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# B-ACE Mobile Learning with Outcome-Based Education Approach: Developing ESP Learning Media for Airport Civil Engineering Students

**Raga Driyan Pratama[1], Edelweis Silmi Eka Jazera[2], Ershanda Ardini Putri[3], Fatmawati Fatmawati[4], Lusiana Dewi Kusumayati[5]**

[1*]*Corresponding author. Email: raga_driyan@poltekbangsby.ac.id*

[12345] **Politeknik Penerbangan Surabaya**

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**ARTICLE**

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**ABSTRACT**

This study sought to develop prototype of B-ACE mobile learning application using Android operating system with an outcome-based education approach as a media to learn basic airport civil engineering. This study adopted the ADDIE development model. This study involved 72 aviation cadets of Airport Civil Engineering Department to complete the student needs analysis questionnaire and three lecturers who taught Basic English course in the department to complete the curriculum needs analysis questionnaire and conduct FGD. Results showed that the B-ACE prototype was developed through analysis, design, development, implementation, and evaluation stages. Experts showed valid scores without revision as the result of translational validity test ($\bar{x}$ = 3.86), thus, the B-ACE mobile learning prototype was in accordance with the airside and landside materials and the outcome-based education curriculum applied in higher education. The students' responses were positive after learning using B-ACE ($\bar{x}$ = 98.8%).

## INTRODUCTION

Currently, the globe is living in a time of rapid transition where industries, including education, are experiencing these changes, such as the integration of information and technology (IT) in daily life (Hımmetoglu et al., 2020). The educational system, particularly in higher education, is enforced to produce students who are capable of operating technology and developing technology-based tool assistance for easing human's life (Kabir et al., 2020). Regardless the demand of mastering technology-based tools, students are still required to perceive basic survival skills such as critical thinking, creative thinking, communication, and compassion, which have been exaggerated by outcome-based education as the current curriculum for higher education (González-Pérez & Ramírez-Montoya, 2022). These skills comprised in the 21st-century education model are used to prepare them during the volatile

transformations. Thus, students will conceive firm self-preparedness in responding to the emerging disruptive era of Society 5.0.

This phenomenon consequently affects the learning method applied in higher education setting. Lecturers are demanded to integrate the use of technology or Internet of Thing (IoT) permeated within their learning process (Meacham et al., 2018). They must be a good facilitator, yet a pertinent role model, in utilizing technology-based learning media. This perspective creates an external force to make them able to develop a technology-based learning media where no appropriate medium is suitable to IT integration and IoT. For instance, many studies have developed mobile learning applications for diverse branch of science such as in biology education (Susantini et al., 2022), English education (Kacetl & Klímová, 2019), general civil engineering (Avci et al., 2021), and aviation (Chittaro et al., 2018). These studies have successfully formed a technology-based learning experience so the students are able to increase their learning process due to the easy and efficient usage. The additional point lies on the fact the students are habituated by the use of technology during their learning process, hence, they can master IT and IoT simultaneously (Kuppusamy, 2019; McRae et al., 2018). Therefore, lecturers must be aware of this demand and put excessive efforts in realizing technology-based learning experience.

As one of the fields in English for specific purpose (ESP), learning basic and technical English for airport civil engineering is worthy to be evaluated. Materials of airside and landside have been the most required-to-comprehend knowledge in airport civil engineering (Marquez, 2019). These let students know the distinctive usage and function of airside and landside of the airport. Furthermore, they comprehend the construction model that is suited for each purpose. The mastery of technical English on those materials also contributes to the effectiveness of the learning process, thus a decent ESP design should not be overlooked (Ibbotson, 2009). An appropriate learning aid for this ESP setting should serve as an intermediary to help students understand many pertinent terminologies used in both airside and landside. Also, there is a demand on the media to include authentic potential occurrences emerging in each facility, both on airside and landside. Through this diversified learning approach, students can gain a deeper, more authentic, and more accurate understanding of both the technical English and the airside and landside materials.

To the best of the researchers' knowledge, the availability of technology-based learning media regarding the materials of airside and landside pertaining to technical English has not been widely addressed by many studies. Suryan et al. (2023) developed a runway defect detection device to detect runway damage; however, this learning tool only deals with the specific area of airside and does not give the technical English required during the detection instruction. Sylvia and Hutabarat (2021) conducted research on the development of e-learning resources for an elementary English course for Air Traffic Control Department students. Unfortunately, this study does not highlight the connection between exposure to air traffic control phenomena and the fundamental English contents. Furthermore, the study has no bearing on airport civil engineering. In addition, Pamungkas et al. (2023) developed an e-apron movement control module for air transportation management students to enhance their ability in comprehending apron control. This study also has not considered the importance of technical English in apron and does not signify the students with basic knowledge of apron construction as it is more into apron management. Therefore, there have been limited studies developing technology-based learning media to master airside and landside materials with the teaching of relevant technical English.

With reference to the aforementioned explanations, the goal of this study is to develop a working prototype of the B-ACE mobile learning application that utilizes Android as its operating system with an outcome-based education approach as a means of instruction to teach students the fundamentals of airport civil engineering. The application takes into account basic English skills such as listening, reading, speaking, and writing, of which this common learning mode has been proposed as a relevant media for aviation students (Rifai et al., 2022). The development of the B-ACE mobile learning application as a technology-based learning media to help Indonesian aviation students understand fundamental civil engineering topics constitutes the novelty of this work. This particular ESP learning resource is also criticized for contributing to the dearth of suitable materials in the field of airport civil engineering and for supporting Indonesian aviation students' efficient learning process by providing them with a convenient resource that they can use at anytime and anywhere.

**Review of Literatures**

*English for Airport Civil Engineering: Airside and Landside*

Airport civil engineering is a study of maintenance techniques, regulation, operation of landside and airside facilities at airports, as well as supervision of construction or repair activities of airport buildings (Pasandín & Pérez, 2021). Airside is part of the airport supporting the aircraft activities for landing and take-off including runways, taxiways, and aprons (Ali et al., 2022; Hom & Orman, 1975). Runway is an area used for aircraft landing and take-off activities (Di Mascio et al., 2020). Taxiway is an area that connects the runway and apron, which has a function as an aircraft path moving from the runway to the apron or vice versa (Jiang & Hao, 2024). Apron is an area used by aircraft for parking, refueling, aircraft maintenance activities, and loading and unloading passengers and goods (Wang et al., 2024). This area is built adjacent to the terminal building for the efficiency of these activities. Landside is the part of the airport on the land side that consists of terminals and parking areas (Di Mascio et al., 2020; Janić, 2018). The terminal or concourse is the center of business for arriving or departing passengers. It contains X-ray baggage scanners, check-in counters, custom-immigration-quarantine for international airports, boarding lounges, and various other facilities for passenger convenience. Parking area is an area used for parking passengers' vehicles and escorts or pick-ups.

To better comprehend the materials of airside and landside along with their construction modes, basic and technical English is necessary to be mastered. In coping with basic English, the introduction of vocabularies belonging to verbs, adjectives, adverbs, and nouns are essential to construct English sentences (Burton-Roberts, 2021). Basic knowledge of tenses is also given at this level to cope with constructing sentences regarding time differences (Ballard, 2022). The specification of technical English usage should also be considered for the sake of understanding the airside and landside definitions, characteristics, and functions (Pacheco, 2022; Tarnavska et al., 2021). The integration of both basic and technical English in airport civil engineering must be conducted within the mastery of problem-solving skills in coping with airside and landside phenomena (Doboli & Doboli, 2021). In this case, the ESP materials can be delivered precisely to the needs of airport civil engineering students when they need to master their expertise and develop their English skills (Azhar & Masyi'ah, 2023). Therefore, the exposure to English mastery through related vocabularies, for instance, as well as content-based learning should be carried out when coming to ESP learning process.

## METHOD

This study used Design and Development Research (DDR) with the adaptation of the ADDIE development model encompassing the stages of analysis, design, development, implementation, and evaluation (Molenda, 2003). There were seventy-two aviation cadets enrolled in the first grade of airport civil engineering class at one of aviation polytechnic in Surabaya, Indonesia, who were involved as the research respondents. They were chosen using voluntary sampling technique with several inclusion criteria. Table 1 shows the demographic data of the respondents.

Table 1. Student respondents' demographic data

| Aspect | Category | Percentage |
|---|---|---|
| Gender | Male | 74.6% |
| | Female | 25.4% |
| Age | 15-20 years old | 100% |
| Class | 7A class | 33.3% |
| | 7B class | 33.3% |
| | 7C class | 33.4% |
| Type of Class | ASN (civil servant) candidates | 100% |
| Grade | First grade | 100% |
| Department | Airport civil engineering | 100% |

Table 1 shows that the respondents were well-distributed since the number of students in a class was similar, thus, the data could be generalized. In addition, there were three lecturers who taught elementary English for aviation civil engineering class involved as the other respondents of the study. They were chosen using purposive sampling technique to help the researchers determine the needs of learning media. The lecturers had qualifications of Master in English Education, 5-10 years of teaching experience, and ESP experts of Aviation English.

Data were collected using student needs analysis questionnaire, curriculum needs analysis questionnaire, FGD notes, assessment sheet for translational validity test, and student's response questionnaire. Student needs analysis questionnaire was used to obtain the students' expected learning media for airside and landside materials. This questionnaire consisted of 20 items and was in a form of five-point Likert's scaling method from very disagree (1) to very agree (5). Curriculum needs analysis questionnaire consisted of 10 items and was in a form of five-point Likert's scaling method from very disagree (1) to very agree (5). This questionnaire was administered to the three English lecturers. Both questionnaires were developed by the researchers and had passed the reliability and validity tests ($a$ = 0.867 for the student needs analysis questionnaire and $a$ = 0.757 for the curriculum needs analysis

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questionnaire) with valid-with-no-revision category. Besides, FGD was undertaken by the lecturers to get triangulation data to support the result of curriculum needs analysis questionnaire. The assessment sheet was used to validate the developed prototype with five items for each content and face validity test. The validation test was undertaken by two experts in airport civil engineering and learning media development. Table 2 portrays the category of validity test result. At last, the student's responses questionnaire was in a form of rating yes/no showcasing their feelings, perspective, and experience after using B-ACE in learning airside and landside.

Table 2. Category of Prototype Validity Test Results

| $\bar{x}$ | Category |
|---|---|
| $\bar{x} > 3.6$ | The content and appearance of the prototype are highly valid |
| $2.8 \leq \bar{x} \leq 3.6$ | The content and appearance of the prototype are valid |
| $1.9 \leq \bar{x} \leq 2.7$ | The content and appearance of the prototype are sufficiently valid |
| $1.0 \leq \bar{x} \leq 1.8$ | The content and appearance of the prototype are not valid |

Using the quantitative-descriptive approach, the obtained data were analyzed using descriptive statistics assisted by IBM SPSS 25.0 version (Pallant, 2020). Results from the descriptive statistics test was used to obtain the *M* scores. Then, the M score was transformed into a percentage (*M%*) by dividing it with 5 ($M_{max}$) and multiplying the result with 100%. The *M%* score was categorized using Swanson's leveling method (2014). If $M\% < 25\%$, there was a very low agreement toward the given validation items. If $25\% \leq M\% < 50\%$, there was a low agreement toward the given validation items. If $50\% \leq M\% < 75\%$, there was an agreement toward the given validation items. At last, if $M\% \geq 75\%$, there was a high agreement toward the given validation items. The revealance of *M* score was undertaken in aggregate and sub-scale scheme. The triangulation data obtained from the FGD were in the form of notes with the specific information of course, learning methods, learning goals, sub-learning goals, and indicators for airside and landside materials.

## RESULTS AND DISCUSSION

*Analysis Stage: Student Needs and Curriculum Needs Analysis*

The student needs analysis questionnaire was administered to 72 respondents and returned 100% to the researcher. All respondents filled out the consent form completely so they were said to agree to voluntarily fill out the questionnaire with honest answers and participate in the study without coercion. In addition, none of the respondents chose to walk out of the study from the beginning to the end of the data collection process. Table 3 portrays the results of student needs analysis related to the needs of airside and landside learning media.

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Table 3. Results of student needs analysis

| Aspects and Items of Questionnaire | *N* | *SD* | *M* | *M%* | Category |
|---|---|---|---|---|---|
| Aspect of previous learning media | | | | | |
| On my opinion: | | | | | |
| 1. Airside and landside learning media is very interesting. | 72 | .55647 | 1.5139 | 30.28% | Q2 |
| 2. The previous learning media motivated me to learn. | | | | | |
| 3. Airside and landside learning media are suitable for my learning needs. | 72 | .53056 | 1.4861 | 29.72% | Q2 |
| 4. Airside and landside learning media are very complete. | | | | | |
| 5. Airside and landside learning media is very easy to use wherever I am. | 72 | .47471 | 1.3333 | 26.66% | Q2 |
| 6. Airside and landside learning media are in accordance with the demands of the competencies that I must master. | 72 | .49390 | 1.4028 | 28.05% | Q2 |
| 7. Airside and landside learning media does not contain racial elements. | | | | | |
| 8. Airside and landside learning media train me to solve problems. | 72 | .49863 | 1.4306 | 28.61% | Q2 |
| 9. Airside and landside learning media train me to think at HOTS level. | | | | | |
| 10. Airside and landside learning media has been IT-based. | 72 | .50176 | 1.4583 | 29.16% | Q2 |
| | 72 | .42767 | 4.2361 | 84.72% | Q4 |
| | 72 | .46387 | 1.3056 | 26.11% | Q2 |
| | 72 | .40897 | 1.2083 | 24.17% | Q1 |
| | 72 | .44383 | 1.2639 | 25.28% | Q2 |

| Aspects and Items of Questionnaire | *N* | *SD* | *M* | *M%* | Category |
|---|---|---|---|---|---|
| Aggregate scores | 72 | .12705 | 1.6639 | 33.29% | Q2 |
| Aspect of expected new learning media | | | | | |
| On my opinion: | | | | | |
| 1. Airside and landside learning media must be attractive in appearance. | 72 | .50331 | 4.5139 | 90.28% | Q4 |
| 2. Airside and landside learning media can make it easier for me to learn wherever I am. | 72 | .44383 | 4.7361 | 94.72% | Q4 |
| 3. Airside and landside learning media can motivate me to learn independently. | | | | | |
| 4. Airside and landside learning media has complete material. | | | | | |
| 5. Airside and landside learning media does not contain racial elements. | 72 | .37529 | 4.8333 | 96.66% | Q4 |
| 6. The airside and landside learning media contain skills content that I will need in the future. | | | | | |
| 7. Airside and landside learning media has problem-solving features that can train critical thinking skills. | 72 | .44383 | 4.7361 | 94.72% | Q4 |
| 8. IT-based airside and landside learning media to adapt to the global era. | | | | | |
| 9. Airside and landside learning media should be interactive. | 72 | .45105 | 4.7222 | 94.44% | Q4 |
| 10. Airside and landside learning media should be one-stop learning (there are various learning activities that can be done with the media). | 72 | .49863 | 4.5694 | 91.38% | Q4 |
| | 72 | .50039 | 4.5556 | 91.12% | Q4 |
| | 72 | .47943 | 4.6528 | 93.05% | Q4 |

| Aspects and Items of Questionnaire | *N* | *SD* | *M* | *M%* | Category |
|---|---|---|---|---|---|
| | 72 | .43605 | 4.7500 | 95.00% | Q4 |
| | 72 | .44383 | 4.7361 | 94.72% | Q4 |
| Aggregate scores | 72 | .10159 | 4.6806 | 93.62% | Q4 |

In accordance with Table 3, student respondents showed a low agreement level (Q2) towards the items contained in the previous media aspect aggregately (*M* = 1.6639, *SD* = .12705, *M%* = 33.29%, *N* = 72). This showed that student respondents lacked interest in the airside and landside learning media they used formerly. However, there was an item namely item 7, which stated that the airside and landside learning media did not contain racial elements (*M%* = 84.72%). In addition, item 9 which stated that the airside and landside learning media trained the students to think at the HOTS level received the lowest M% of 24.17%. This conveyed that student respondents considered that the previous media could not train their HOTS skills. At last, the remaining items showed Q2 category, which implied that the student respondents thought that the previous learning media were not interesting, could not motivate them to learn, did not suit their learning needs, were incomplete, were not flexible to use and carry around, did not meet competency demands, did not contain problem solving exercises, did not promote HOTS thinking, and were not IT-based. In contrast to the responses on the aspect of the expected new learning media, student respondents expressed very high agreement (*M* = 4.6806, *SD* = .10159, *M%* = 93.62%, *N* = 72). On a sub-scale basis, all items on the expected new learning media aspect had an M% > 90% (Q4). This portrays that cadet respondents strongly agreed that the new learning media should be attractive in appearance and easy to use anywhere, could motivate independent learning, complete material, did not contain racial elements, contained the skills needed, comprised features of learning to solve problems and HOTS, IT-based, interactive, and one-stop learning.

In addition, this study used curriculum needs analysis to determine learning needs so that sub-learning goals and indicators could be met properly. Table 4 shows the results of the curriculum needs analysis conducted by three lecturers.

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Table 4. Results of curriculum needs analysis

| Items | *N* | *SD* | *M* | *M%* | Category |
|---|---|---|---|---|---|
| 1. The need for learning media that supports the blended learning model | 3 | .00000 | 5.0000 | 100% | Q4 |
| 2. The need for basic English materials such as basic sentence construction and tenses | 3 | .00000 | 5.0000 | 100% | Q4 |
| 3. The need for airside materials especially on the topics of runways, taxiways, and aprons | 3 | .00000 | 5.0000 | 100% | Q4 |
| 4. Landside material needs, especially on the topic of terminal building and parking area | 3 | .57735 | 4.6667 | 93.34% | Q4 |
| 5. Material needs to support project-based learning | 3 | .00000 | 5.0000 | 100% | Q4 |
| 6. Material needs to support HOTS training | 3 | .00000 | 5.0000 | 100% | Q4 |
| 7. The need for practice questions that are relevant to basic English, airside, and landside materials | 3 | .00000 | 5.0000 | 100% | Q4 |
| 8. Material needs to support self-assignment | 3 | .00000 | 5.0000 | 100% | Q4 |
| 9. Evaluation needs for basic sentence construction and tenses material | 3 | .00000 | 5.0000 | 100% | Q4 |
| 10. Evaluation needs for airside and landside materials | 3 | .00000 | 5.0000 | 100% | Q4 |

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| Items | *N* | *SD* | *M* | *M%* | Category |
|---|---|---|---|---|---|
| | 3 | .00000 | 5.0000 | 100% | Q4 |
| Aggregate scores | 3 | .05774 | 4.9667 | 99.34% | Q4 |

Based on the statistical data in Table 4, the three lecturer respondents showed a very high level of agreement toward the items of curriculum needs analysis (*M* = 4.9667, *SD* = .05774, *M%* = 99.34%, *Q* = 4). In item number 5, the *M* score was not maximum so there was one lecturer who gave a score below 5. This was confirmed during the FGD, and one lecturer stated that she agreed to the need for materials to support project-based learning. However, the lecturer gave an acceptable reason.

> "*In my opinion, all learning media must be able to be used offline and online. However, the project-based learning model is not the only learning model to support OBE. There is still a case method*." (L2)

Overall, the needs of the materials in the curriculum to support the successful completion of sub-learning goals and indicators were agreed on the crucial aspects in the curriculum needs analysis questionnaire. Thus, materials that were in accordance with the curriculum that must be included in the learning media involved basic English, airside, landside, HOTS exercises, and evaluation.

*Design and Development Stages: Developing B-ACE Learning Media Prototype*

In this section, the design and development of B-ACE learning media prototype were generated. Figure 1 shows the application opening interface along with the logo of the application.


Figure 1. Opening interface of B-ACE Learning media prototype

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After the opening interface, there was a login page where users were required to fill in their identity and create a password used for the login process in the future. With this feature, participants could continue and complete the commenced learning activities in the B-ACE application. After the login page, there were several features inside described in Figure 2.

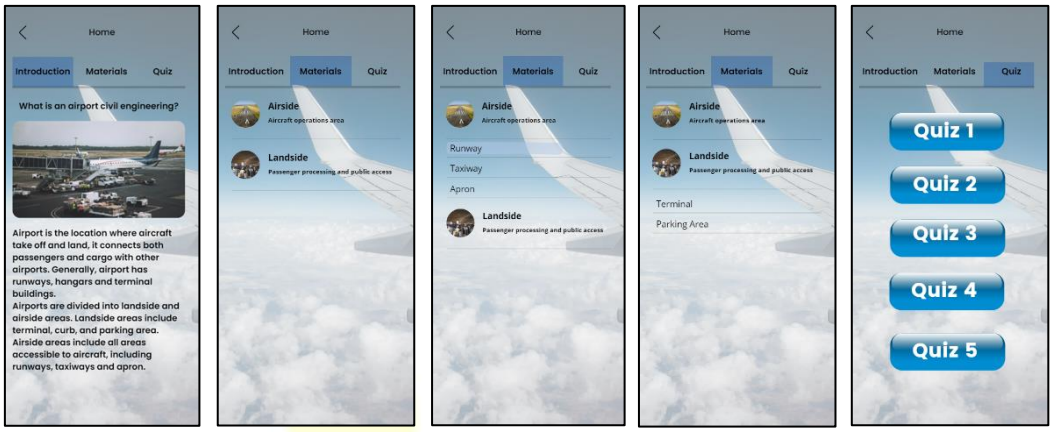


Figure 2. B-ACE features

This android-based B-ACE mobile learning application had several features that supported the understanding of airport civil engineering. These features included introduction, materials, and quiz. The introduction feature contained general knowledge and understanding of airport civil engineering. Furthermore, the materials section explained about each part of the airside and landside. To deepen knowledge and train users in problem solving, this mobile learning application was also equipped with quizzes. The quiz feature in this application used the outcome-based education (OBE) curriculum where HOTS questions were given. HOTS questions were assessment instruments that demanded higher-level thinking skills in shaping better student quality. With these HOTS questions, students were expected to be able to meet the competencies that were standardized by the Outcome-based Education (OBE) curriculum. In each feature, there was an exaggeration of technical English vocabularies regarding airport civil engineering.

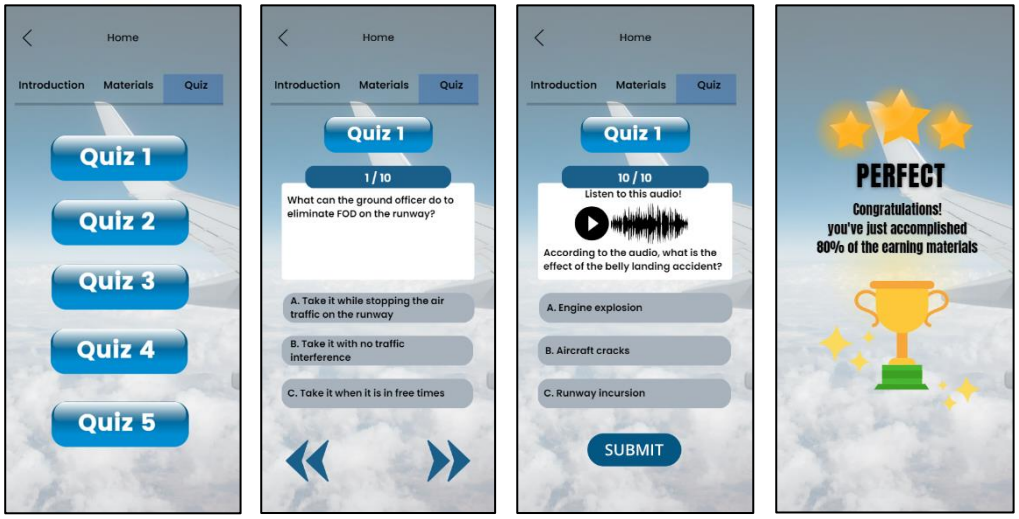


Figure 3. Integration of OBE in B-ACE mobile learning application

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Regarding Figure 3, in the quiz feature, B-ACE users were given a problem that often occurred in the airside and landside areas. In this section, a critical thinking process as required to solve the problem. To support listening skills, some question materials were given in the form of audio and some were in the form of text and audio-visual. The problems contained in the quiz feature could be used as cases when carrying out learning in the classroom. In addition, solving this material could be done in groups and classically. The application of this model could also support the blended learning process that was promoted in the current OBE curriculum in higher education.

Table 5. Prototype validity test results

| Expert | Background Information | Aspects of Validation | Score | $\bar{x}$ | Category |
|---|---|---|---|---|---|
| 1 | Expertise in airport civil engineering | Content validity | | 3.81 | The content and appearance of the prototype are highly valid. |
| | | - Effective and clear language usage | 4 | | |
| | | - Relevance to OBE curriculum | 4 | | |
| | | - Material completeness | 4 | | |
| | | - HOTS practice | 4 | | |
| | | - Authenticity of cases | 4 | | |
| | | - Chronological delivery | 4 | | |
| | | - No racial issues | 4 | | |
| | | Face validity | | | |
| | | - Interesting design | 3 | | |
| | | - Easy to operate | 4 | | |
| | | - Complete features | 4 | | |
| | | - Captivating interaction | 3 | | |
| 2 | Expertise in learning media development | Content validity | | 3.91 | The content and appearance of the prototype are highly valid. |
| | | - Effective and clear language usage | 4 | | |
| | | - Relevance to OBE curriculum | 4 | | |
| | | - Material completeness | 4 | | |
| | | - HOTS practice | 4 | | |
| | | - Authenticity of cases | 4 | | |
| | | - Chronological delivery | 4 | | |
| | | - No racial issues | 4 | | |
| | | Face validity | | | |
| | | - Interesting design | 3 | | |
| | | - Easy to operate | 4 | | |
| | | - Complete features | 4 | | |
| | | - Captivating interaction | 4 | | |

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After the prototype model was developed, the two validators were asked to do content and face validity tests. Table 5 shows that both experts agreed that the developed B-ACE was highly valid with the $\bar{x}$ scores of 3.81 and 3.91, respectively. This implied that the content and appearance of the prototype were highly valid with no major revision. Thus, the B-ACE mobile learning application prototype could be used in the next developmental stages namely implementation and evaluation.

*Implementation and Evaluation Stages: Trialing B-ACE in Classroom Learning*

After the design and development stages, the B-ACE mobile learning application was trialed in a classroom learning activity using project-based learning method. As in the implementation section, the B-ACE mobile learning application was introduced by the class lecturer covering its functions, objectives, and procedures of learning process. The lecturer asked the students to open the prototype and follow each step in the introduction section. Afterward, the lecturer gave an instruction to do a project namely describing airside facilities and building construction. Then, they utilized B-ACE to accompany them complete the project. At the end of the learning process, the lecturer asked the students to present their project and had a discussion. They, further, were given a response questionnaire to give the lecturer feedbacks regarding the use of B-ACE in learning airport civil engineering. Table 6 displays the student respondents' responses after using B-ACE in a classroom learning.

Table 6. Student respondents' responses on B-ACE implementation

| Items | "Yes" Answer |
|---|---|
| The application has a very interesting interface design. | 97.22% |
| The application consists of useful features in learning airside and landside materials. | 100% |
| The application can be operated regardless times and places. | 95.83% |
| The application is easy to be operated. | 100% |
| The application consists of reliable contents. | 97.22% |
| The application helps me train HOTS. | 100% |
| The application helps me learn basic English. | 100% |
| The application assists me to learn technical English regarding airside and landside materials. | 98.61% |
| The application gives an authentic phenomenon as example. | 100% |
| The application offers an efficient learning time. | 100% |

Table 6 shows the positive responses toward the use of B-ACE. Students conveyed that the application consisting useful features, being able to train students HOTS, helping the students learn basic English, and giving an authentic phenomenon as example, and offering an efficient learning time. The students showed that the least positive response (95.83%) regarding the flexibility of operating the application. This might be due to the fact that B-ACE was online application so it needed internet and proper mobile phone to support its operation. The presence of internet in diverse geographical locations might be dissimilar, thus, the students less agreed the item 3. Overall, the responses were positive and this evaluation let the researchers improve the application for another operating system like IOS.

## DISCUSSION

The present study found that the development process of B-ACE mobile learning media prototype could be carried out using ADDIE developmental model. This was similar to other developmental studies that used ADDIE to develop mobile learning application. For instance, Prasetyo et al. (2020) developed an e-learning management system using ADDIE in a form of mobile learning so that the teacher and students could do interaction regardless times and places. This e-learning system showed a positive response obtained from the students. Hanafi et al. (2020) also developed mobile-learning management system using ADDIE to enhance the learning process in worship education. This system was also responded positively by the students as they experienced captivating learning process. Saeidina et al. (2022) also developed a mobile learning application for self-care against COVID-19 using ADDIE. This mobile application was not only a learning of COVID-19, but it was also an educating platform for those responding the COVID-19 outbreak. Murdiono et al. (2020) also developed an android-based mobile learning application to learn civic education using ADDIE, of which the application was agreed to be useful in giving students' learning assistance. At last, many studies developed mobile learning application in supporting the learning process in aviation sector (Aurina et al., 2023; Pai, 2020; Park & Huffman, 2020; Prayitno et al., 2023).

This study also found that conventional learning media such as books and printed materials were not interested by students. For example, Budnyk et al. (2021) showed that the use of printed book was less favored by modern students as it was less handy when it consisted of thousand pages. Wu and Amzah (2023) stated that printed books did not support students' story comprehension and reading motivation for preschoolers as the integration of technology was more favored by the kids. Tosun (2014) showed that 96.5% of the respondents did not like to read printed books, as long as the technology supported their reading process. Ip et al. (2021) and Tosun (2014) agreed that boy students were not more into printed book as it was not efficient to be carried when multiple books became the learning resources. By looking at these previous studies, printed books were less favored for modern students as they like more effective and handy media such as mobile learning application and electronic books (e.g., flipped book).

Even though conventional learning media like printed books were less interested by modern students, this media still included no racial problems. This present study found that modern students still wanted to use learning media with no racial issues. This might due to the fact that the student's tolerance and awareness of diversity were sufficiently high (Hjerm et al., 2020). In addition, they might be more open and critical toward a sensitive issue that could bear schism (May & Perry, 2022). Some studies also agreed that a learning media should not promote the portrayal of racial issues. For instance, Gretter and Yadav (2018) stated that teachers thought that media literacy for school should not promote racial, religion, ethnic, and group issues as these problems might raise discrimination within classroom activities. Widodo (2018) also emphasized that racial issues must not be an example of mathematical story for junior high school students. This effort was a part of building good character of students by intolerating anyone with racial issues. Therefore, a good learning media literacy must be relevant to character education (Achmad & Chen, 2021; Fajarianto et al., 2023; Murti, 2020).

At last, this study found that outcome-based education applied in higher education can be implemented by using both project-based learning (PjBL) and case method. PjBL might be used as an alternate approach in the OBE curriculum, giving teachers the chance to oversee complex project

activities that included tough real-world challenges and investigative questions (SrinivasaPai et al., 2018). PjBL had the potential to enhance and expand learning topics' competencies, encompassing knowledge, skills, and attitude-oriented areas (Sansone et al., 2020). In addition, using PjBL in an OBE curriculum could raise benefits including raising student motivation for learning, improving communication, cooperation, and higher order thinking skills, as well as helping them become more capable of working independently (Gupta, 2022). As a result, PjBL might be a useful tactic for accomplishing OBE objectives and raising Indonesian educational standards. Another method was a case method, which was realistic and pertinent problem scenario for particular section of the subject matter being studied (Zhao et al., 2020). The case method's features included the use of cases, study questions, group discussions to resolve problems, and assessment of learning objectives (Malikovna et al., 2020; Zhao et al., 2020). As a result, the case method could assist students in grasping ideas and enhancing their research, thinking, and communication abilities (Zhao et al., 2020). Both PjBL or case methods might elevate the 21st-century education skills reflected through OBE curriculum that must be mastered by students in higher education level, specially (Zhao et al., 2020).

## CONCLUSION

The android-based B-ACE mobile learning application prototype is developed using the ADDIE model consisting of analysis, design, development, implementation, and evaluation stages. This mobile learning application prototype is also developed by implementing the outcome-based education (OBE) that suits higher education curriculum. The OBE curriculum requires students to be able to think critically, creatively, and innovatively to be able to solve real-world problems. The product is categorized reliable and valid and it provides knowledge and skills in enhancing basic English, technical English, and mastering airside and landside materials. With this application, the needs of society 5.0 and the digital evolution of IoT can be achieved optimally. This learning media can support the undertaken ESP learning process especially in airport civil engineering. This study is expected to be useful for ESP teachers, especially those expertise in aviation English with the focus of airport civil engineering. Future studies are suggested to provide more mobile learning applications in aviation so that the students in aviation vocational college can experience better technology-based learning process.

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