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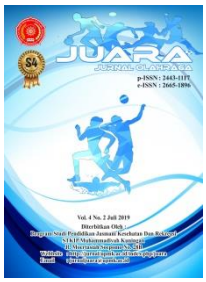

# *THE DEVELOPMENT OF IMMERSIVE LEARNING BASED ON NATURAL USER INTERFACE (NUI) ON TABLE TENNIS EXERCISE*

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**Abstract**

*This research is a learning media development research with the theory used is Immersive Learning based on Natural User Interface. Immersive Learning is expected to help students to practice table tennis without the limitations of space and time tools because Immersive Learning emphasizes learning that is virtual with the help of the Kinect camera from the Xbox 360 so that it is as if students can experience table tennis learning practices directly without the limitations of tools such as table bet net and save space. This research aims to give a new impression in the game of table tennis by giving a modern impression with the technology provided through Immersive Learning Based on Natural User Interface (NUI). In addition, to facilitate the assessment of sports subjects, especially table tennis material because in practice the assessment of the psychomotor domain. In practice in the field, teachers only measure the psychomotor abilities of students approximately during the learning process without making clear indicators so that the objectives of practicum activities according to basic competencies in the curriculum. Thus resulting in the usual subjectivity and unfavorable to improving the quality of learning. This study aims to help students know the level of objectivity in learning the basic movements of table tennis with the ADDIE development model. While the results of the Immersive Learning application trial were determined by looking at the results of the individual trial with a score of 97.5% and the field test with a score of 95.5%. These results show that table tennis Immersive Learning is declared quite effective in improving psychomotor learning outcomes.*



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## INTRODUCTION

The advancement and development of technology today brings many extraordinary changes in all aspects of human life, including advances in the field of education. One of the current technological advances is the change in learning resources and learning methods from traditional to more modern digitalization. In a book Innovating Pedagogy 2017, there are new disruptions about innovation and change in the field of education, one of which is Immersive Learning. Simply put, immersive learning allows a person to experience a situation as if they were there in the virtual world. (Sharples et al., 2019) Humans can fantasize or experience mind wandering through their imagination as an alternative reality (Morteza, 2022). Some authors define immersive learning as learning enabled by the use of immersive technology (Li, Richard Chen. Horace, 2022) By using science and resource development to solve problems or practice skills, learning is intensified by bringing visuals, sound, movement, spatial awareness and touch into the virtual space. Natural User Interface (NUI) is a more natural way for users to interact with technology and is a general term for technology that can accept voice, touch and gesture input. Natural User Interface (NUI) does not refer to interface design, NUI refers to the ways of interacting used by users (Webb, J. & Ashley, 2012). The use of Natural User Interface (NUI) with interactive multimedia in education is a technological trend that is being developed today Project, (2012) The resulting technologies such as multitouch, speech recognition, kinetic interface are features found in kinect or the general term called NUI Soepriyanto & Baskara, (2017) To interact between the user and the computer using NUI, it will occur without intermediaries as if the interaction media is invisible, which is the hallmark of this technology. Meanwhile, the technology in the *Kinect* will send data to the computer by taking swipe gestures or human movements that replace the mouse and keyboard. This becomes more interesting in the field of computer interaction and technology with user interfaces, which can carry out the functions of immersive systems that can be controlled with the human body as a natural interaction with the computer. To interact between the user and the computer using NUI, it will occur without intermediaries as if the interaction media is invisible, which is the hallmark of this technology. Meanwhile, the technology in the *Kinect* will send data to the computer by taking swipe gestures or human movements that replace the mouse and keyboard. This becomes more interesting in the field of computer interaction and technology with user interfaces, which can carry out the functions of immersive systems that can be controlled with the human body as a natural interaction with the computer.

The principles of NUI development consist of several elements. The component elements are defined by three elements Daniel, Wigdor. Dennis, (2011): fun, leading to skillful practice, appropriate to the context. Immersive development products in this study use the help of Unity as software used to develop a virtual world designed to resemble a room with table tennis equipment and its user avatars. The development product will be more functional by using some of the main features contained in the *Kinect,* which include depth sensor and skeletal tracking that can detect the user's skeletal with the range of the *Kinect* camera (Gunawan et al., 2017). Interactive multimedia is one of the reasons learners use it as a learning strategy, besides that it also contains learning materials as well as entertainment (Ludwig et al., 2004).

Concerns occur when the world of education does not adapt to the social changes that populations around the world face, both knowledge-wise and with emerging technologies. For example, the results of Washington's National Center for Educational Statistics 2016 show a deep gap between students' knowledge and procedures, and their understanding of the application of that knowledge through reasoning and research, with the study concluding as follows: "substantial changes are needed in what we expect students to know and be able to do in technology and science, how science should be taught, and how it should be assessed (Pellegrino, 2016).

Observations that have been carried out at Senior High School Number 1 South Bengkulu found that, table tennis learning is only limited to conventional learning, which requires a room and a long enough learning time, so that all students can practice directly to perform table

tennis movements. To minimize the gap between the world of education that is still conventional and modern using today's technology. This research aims to give a new impression in the game of table tennis by giving a modern impression with the technology provided through Immersive Learning Based on Natural User Interface (NUI). In addition, to facilitate the assessment of sports learning materials, especially table tennis material, because in practice the assessment of the psychomotor domain when in the field the teacher only measures the psychomotor abilities of students approximately during the learning process without making clear indicators so that the objectives of practicum activities according to basic competencies in the curriculum. So that it results in the usual subjectivity and is not beneficial to improving the quality of learning.

In the immersive teaching and learning process, the *Kinect* camera is used with Natural User Interface (NUI), using gestures as controls (Human Computer Interface) which are then translated and presented in the form of multimedia presentations Villaroman, N., Rowe, D., Ph, D., Swan, B. & Ph, (2011) The sensor in the *Kinect* camera uses a depth sensor to convert data and change it with 3D features captured from the light intensity of the user. According to Catuhe, (2012) the camera of the *Kinect* sensor can function properly with a 57o Horizontal View Distance, 43o Vertical View Distance, camera distance with user 2 meters to 4 meters. The use of the camera can be used with little light in the room. This research aims to provide solutions to help the learning and training process of table tennis, as well as to help the evaluation process in the psychomotor domain, namely through the help of learning media that will be developed further with the Immersive Learning format based on Natural User Interface (NUI), which is expected to be able to help educators explain the material and students can also practice directly the activities and basic movements of table tennis with the help of modern learning technology, helping to measure the movements. The existence of virtual technology with immersive concepts in this research is expected to optimize the learning process of students in imitating basic table tennis movements.

## METHODS

This study uses the ADDIE model development model (I, Made, Tegeh. I, Nyoman, Jampel. Ketut, 2014) there are five steps of multimedia development, namely: (1) analysis consisting of needs and preliminary-end analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The stages of development with the ADDIE model for more details are in Figure 1.

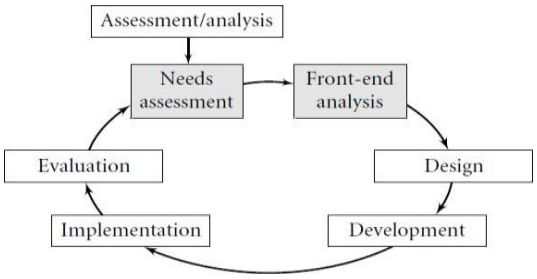


*Figure 1. ADDIE Model* (I Made Tegeh, I Nyoman Jampel, 2014)

The development objective is to develop a valid and effective immersive learning application to help learn basic table tennis movements. By paying attention to these objectives, quantitative and qualitative data are needed which are analyzed and processed. Data sources obtained from quantitative data use research instruments, namely validation sheets, while data sources for qualitative data are obtained from input and suggestions from validators and students as users of immersive learning applications.

The target of the research conducted was Senior High School Number 1 South Bengkulu class X students who had received material on table tennis subjects. The product was first validated by several experts and students who were members of the audience. X grade students who were selected as research targets were 10 X grade students of Senior High School Number 1 South Bengkulu as well as included in 1 large

group in the study. Before the product is tested on a large group, the next process is to validate it using a validation sheet to media experts and material experts. Data from the validation results were calculated into a percentage score with the formula Arikunto, (2010) Tests are used to collect data related to student learning completeness. The test was conducted in the form of basic table tennis movements, which were scored objectively through the help of Immersive Learning learning media applications. To carry out the implementation of learning media in the field, after the product is developed, the next steps are: (1) After the media product is validated and tested then revise the learning media product if there are errors, it will be tested in the field, namely on 10 class X students, (2) The developer provides files to students to download in the form of software, (3) Students can learn table tennis movements after getting files on the learning media, (4) students imitate and learn table tennis movements outside of class time, (5) The next meeting practiced the learning media application directly accompanied by the teacher and developer, (6) students get an assessment instrument in the game as well as being used as an instrument test to determine the effectiveness of the media.

The expected graduation competency in immersive learning media is to be able to imitate basic table tennis movements consisting of a ready stance, basic strokes, serves and smashes in accordance with table tennis learning material. To achieve the completeness of learning outcomes assessment, which focuses on 3 psychomotor domains, namely Perception or perception, Set or readiness, Guided response or guided movement. This aspect can be an indicator of psychomotor measurement with Immersive Learning learning media, then the assessment measurement will be more expected to be measured and accurate. For each student the minimum score in the application is 500 points. The learning outcomes of table tennis movements are said to be effective, with the achievement of complete learning outcomes or minimum completeness criteria score 76 contained in the learning media application.

**Findings**

The results of the trials that have been developed and analyzed will be discussed first is the data from media experts, material experts, student respondents and student learning outcomes. The part that needs to be validated is the media part and the learning content material. In validating the media, media experts related to educational technology are needed. As for the material on the basic movements of table tennis, it requires material experts related to the field of Physical Education and Sports. In the table tennis learning material above is the content of the material for students to imitate the movements according to the illustrative examples in the picture. At this stage students will see examples of movements and then imitate the movements before the table tennis game begins. There are eight movements that will be displayed on the initial scene menu in the application with four categories, namely attitude, punch, serve and smash. Attitude consists of ready and stance, while punches, serves and smashes are the same, consisting of backhand and forehand.

| Expert | Score | Percentage | Result |
|---|---|---|---|
| Media Expert | 60 | 100% | Valid |
| Material Expert | 55 | 90% | Valid appl |

A. *The validation results shown in Table 1 can be continued for field trials or large group trials. Large group trials are conducted by implementing the use of immersive learning media applications when table tennis learning materials have been implemented previously. This is used as a reference for application trials at a later stage.*

B. *Table 1. Media and Material Expert Validation Test Results*

Data analysis in table 2 shows a score of 117 which is included in category A (76% - 100%) this means that the immersive learning application developed is valid and feasible to use in table tennis learning activities using the

application developed by the researcher. Individual trials were conducted by implementing the use of immersive learning media applications when table tennis learning materials had been previously implemented. This is used as a reference for application trials at the field trial stage.

*Table 2. Individual Trial Results*

| No. | Student | Score | Result |
|---|---|---|---|
| 1. | Student 1 | 5200 | **Pass** |
| 2. | Student 2 | 3000 | **Not Pass** |
| 3. | Student 3 | 5200 | **Pass** |
| 4. | Student 4 | 5200 | **Pass** |
| 5. | Student 5 | 5200 | **Pass** |
| 6. | Student 6 | 5200 | **Pass** |
| 7. | Student 7 | 4500 | **Pass** |
| 8. | Student 8 | 4500 | **Pass** |
| 9. | Student 9 | 4500 | **Pass** |
| 10. | Student 10 | 5200 | **Pass** |

Data analysis in table 3 shows a score of 573 which is included in category A (76% - 100%). This means that the immersive learning application developed is valid and feasible to be used in table tennis learning activities using the application developed by the researcher.

*Table 3. Field Trial Results*

Data analysis in table 3 shows a score of 573 which is included in category A (76% - 100%). This means that the immersive learning application developed is valid and feasible to be used in table tennis learning activities using the application developed by the researcher.

*Table 3. Field Trial Results*

Analysis of the learning outcomes test after using the table tennis learning immersive learning application in table 4, it is known that 9 students or 90% of students understand the table tennis movement material presented and the score was 10% or 1 student who has not understood the material. Then from the data from the validation results, individual tests and learning field trials it will be concluded that the Immersive Learning application on table tennis learning material is valid and can be used in table tennis movement learning activities. The trial results will be used as a reference for the main learning media for learning table tennis movements with additions and developments according to the subject matter.

**Discussion**

The utilization of technology in education is a positive progress to educate the nation's children. Immersive Learning Application Based on Natural User Interface (NUI) is one of the learning tools that can support and optimize assessment in the psychomotor domain for table tennis learning material. In using the Immersive Learning application, students can virtually imitate basic movements, so that it is as if the learning is "there" in the virtual world. In this application there is a "score" feature which has an assessment function that can be done independently and interactively. Assessment in this application is carried out objectively to assist teachers in conducting more measurable student learning outcomes tests. This NUI-based Immersive Learning ication aims to train students to understand the basic movements of table tennis using the XBOX 360 *Kinect* camera and unity software assistance, so that students are expected to practice and learn independently in understanding the basic movements of table tennis virtually. Meanwhile, research conducted found utilization using immersive technology, namely: education, entertainment, health, and marketing. They also identified two main streams of research. First, studies that examine the user experience and effects of unique system features of immersive technologies. Second, studies that examine how the use of immersive technologies improves user performance through, for example, learning and teaching effectiveness. Ayoung, Suh. Jane, (2018) provided the following classification framework for the use of immersive

technologies: Stimulus aspects (i.e., sensory, perceptual, and content), Organism aspects (i.e., cognitive and affective reactions), Response aspects (i.e., positive and negative outcomes), and Individual differences in VR use (i.e., gender, age, sensation-seeking tendencies, and personal innovativeness). According to another point of view in the world of technology, the term immersive means "the extent to which a computer display is capable" of providing an inclusive, pervasive, surrounding, and vivid illusion of reality (Slater, M. and Wilbur, 1997). Meanwhile, according to the psychological view, immersive is a psychological state where the user feels sensory 'isolation' from the real Witmer, B. G., & Singer, (2004) Immersiveness and interactivity are considered the core characteristics of VR technology (Ryan, 2016). The term interactivity can describe how users can re-modify the virtual reality (VR) environment in real-time (Steure, 1993). While some researchers agree on the definitions of interactivity and presence, a different view exists on the concept of immersive. One branch of research argues that immerse should be seen as a technological attribute that can be objectively assessed, whereas another opinion considers that describing immersive as a form of individual belief, i.e. a psychological.

In general, immersive learning can combine learning using modern AR and VR technologies with conventional learning methods. The developed product uses the help of *Kinect* Xbox 360 camera. This camera was developed by Microsoft on June 16, 2011 by releasing *Kinect* Software Development Kit (Kinect SDK) software. In previous research according to Kurniawan, (2017) to interact with the features contained in the Natural User Interface (NUI) requires a *Kinect* Xbox 360 camera sensor that functions to read human movements intuitively and translate with the help of computers to get the alignment of human movements in virtual and user movements in the real world. The use of *Kinect* Xbox in 3D scanning with depth range (color and hue, texture, object detail) and is widely developed in the field of computer vision. Previous research by Suryani, M., Paulus, E., Farabi, (2016) on improving learning abilities and motivation when using VR as a learning medium was reviewed by conducting direct trials into the field. From the results of giving pretests and posttests, it was found that there was a significant difference in cognitive ability with a p-value of 0.448 after students used the Semi- Immersive Virtual Reality application.

Increased learning motivation also gets an increase in the learning process tested for students. In its application, this immersive learning application provides stimulus in the form of animation, images, imitating movements, feeling new sensations in learning table tennis visually and immersively. So it is expected that a student can construct a new knowledge through immersive table tennis learning media through the skills gained when in the process of learning to imitate basic table tennis movements. The development of learning methods using AR, VR and XR features of immersive learning is developed in the future with a wider range of learning media, materials that support virtual learning, both at school and outside school. The use of software and the selection of materials that support immersive learning need to be studied better. If this immersive learning application uses a server and website to access, it will be easier to deliver learning online. So that the delivery of learning materials will be more efficient to be accessed anywhere by using online immersive learning. By using the remote desktop, those who access this immersive learning application only need to access the available server/website to learn, imitate, get new experiences, and experience directly through the website. Immersive itself aims to bring direct experience when existing in a certain virtual world.

As educators in modern times, the use of technology that helps in learning is certainly very useful in improving student competence and facilitating learning with innovations that support learning activities themselves. The purpose of Immersive Learning is for (Long Term Goal Behavior), namely knowledge and skills that can be used and useful for the long term both in the scope of school and in life. Because psychomotor learning related to body movements contained in basic table tennis movement material, not only through theory, but requires intensity in practicing, and it is hoped that the Immersive Learning application

can be a learning facility. In other developments, this application can be developed not only limited to table tennis learning, but can be developed on other learning materials. For the medical world, NUI-based immersive learning can be developed and used for physiotherapy in training post-healing patients, such as walking and hand movement exercises with the help of immersive applications. Research conducted by Chiarovano E, de Waele C, MacDougall HG, Rogers SJ, Burgess AM, (2015) is related to the field of health in the elderly and disabilities for balance tests and research by Zaveri P. P. et all, (2016) in the health sector is related to learning simulations for patient handling by doctors. Another impact of VR application research is the emergence of cybersickness for its users, therefore the category in the development of the health sector needs special attention if the use is too long and the technical use is appropriate (Rosa, P.J., Morais, D., Gamito, 2016). To face complex problems with immersive technology, in the future, as technology activists, we must be able to have a broad understanding of virtual media. This is used as a reference for a more creative future vision and innovative solutions in the development of virtual education. This knowledge is essential for future applications of the Metaverse (Blascovich, J.; Bailenson, 2011)

## CONCLUSION

This research aims to give an impression and new things in table tennis learning material with modern elements developed using technology through Immersive Learning media based on Natural User Interface (NUI). In addition, to facilitate the assessment of sports learning materials, especially table tennis material. In addition, it aims to help students know the level of objectivity of learning evaluations in learning the basic movements of table tennis with the ADDIE development model. The target of the research was class X students of SMA Negeri 1 Bengkulu Selatan as many as 10 students. The development results that have been validated by media experts and material experts get a very valid category. While the results of the Immersive Learning application trial are determined by looking at the results of individual trials and field tests with valid categories. These results show that table tennis Immersive Learning is declared quite effective in improving psychomotor learning outcomes. Thus, Immersive learning media can be implemented as learning media on learning material for basic table tennis movements in the virtual world.

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