Animals of Nusantara: Virtual Reality-Based English Learning Materials for Secondary Students

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ABSTRACT

Virtual Reality (VR) has come to a point for more authentic learning as it provides opportunities for learners to visit various places or objects they cannot physically see and do because of school and home boundaries. A preliminary observation and interview were conducted to disclose the teachers' views on the use of the previously released Animals of Nusantara (AoN) VR application implemented in public and private schools in North Bali, Indonesia. They admitted to be somewhat familiar with the application after several trial attempts. Despite the positive learning supports, the teachers also faced problems in implementing this authentic learning media in the English instruction in the metaverse era. This situation led to the development of VR for English Learning handbook to fulfill teachers' queries on adequate information about authentic media, tutorials on using AoN VR application, and meaningful learning activity ideas. ADDIE model was employed as the research design. Instruments used include an interview guide, a checklist, and expert judgments' evaluation sheet. All gathered data were analyzed qualitatively and quantitatively. It was found that this handbook is as excellent media to assist teachers in teaching English in secondary school level, meaning that the book can be one potential learning resource for English instruction in the metaverse era. It is suggested that the teachers to utilize this handbook to implement authentic learning in the class projects while delving into interesting information provided by the VR application.

Keywords: English learning materials, secondary students, virtual reality

Introduction

In the 21st century, authentic learning is suggested to be used to engage the attention of students, so that students can face a real problem in society (Arianie, 2017), understand the material easier and engage in the learning process (Gürgil, 2018). Learning in this 21st century needs to blend knowledge, thinking, innovation skills, media, Information and Communication Technology (ICT) literacy, and real-life experience (Alismail & McGuire, 2015). The importance of authentic learning in the learning process impacted the way teachers teach in the class. The use of technology also preferred as the media to create authentic learning (Cydis, 2015). In this case, the use of technology offers stimulation to bring the real situation to the 21st century learning. This activity will automatically give them experience and construct the information. One advancement of technology that stimulates real-life experience to students can come from the metaverse area, including virtual reality (VR).

VR is an immersive, realistic, and three-dimensional technology that can bring real experiences to activate and engage the passive student (Hu-Au & Lee, 2017). It means that VR can motivate the students to participate actively in the class. As mentioned by Yulia (2013) that...
students' motivation in learning a foreign language is still a problem faced by teachers in Indonesia. VR is not only for playing a game but can be beneficial in the educational area, too as it can help the teacher in bringing real-world experience to the class (Pilgrim & Pilgrim, 2016). The environment can be designed based on the learning objective. The example of using VR in language learning was explained by Bonner and Reinders (2018). They promote two kinds of learning by using VR. They were learning by using VR video creation and orienting students to a reading topic through 360-degree videos. The other example of VR for education in the form of application is the Animals of Nusantara (AoN). This application was published on the 20th of January 2019 by Susila Lan Dharma (SLD) Team, qualified by Google’s terms and conditions, and able to be downloaded through the Google Play Store. AoN uses endemic animals of Indonesia as the theme. Those animals are Javanese Rhinoceros, Sumatran Elephant, Tiger, Sandalwood Pony, Sun Bear, Tapir, Spider Monkey, Bird of Paradise, and Kangaroo. This application can be used by using VR glasses and a smartphone.

As technology advances rapidly in today's learning era, one of the ways to utilize authentic learning is to use virtual reality (VR). It appeared in the form of a 3D, visually immersive experience for people who used it (Hu-Au & Lee, 2017). With the help of a 3-dimensional object and immersive 360-degree experience, the teachers can bring real-life experience to the class. Students can explore the 3D environment by looking forward, backward, or even turn around. To experience the virtual 3D dimension, students need to use a smartphone and Google glasses. The material would be available on the smartphone. In the area of VR, its features in virtual reality as an immersive technology can increase students’ participation and engagement (Allcoat & von Mühlener, 2018; Hu-Au & Lee, 2017). Tutschek and Ebert (2018) further explained that using VR in the teaching and learning process can help in creating the efficiency in teaching and learning process. VR is also claimed to accelerate students' achievement in learning (Pantelidis, 2009; Santosa & Ivone, 2020).

There have been several studies conducted on authentic learning and virtual reality as learning media in the classroom. Authentic learning is a concept related to the real-world, complex problems, and their solutions (Lombardi, 2007). The experience of learning using authentic learning would occur following the constructivism learning theory (Gürgil, 2018). Learning using authentic materials can be beneficial. According to Albiladi (2019), authentic materials can give a positive advantage, especially in increasing students' motivation. Students’ achievement can also be influenced by implementing authentic learning in the class (Gürgil, 2018). Authentic learning can be implemented and foster any skills in English learning, such as writing (Chamba et al., 2019), speaking (Ortiz & Cuéllar, 2018), and listening (Polat & Erişti, 2019). Authentic learning aims to assist students with the required knowledge, skills, and values to solve problems in real-life situation as indicated in the 21st-century learning.

Despite its potential, VR does come with some considerations. Technical aspects, like supporting equipment, like VR glasses or cardboards, supportive smartphones, and relevant learning content are the main things to prepare before the use. Familiarity and understanding of utilizing the VR platform is also something major in its integration in the teaching and learning process. Relevant materials like handbooks and guides are important.

A preliminary observation and an interview were conducted to disclose the teachers’ views on the use of AoN VR application implemented in public and private schools in North Bali. The results showed that teachers have been implementing the VR application as authentic learning media support in the class as it is suggested in this 21st-century learning. In the interview, teachers said that they were willing to use VR as an innovative learning media, replacing their outdated practices of learning media use in their classes. They mentioned being somewhat familiar with the VR application as they had a couple of times tried AoN VR application. In the class context, teachers found that the learning media help them to create a real-life environment and bring it to the learning environment. For example, they can use the VR application for brainstorming activities, like guessing the names of the animals, mentioning the characters and behavior, and also
describing the animals. Therefore, students experience learning in a more realistic, enjoyable, and fun way. They believe that providing contextual learning assists students to learn better and optimize the teaching and learning process.

Despite the positive learning supports provided by the VR application, the teachers also admitted to face problems in implementing this authentic learning media in the classroom. After showing the animals through the VR glass and sometimes brainstorming ideas related to the animals going to be learned in the lesson, teachers found it challenging to make students to be active in responding to the materials given. Teachers needed to take charge eventually, making it a shift to teacher-centered learning, one more time. Teachers admitted not preparing learning activities clearly due to several reasons, predominantly because of lack of understanding on pedagogies, classroom management, and technological readiness as well as supports for effective learning. This situation leads to limiting the teachers’ creativity in designing contextual and meaningful learning activities on particular learning topics that could be enabled by the use of VR.

Some other potential issues were also coming from technical perspectives. Most of the teachers found some difficulties in operating the application. They found that VR application, like AoN, requires a VR glass and a smartphone in its use for better implementation. According to the teachers, this equipment are not always available for every individual in the classroom setting. Additionally, a lack of time to explore the tool was one major factor to limited the optimal utilization of the learning media for meaningful learning in the EFL context. These conditions eventually hinder them from utilizing the learning media in an optimal learning process.

An initial study was done in the form of a document analysis on the syllabus and lesson plan. From analyzing the syllabus, it is found out that the topics taught in 7th grade students were relevant to the theme of AoN VR application. From the lesson plan, teachers used pictures, and textbooks to teach some topics, and tended to be teachers-centered. Less active participation and excitement emerged due to this practice. The lack of authentic media was confirmed by the teachers through an interview. Teachers explained that it was difficult to prepare some authentic media. In teaching about a descriptive text with the topic of animals teachers could not bring the real animals to the class or take the students out to see the animals in their habitat. In teaching about procedure text teachers found it is difficult to prepare, bring, and let the students explore by themselves because of the lack of time.

From the observation, interviews, and document analysis, it can be concluded that teachers faced four main problems in using the AoN VR application. Most of the teachers found it difficult to design meaningful learning activities for their students by utilizing the VR learning application. They also felt that technical operation limits them in creating an effective integration of innovative learning media, like VR, and their learning lessons. With the additions of strict regulations and limitations of time, making use of the contextual VR application in their classes was not optimal. As mentioned in Drajati et al (2018), time and facilities still become problems for teachers to use technology in the classroom. Teachers still face difficulties in preparing authentic learning media to support the teaching and learning process. The use of pictures and textbooks gives less chance for the students to be active in the class.

To deal with the conditions, teachers tried to explore more about the VR application and search for new ways to operate the application more effectively. As VR learning media have become available and potentially provide real-life learning context, a way to present the instructional process more systematically with various ideas is urgently required. Looking at the issues faced by the users, a more focused look into the pedagogical use of the VR media is important. The technical sides should be suited later with the available supports in the respective learning contexts. From the situations, teachers welcome the provision of the guided book or materials related to the use of the VR application in their learning process. They further expected that this handbook would contain comprehensive information and the potential activities when using AoN VR application.
A handbook usually contains factual information on a particular subject and instructional for operating a machine or application. It is a guide to the users on how to operate a product (Rahim & Hulukati, 2021). Specifically, Greene and Petty (1975) highlighted ten criteria of a good handbook, stating that it should (1) attract the attention of students, (2) use compelling resources like books to motivate students, (3) contain illustrations that can attract students’ attention, (4) think about linguistic aspects that match the expertise of students, (5) closely related to other lessons, (6) cause the kids who use it to act in a certain way, (7) be organized with clear principles so that students may use them without hesitation, (8) have a distinct and solid point of view so that it ultimately becomes the consumers’ point of view, (9) share the strengthening and emphasis of personality values to the participants, (10) appreciate the individual accounts of students within the differentiated instruction principles. Tomlinson and Masuhara (2018) explained that a good handbook includes a) comprehensive information, b) tutorial/steps to use the product, and c) the possible activities to implement the product. Santosa et al. (2022) further asserted that a good handbook contains comprehensive information about the product, the steps or procedures of using the product, and the activities to utilize the product effectively. Therefore, it is of high importance that a product especially those in the digital era today provides detailed ways and information to operate the product for the best optimum result – both from a technology and pedagogy perspective.

Thus, the guided book or the handbook is expected to give ideas on meaningful learning activities by using the VR application. Wong (2015) explained that meaningful learning is constructed by some elements, such as active, constructive, intentional, authentic, and cooperative. It means that the activity needs to engage the students to be active, let them construct the concept, do it for a purpose, bring real-world experience to the class, and encourage the students to be cooperative in learning. Meaningful learning activity design becomes important with its concept of making meaning in the learning process. Vallori (2014) found that students enjoyed themselves in learning, liked to do the work, were motivated, active in searching for additional materials, and were pleased by the experiences. Teachers felt that it was much easier to teach and work with happy students in the learning process.

Based on the explanation, more comprehensive learning media to provide information about digital products, such as the AoN VR application is urgently needed. It comprises the information on the product, the way to use the product, and the activities design can be written in the form of a handbook. In this study, the handbook is to guide the user to use the AoN VR application. It contained the concepts of VR and its use in English learning, its strengths and disadvantages, comprehensive details on AoN, and the possible activities conducted by using AoN. It is expected that teachers can create innovative ways of teaching today’s generations of learners by using VR technology while emphasizing the pedagogical perspective in play. The pedagogical part is highly important when utilizing a particular technological tool (Santosa, 2023).

**Methods**

This study employed the ADDIE research design (Richey & Klein, 2007) that contains five developmental phases analysis, design, development, implementation, and evaluation. Along with the five phases, the revisions were conducted to increase the quality of the product. Figure 1 presents the ADDIE design conducted in this present study.

![Figure 1. ADDIE Design (Richey & Klein, 2007)](image-url)
The analysis process of this study was done by conducting a document analysis to know the relevant topic to be developed. The designing process was conducted by drafting the content of the handbook. This handbook contained four units completed with appendices. The first unit is about the information about AoN VR application, the second unit is about the tutorial to use the application, the third unit is about the activities designed when utilizing the app, and the fourth unit is the closure. The blueprint of fifteen learning activities using AoN VR application was created in the learning design unit. The development process was done with the help of Microsoft Office Word and Photoshop. The expert judgments were conducted to determine the quality of the product. In the implementation process, an English teacher was asked to use the handbook and implement the activities in the handbook in the teaching process. This activity was continued by having an interview with the teacher as the evaluation of the implementation and the handbook as the product.

Respondents to the research

Based on the preliminary study, one public and one private school in North Bali were selected as the settings to collect the data. Using a purposive sampling technique, four English teachers in those schools were selected as the respondents of this study, comprising two teachers from public schools and two teachers from private schools.

Instruments

The study utilized an interview guide, a checklist, and an expert judgment evaluation sheet as the research instruments. The checklist was used during the design and development, the expert judgment sheet was used to examine the quality of the handbook after the implementation, and the interview guide was utilized during the evaluation stage. Before data collection, all instruments were judged by experts to ensure their validity and reliability.

Data analysis techniques

Framed within the exploratory sequential mixed methods, the gathered data in the form of interview transcripts, observation checklists, and expert judgment scores were analyzed both qualitatively and quantitatively. The checklist was deeply explored and interpreted to understand the existing conditions and enable and adjust the creation of the relevant AoN VR application. The judges’ scores were analyzed using the Ideal Mean Score analysis proposed by Nurkancana and Sunartana (1992) which can be seen as follows.

Table 1. Ideal mean score formula (adapted from Nurkancana and Sunartana, 1992)

<table>
<thead>
<tr>
<th>Score</th>
<th>Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>X ≥ Mi + 1.5Sdi</td>
<td>Excellent</td>
</tr>
<tr>
<td>Mi + 0.5Sdi ≤ X &lt; Mi + 1.5Sdi</td>
<td>Good</td>
</tr>
<tr>
<td>Mi - 0.5Sdi ≤ X &lt; Mi + 0.5Sdi</td>
<td>Average</td>
</tr>
<tr>
<td>Mi - 1.5Sdi ≤ X &lt; Mi - 0.5Sdi</td>
<td>Below Average</td>
</tr>
<tr>
<td>X &lt; Mi - 1.5Sdi</td>
<td>Poor</td>
</tr>
</tbody>
</table>

After this, the data from the interview transcripts were used to help understand deeper about the teachers’ opinions about the product. Data triangulation was further conducted to confirm the credibility and trustworthiness of the analyses.

Results and Discussion

The handbook was developed in five stages conducting document analysis, designing the handbook by making a blueprint, developing the product, judging the quality of the handbook by the experts, implementing the product in the class, and conducting an evaluation of the product. Each of the stages is a successive process in nature with evaluations in between.
**Analysis**

Document analysis was done as the starting point of developing AoN’s handbook. The document analysis is in the form of a syllabus analysis to find the relevant topics. Syllabus analysis is important to understand and familiarize the needs regarding the contents to be delivered to the students (Richards, 2001). The instrument to get the data on the relevant topic is the syllabus checklist. The selection of the topic is done with the help of Junior High School’s English teachers. From 8 topics, 4 relevant topics were suitable to be developed using the AoN VR application. Those topics were (1) the number, name, and preposition of animals, (2) the characteristics of animals, (3) the behavior of animals, and (4) descriptive text. These four topics were developed into 15 potential activities to implement the AoN VR application. Those 15 activities were designed to achieve the learning objective or purpose of learning more meaningfully.

**Design**

After conducting the need analysis, the second stage of the step is designing the product in the form of a handbook for the AoN VR application. Microsoft Office Word and Photoshop were used to design the handbook. In designing the handbook, the drafting process matters. The content inside of the handbook must be considered based on the interview and the syllabus analysis. From the interview, teachers expected to get three things, namely comprehensive information about the product, the tutorial to download and use the product, and the potential activities using the application. The syllabus analysis also found there are four relevant topics for the AoN VR application. This handbook consisted of four units and was completed with appendices to support the activities.

Unit one of this handbook consists of the concepts regarding the disruption era and Industrial Revolution 4.0, the implementation of Information and Communication of Technology (ICT) in teaching English, AoN VR application, and authentic learning. This information was beneficial to know more about the underlying principles of developing the application and the handbook. Unit Two is about the tutorial on downloading and using the AoN VR application. This part was divided into three sections, they are the information about the requirements of using AoN VR application, an explanation on downloading the application, and a description of using the application. This unit was completed with images and illustrations so that users can do it autonomously. Unit Three is the main section of the handbook that contains the activities designed using AoN VR application. The first activity is *Let's Count!* This activity is designed as an individual activity in the class. This activity aims to make the students work individually to find out how many animals are there in the scene. This activity could develop students’ critical and communicative skills as a part of 21st-century learning skills.

*Scramble Letters* is the second activity aimed at a group work activity to enable the students to learn about animals' names in a fun way collaboratively. The students have a responsibility to arrange the unorganized letters into the correct names of animals. In teams, the students could arrange the names of the animals inside of the application or other animals provided by the teacher. Students’ creativity and collaboration skills are mainly trained in this activity.

The third activity is *Stick It!* This activity is designed as an individual and group work exercise to increase students’ critical thinking skills with emphasis on determiners, and singular, and plural concepts. The students should remember the numbers, names, and prepositions of the animals inside of every scene in the application. The individual work and group work are differentiated in this activity.

The fourth activity is *Where is the...?* This activity promotes communicative skills, especially in public speaking. Group work is designed here by emphasizing the use of prepositions in explaining the animals inside of the application.

The fifth activity is *Guess Me and Spell My Name*. It is a group work activity to learn and play at the same time. The students play a game to guess the names of animals based on the given clues.
about animals’ characteristics. In answering the animals’ names, they should arrange the letters correctly. This activity is aimed at training students’ communicative skills.

Mind Mapping is the sixth activity that lets the students get the information, construct the concept, and organize the information about endemic animals. This activity lets the students experience and involve well in the activity within the constructivism learning theory (Gürgil, 2018). Besides, students’ creativity skill is also emphasized.

The seventh activity is Summer Zoo Trip. It is a mixed activity of individual and group work. This activity gives students an authentic learning experience by observing the animals at 360 degrees. Students move around to observe the animals closer through VR glass while strolling around the zoo virtual environment.

Who Am I? is the eighth activity which aims to use declarative and interrogative sentences to guess the animals based on their behavior. Those sentences can be used in teaching asking and giving information about the animals’ behavior in the application. It is designed as a group work activity to increase students’ collaborative skills.

The ninth activity is Puzzle Time. This activity is a group work activity to learn about students’ behavior. Here, students identify the animals based on their behavior mentioned inside the puzzle by exploring the VR environment. Alternatively, the students could also do Who Am I? activity at first and then continue to do Puzzle Time to check students’ comprehension within groups’ collaborative works.

Pass Me the Ball, Please! is the tenth activity provided in the handbook. This activity has the purpose of checking students’ comprehension of the animal’s behavior in a fun way. The students have to observe the animals from Animals of Nusantara application, learn about the behavior of animals, and finally play this game together with friends. Students need to make a circle and sing to pass the ball. The student who gets the ball gets a paper written the name of an animal. They need to recall the information they learned about animals’ behavior and explain it orally. Students’ critical thinking to make a new sentence in a limited time is trained in this activity.

The eleventh activity is What Do You See? This activity is a way to grab students’ attention and increase their motivation to learn English with VR. Through this activity, students are expected to increase their ability to describe objects in the form of an activity. The students need to describe the animals they see from the application by writing a descriptive text. After writing, the students are invited to share their work in front of the class. This activity can develop students’ communicative and writing skills.

Lottery and Speak Up is the twelfth activity that can be found in the handbook. It aims to train students’ speaking competency in the form of describing animals spontaneously. After observing nine animals in the application, students will have to describe the selected animals based on the lottery they selected.

The thirteenth activity is I am a Reporter, designed as a group work activity. It offers the experience of acting as a reporter for the students. They observe the animals virtually, then one student has to create a news report about those animals. Discussions, Google searches, interviews, mind maps, and writing short news report activities are utilized here. This activity is expected to develop students’ communicative and collaborative skills.

Design My Own Zoo is the fourteenth activity in the handbook. Students observe the VR animals and are encouraged to create their own zoo. Students could draw it or find the animals’ pictures in magazines or on the internet. It expects students to train their critical thinking, creativity, collaborative, and communicative skills.

Finally, the fifteenth activity is Zoo Brochure that is designed as a group work activity. Students make a zoo brochure about animals to attract visitors to visit the zoo. The brochure must have an appealing description of the animals. The students can pour their creativity and ideas into making a zoo brochure. Through this activity, students can train their creative skills in designing a zoo brochure with proper information on it.
The description, purpose, requirements, and the steps in doing the activities were explained in detail in the handbook. There are pictures to support the users in the activities. Each of the activities promotes the 21st century skills which are important today. Each activity employs AoN VR application in a 360-degree learning experience.

Unit Four of the handbook is the closure. This unit summarizes the book and provides some additional information, like supporting media for authentic learning.

**Development**

Developing the AoN VR handbook is the next step by making the blueprint and prototype. The development process of the handbook was assisted by the help of Microsoft Office Word and Photoshop software. After the development, experts judgment was initiated. The three expert judges with various backgrounds of ICT, teaching, and teaching material evaluated the handbook product and filled in the evaluation sheet. Those scores were calculated by using the formula from Nurkancana and Sunartana (1992). The procedure was as follows.

The expert judges' evaluation sheet contained two components of content and face validity. The maximum score for each descriptor is 5 (excellent), and the minimum one is 1 (poor). The total maximum score for the descriptors is 105, while the total of the minimum score is 21. Using the Ideal Mean Score formula, the analysis of measuring the handbook's quality can be presented as follows.

First, use the formula.

\[ Mi = \frac{1}{2} (\text{Maximum Score} + \text{Minimum Score}) \]

\[ Sdi = \frac{1}{3} (Mi) \]

Second, find the Mi.

\[ Mi = \frac{1}{2} (105 + 21) \]

\[ Mi = \frac{1}{2} (126) \]

\[ Mi = 63 \]

Third, find the Sdi.

\[ Sdi = \frac{1}{3} (Mi) \]

\[ Sdi = \frac{1}{3} (63) \]

\[ Sdi = 21 \]

After the Mi and Sdi were identified, Mi and Sdi were placed on the formula for categorization.

<table>
<thead>
<tr>
<th>Table 2. Ideal Mean Score Calculation for the Handbook's Quality</th>
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<tbody>
<tr>
<td><strong>Criteria</strong></td>
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<td><strong>Excellent</strong></td>
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*To be continued...*
Based on the expert judgment result on the handbook, the first judge (EJ1) – an ICT expert – gave score 102, which was categorized as excellent media. The second judge (EJ2) – a learning material expert – scored the handbook 102, categorized as an excellent media. Finally, the score from the third judge (EJ3), as a teacher, was 100, categorized as excellent media. The score was calculated involving the content and face validity of the product. Although it was excellent, there were four revisions given by the experts comprising grammar use, title of the handbook, cover, and adding some book sections for a comprehensive book writing which can be seen in Table 3.

Table 3. Handbook revision

<table>
<thead>
<tr>
<th>Suggestion</th>
<th>Before Revision</th>
<th>After Revision</th>
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<tbody>
<tr>
<td>Grammar</td>
<td>This kind of work actually can be done physically in the real life, but in this</td>
<td>The students can do the work at home assisted by technology. They can search</td>
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<td></td>
<td>disruption era, there is a help of technology in the form of platform or application as the media to give comments on</td>
<td>additional information in the internet. As a result, this kind of learning can improve</td>
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<td></td>
<td>the students’ interaction and collaboration. Thus, it can decrease the gap between the students between higher and lower cognitive ability (Tanaka, 2017).</td>
<td>students’ interaction and collaboration. Thus, it can decrease the gap between</td>
</tr>
<tr>
<td></td>
<td>In short, this is a phenomenon when people shift their activities that were originally carried out in the real world, into cyberspace or digital world.</td>
<td>the students between higher and lower cognitive ability (Tanaka, 2017).</td>
</tr>
<tr>
<td></td>
<td>As the development of disruption era, there are a lot of challenges that must be faced. Effendy (2019) stated there are eight national challenges that would be faced.</td>
<td>According to Miljica (2014), disruption era is the combination of three main things, these are physical, digital, and human. In this era, the elemental generation is really close to technology. People can do some interaction physically in the digital world. In an example, people can give commands to systems physically.</td>
</tr>
<tr>
<td></td>
<td>Those are the access to education, the quality of education and teachers, nation’s competitiveness, nationalism, radicalism, creative industry, quality of employment, health, and demography bonus.</td>
<td>The kind of work actually can be done physically in the real life, but in this disruption era, there is a help of technology in the form of platform or applications as the media to give comments on some picture. In short, this is a phenomenon when people shift their activities.</td>
</tr>
<tr>
<td>Cover and Title</td>
<td>Front Cover</td>
<td>Front Cover</td>
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*To be continued...*
After revising the media, the final version of the handbook was judged for the second time by three expert judgments. As a result, the total score from the first judge (EJ 1) was 103 and it was categorized as excellent media. The total score from the second judge (EJ 2) was 105. This score also indicated excellent media. The third judge (EJ 3) gave 104 as the score and it is categorized as an excellent media. As the handbook is considered excellent, it is ready to be implemented.

**Implementation**

The implementation was conducted after revising the material and interface of the handbook. The English teacher who teaches the seventh-grade students delivered the material about animals by following two activities provided in the handbook. Those activities were "Who am I?" and "I am
A Reporter". This implementation was emphasized on the teachers' thoughts and feeling after implementing the activities in the handbook that integrated with technology. The preparation for the implementation was included in the teaching and learning scenario. The implementation of the two activities was conducted in 1 hour of lesson around 45 minutes.

The teacher followed the steps explained in the handbook for implementing "Who am I?" and "I am a Reporter" activity. The activity began by dividing the students into 5 groups. Each group consists of 3-4 students. The teacher continued the activity by giving a brainstorming to the students. The topic of pets was chosen to open the brainstorming section. In this step, students were active to mention their pets. The third step was introducing virtual reality and explaining the instruction in using it. Fourth, the teacher gave some questions to make sure that students understood his explanation.

The main activity was inviting one of the students in each group to take their turn to use VR glasses with AoN VR application. In the handbook, the other students should make a line to guess the animals. By the class condition, the teacher decided to keep the students sit on their seats and guess the animal by asking some questions in turn. As it is explained in the handbook, the teachers can do some variation based on the class condition and teachers' creativity.

After the main activity was conducted, the teacher invited the students to conclude the characteristics of the animals they have guessed. The teacher then announced the group who got the best score of guessing the animals. To check students' comprehension about the characteristics of the animals, the teacher combined "Who am I?" with "I am a Reporter" activity. This activity was conducted by inviting students to use virtual reality glasses and explain the characteristics of the animals directly in front of the class. The class was ended by having a reflection along the learning process. The teacher asked about the students' favorite part in today's activity.

Evaluation

An evaluation was conducted afterwards to the English teachers as the users. There are three open-ended questions comprising their opinions, responses, and suggestions. In general, the teachers asserted that teaching using VR with the help of the handbook was helpful. The handbook provided clear steps in downloading and using the VR app. The handbook is also attractive as it is completed with relevant illustrations. The teachers also found that integrating technology into language learning was fun as it could attract the attention of both teachers and students. The teachers pointed out that the students were more active in the learning process. They paid attention to the teachers and friends and could guess the name of the animals correctly. Their motivation was also increasing greatly. Most of the students raised their hands to try the VR and guess the animals and it helped them to understand the materials better. Positive responses were also stated by the teachers after the implementation of the handbook. No major revisions were suggested and they found no difficulties in using the application with the guidance from the handbook. One important suggestion include building more realistic 3D objects.

Based on the results, there have been several stages conducted to develop the handbook for AoN VR application, namely analysis, design, and development. The implementation and evaluation were also carried out to disclose the quality of the handbook. The development of the handbook for AoN VR application was conducted by using the ADDIE research design to assist the users when utilizing the app that was developed earlier. Santosa et al. (2020) stated that guidance in the form of handbooks or tutorials are important to guide the product users in maximizing the product's implementation.

The handbook was developed into four units and completed with appendices. The first two units consists of conceptual principles and tutorials. The third unit focuses on the learning activities when using the AoN VR app. The last unit is the closure to conclude the handbook. Fifteen English learning activities written in the third unit of the handbook were designed to reflect the authentic learning activity as it is suggested in the 21st century. Ten points as an authentic learning
activities framework promoted by Luo et al. (2017) are the guideline to design the activities. The first, this handbook can reflect the real world by the activities design. The activities designed to make students able to solve problems, explain something, and maintain good communication with others. Moreover, virtual reality offers the user to get 360-degree experience in observing the virtual environment (Pantelidis, 2009). Second, after explaining the rules or instructions, the students can explain what they are going to do by giving some questions. Third, the activities already provide tasks for the students to participate in the learning process. Fourth, the activities allow students to complete the task using various sources such as virtual reality, link, pictures, etc. Fifth, the activities give the students opportunities to collaborate by doing group work. Sixth, the activities provide a chance to reflect the whole activities at the end of the class. Seventh, the activities can be integrated with different subject. Eighth, there are formative and summative assessment in each activities. Ninth, the activities let the students to produce a product by their own for example map, zoo design, and brochure. Tenth, the activities let the students to give solution how to attract visitors to come to the zoo by making a brochure and zoo design. The guidelines are vital in designing products to ensure its quality (Greene & Petty, 1975).

The activities have been consulted with the experts. There were some revisions and suggestions during the process of development to make the activities motivate and engage the students in learning English (Albiladi, 2019; Allcoat & von Mühlenen, 2018; Hu-Au & Lee, 2017). They found that authentic learning and virtual reality can motivate the students and enhance their engagement in the learning process. By creating fun and critical brainstorming the students can be motivated in learning. The activities also designed as students-centered as it can give a lot of chances for the students to participate in the learning process (Santosa, 2022). The activities are designed as integrated skills so that the students can foster their English skills (Chamba et al., 2019; Ortiz & Cuéllar, 2018; Polat & Erişti, 2019).

In order to get the good quality of the handbook, the criteria or category of a good book need to be considered. This handbook was following the criteria of a good book promotes by Greene and Petty (1975), namely to 1) attract users who use it by creating an attractive cover and layout, 2) give a motivation and ideas for the teachers to be innovative in teaching English, 3) provide illustrations to and help the teachers to get the information served by the book, 4) consider on the users’ linguistics ability in using the language by using a language that is easy to be understood, 5) support others subject in learning or integrated with other subject, 6) stimulates private activities of users, therefore the teachers can construct authentic learning by their own, 7) contain a clear and precise concept and information in this case about authentic learning and virtual reality, 8) give a clear point of view to decrease and avoid misunderstanding by using third person point of view consistently, 9) give values for teachers as the users in this 21st century in enhancing 4C skills, and 10) appreciates the users’ differentiation by giving a lot of variation of activities that can be chosen based on the class situation and condition. These are pivotal in developmental research (Richey & Klein, 2007).

After design and development, the handbook was judged by the three experts. The result of the judgment was calculated using Nurkancana and Sunartana’s formula (1992). The expert judgment was conducted twice, before and after revision. Although the judges categorized the handbook as excellent in the initial evaluation, there were some important feedback given, dealing with the grammar use, the title, the cover, and the writing sections. After the revisions, the handbook was considered as an excellent media and is ready to be implemented. This decision is important in the research and design type of research (Branch, 2009).

From the implementation, an interview was conducted to the English teachers. From the data, it was found that both teachers and students felt excited in the teaching and learning process with VR. This is in line with the study conducted by Bonner and Reinders (2018) that explained VR integration with well-designed learning activities design gave an impact on students’ participation, engagement, and motivation. Hu-Au and Lee (2017) and Allcoat and von Mühlenen (2018) further added that students were more engaged and participative during the VR-infused
learning. A clear scaffolded plan is crucial in this case (Santosa & Ivone, 2020). A more realistic and authentic learning is also present, making it easier for the students to understand things they cannot see or touch directly. Authenticity in learning is strongly suggested in today’s learning (Luo et al., 2017). By having time to explore more about animals, students can learn, have an idea and become more familiar with the topic. According to Hanifa (2018), familiarity of the topic is essential to avoid learning anxiety. It is clear that the handbook went through the stages of ADDIE model with analysis, creation, implementation, and evaluation with continuous revisions between stages to become an excellent product.

**Conclusion**

In conclusion, the development of the handbook was conducted using ADDIE model that consists of Analysis, Design, Develop, Implement, and Evaluation. The final product consists of four units. There are four units of concepts, tutorial, learning activities using the VR app, and closure. After revisions and implementation, it was found to be an excellent learning material to assist students’ English learning utilizing the technology. With the product, the teachers are able to use this handbook to assist them in implementing authentic learning through meaningful learning activities. It is suggested to take into account of more realistic 3D objects in the future development.

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