemukan kesulitan yang berarti. Aplikasinya sangat mudah untuk dioperasikan."

"Personally, I didn't encounter any significant difficulties. The application is very easy to use."

Teacher B:

"Mungkin kesulitan yang kemungkinan dapat dialami adalah bagaimana jika peserta didik menggunakan sistem operasi yang berbeda. Sejauh ini setahu saya aplikasi hanya bisa di akses menggunakan android, belum bisa menggunakan iOS. Saya harap kedepannya aplikasi ini bisa dikembangkan ke dalam bentuk iOs. Koneksi internet mungkin bisa juga menjadi salah satu permasalahan yang mungkin akan dihadapi oleh siswa jika kebetulan siswa tidak memiliki kuota karena aplikasi harus di akses dalam keadaan online."

"A potential difficulty that might be encountered is if the students are using a different operating system. As far as I know, the app can only be accessed using Android, not iOS. I hope that in the future this application can be developed into an iOS version. Internet connection might also be a problem that students might face if they happen to not have any data quota, as the app requires an online connection to access."

Based on the result of the interview, it was concluded that while one teacher operated the app without obstacles, the other teacher still anticipated challenges students might face during its implementation. The app is designed for Android users. This means some students who use iOS devices will be unable to use the app and will have to share devices with other students. The teacher hopes that in the future this application can be further developed so that it can also be used by iOS users. Another issue raised by Teacher B concerns internet connectivity. Since the app is only accessible online, students without internet access will have difficulty using it. Similar difficulties were also found by Afandi & Mahmudah (2025) in their research focusing on the implementation of augmented reality in the classroom. One of the difficulties that must be faced is the limited internet access available to students and teachers, as well as the lack of facilities provided by the school. Unstable internet connections hinder the learning process using innovative media like augmented reality.

Furthermore, the third question was administered to interview teachers on how the app implementation supports students' engagement during the teaching and learning process. These are the results of the last point of the interview.

Teacher A:

"*Pemanfaatan aplikasi ini menurut saya dapat meningkatkan angka keaktifan siswa dalam pembelajaran. Seluruh siswa secara aktif mengikuti seluruh instruksi yang diberikan oleh guru selama pembelajaran khususnya saat menggunakan aplikasi ini. Saya sebagai guru tidak perlu memaksa para siswa untuk melakukan aktifitas pembelajaran, mereka secara otomatis dengan penuh keingin tahuan mencoba aplikasi media pembelajaran yang diberikan. Siswa terlihat antusias dalam memanfaatkan aplikasi ini, mereka bisa memanfaatkan fitur interaktif perbesar dan perkecil gambar. Selain itu, aplikasi juga bisa mengeluarkan suara yang menjadi daya tarik sendiri bagi siswa. Sehingga kelaspun berjalan secara kondusif"*

"In my opinion, the use of this application can increase the level of student engagement in learning. All students actively follow all the instructions given by the teacher during learning, especially when using this application. As a teacher, I don't need to force students to do learning activities; they automatically, with full curiosity, try the learning media application provided. Students seemed enthusiastic about using this application; they were able to take advantage of the interactive zoom-in and zoom-out features. In addition, the application can also produce sound which is an attraction in itself for students. As a result, the class runs conducive."

Teacher B:

"Hal yang saya saksikan selama saya menggunakan aplikasi ini adalah siswa menjadi lebih antusias dalam menjalankan proses pembelajaran. Dengan memanfaatkan aplikasi ini, terdapat beberapa fitur yang menurut saya memicu siswa menjadi lebih mandiri dalam proses pembelajaran. Fitur yang menarik diantaranya fitur deskripsi yang memberikan penjelasan tentang objek buah-buahan yang ditampilkan seperti warna, rasa, serta kandungan yang ada

di dalam buah tersebut. Informasi tambahan tersebut menurut saya merupakan salah satu nilai tambah tersendiri, sehingga aplikasi ini tetap relevan dan bisa digunakan oleh siswa tidak hanya untuk mendapatkan pengetahuan mengenai objek secara mendalam, tidak hanya berfokus kepada proses pembelajaran kosa kata. Fitur lain yaitu fitur audio yang dapat diklik oleh siswa dan kemudian akan menampilkan suara dalam bahasa Inggris yang bisa mencontohkan siswa tentang bagaimana malafalkan objek dalam bahasa Inggris. Di harapkan dengan adanya aplikasi ini, dapat mendorong siswa untuk melakukan latihan prunounciation secara mandiri."

"What I observed while using this application is that students became more enthusiastic in carrying out the learning process. By utilizing this application, there are several features that I think encourage students to become more independent in the learning process. Interesting features include the description feature which provides explanations about the displayed fruit objects such as color, taste, and the content contained in the fruit. I think this additional information is a separate added value, so this application remains relevant and can be used by students not only to gain knowledge about objects in depth, not only focusing on the vocabulary learning process. Another feature is the audio feature that can be clicked by students and then will display sound in English that can give students an example of how to pronounce objects in English. It is hoped that with this application, it can encourage students to practice pronunciation independently".

From the evidence obtained above, it was found that utilizing the AR Fruit Introduction application, it can support students in carrying out active learning. By utilizing this application as a learning medium, students are automatically moved at their own pace to try the application. This application has also been proven to support the implementation of independent learning. Students can use this application to learn autonomously anywhere easily. The features seen by teachers as interesting features for students include the zoom-in and zoom-out features so that students can get an attractive 3D visual display. Another feature is the audio feature provided in the application which can provide simulations for students regarding how to pronounce the displayed object correctly. In addition, there is a description feature that displays extended information that is interesting for students to know. So it is hoped that students' understanding is not only limited to the vocabulary and pronunciation of the displayed object but also a detailed description of the object being studied so that meaningful learning is achieved. Giancaspro et al. (2024) also stated a similar point that the implementation of augmented reality with the guided instruction method has beneficial effects in enhancing students' understanding and active engagement in learning activities. Furthermore, Ardiyanti & Jayanta (2024) also found that by utilizing augmented reality, it can support students' independent learning. Students can cultivate their self-directed learning attitude by utilizing augmented reality as a learning medium that can be implemented anytime and anywhere.

CONCLUSION

This study demonstrates that both students and teachers hold positive perceptions regarding the use of the AR-based Fruit Troduction application as a learning medium. In-depth interviews revealed that the Fruit Troduction application successfully met all the expected criteria of an effective learning medium. From the students' perspective, they felt more motivated and engaged in the learning process when using the Fruit Troduction application. The interactive elements of the 3D AR display made learning more enjoyable. Additionally, the Fruit Troduction application encouraged students to participate actively in learning. This helped students to better understand the subject matter. Lastly, students felt more confident and motivated to learn due to the ease of using the application.

Furthermore, from the teachers' perspective, they found the Fruit Troduction application to be interesting for the students and give new experiences in learning. Moreover,

the teacher also stated that utilizing this application can support students to become active learners. In addition, the use of this application can also support students to become independent learners. From all the advantages gained from using this application in the students' vocabulary learning process, there are challenges faced, namely the difficulties that may be encountered due to internet connection. Because this application can only be operated in online mode, it will be a challenge in itself for students who do not have an internet connection when they need to apply it. In addition, another challenge is from the processor used. It will be a challenge for students who use iOS to access this application. This is because the application was built in Android mode, this far the application can only be accessed by Android users. It is hoped that research on this application can be developed so that the application can be utilized not only by Android users but also iOS users.

Overall, this study indicates that the use of the AR-based Fruit Troduction application as a learning medium is a suitable step in efforts to improve the quality of learning. The Fruit Troduction application not only fulfills the ideal factors for media use but also provides a more engaging and effective learning experience for students. Therefore, the Fruit Troduction application can be considered as a viable alternative learning medium for educators.

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