



3D Cooperative Multiplayer Online Game Design as Introduction to Gobak Sodor Traditional Sports Game : Multimedia Development Life Cycle (MDLC)

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Abstract: This research aims to develop a design for a 3D Cooperative Multiplayer Online Game to introduce the traditional sport of "Gobak Sodor" to students. This research method used research and development based on the Multimedia Development Life Cycle (MDLC) steps consisting of concept, design, material collecting, assembly, and testing. Expert Judgement was required to evaluate and validate the developed design by considering various aspects. The testing conducted by media experts resulted in a score of 83,93%. The result of this study indicated that the proposed design falls into the highly feasible category. The results of this research imply that this media can be used to preserve traditional game culture.

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Introduction

The term "digital natives" can be associated with the generation born after 1980 or 1990, an era when digital and social technologies started connecting online (Combi, 2016). A study funded by the Indonesian Ministry of Research and Higher Education revealed that many young generations need more interest in the rich traditional culture and its values of wisdom (Dwiyoaga Widianoro et al., 2018). The study involved 273 students from the academic year 2016/2017 who are considered digital natives. This lack of interest is not because they dislike it but because they are unaware of it. There is a need for a contemporary approach to bridge the gap and introduce traditional culture to the digital native generation, who have been exposed to advanced technology since birth, transforming traditional culture to make it more accessible. Traditional Sports and Games (TSG), often known as traditional games, are one of the forms of traditional culture. As a diverse country, Indonesia possesses a rich cultural heritage, including various types of TSG. Preserving and promoting TSG as sporting practices and intangible cultural heritage is a significant challenge for future sports and society development (UNESCO, n.d.).

In his research, Rusmana et al., (2022) present various Traditional Sport and Games (TSG) in Indonesia and successfully identifies several character education values embedded in each TSG. Values such as attention, cooperation, and interpersonal skills are closely related to the cultural value of "gotong-royong" (community cooperation). In order to win the games, "gotong-royong" is highly necessary. If these TSG are digitized into video games, online multiplayer games are suitable for accommodating cooperation and cooperative attitudes among players, enabling real-time interactions through their respective digital devices. Digital multiplayer online video games are seen as capable of accommodating and maintaining the value of "gotong-royong." In a study conducted by Hartshorne et al., (2012) with respondents who are notably players of the MMORPG (Massively Multiplayer Online



Role-Playing Game) World of Warcraft, which is a game played together online, a finding shows that over 82% of players, whether acting as guild leaders or members, demonstrate a culture of teamwork in the game. Consequently, online games are expected to encourage these teamwork values if applied to TSG-based digital video games.

Based on the literature study conducted by Maryuni & Nasrulloh (2022) regarding TSG, it is found that there is a need for attention and encouragement, both internally and externally, towards TSG. Several researchers have shown interest in TSG based on existing research. However, there are still limited studies related to TSG that explore the utilization and development of Information and Communication Technology (ICT) for TSG, such as Setiawan et al. (2013), which tried to use AR to preserve a specific TSG. A lack of research focuses on developing and utilizing 3D multiplayer online games to introduce TSG. However, non-modernized TSG, in line with the progress of time, is gradually eroding and disappearing from civilization. The development of TSG in the last five years has centered around investigative surveys from various aspects, such as organizational structures and rule development. It can be observed after conducting searches related to TSG development on Google Scholar in the last five years. For instance, one study investigated the development of TSG and esports by comparing their initial institutionalization (Summerley, 2020). With the advancement of technology, TSG has begun to be displaced and replaced by online games. To address this, a study intervened by developing a traditional game learning module as an alternative game to prevent students from feeling bored and disengaged during the learning process (Rachmawati et al., 2020). The module had a positive impact on students. However, considering the digital natives' relationship with technology, the module would only affect students during classroom activities. Furthermore, it would not keep students away from technology as digital natives have been deeply attached to it since an early age. Another study successfully developed a product to reintroduce TSG Gobak Sodor as a Multiplayer Table Game (Pratalaharja & Dirgantoro, 2021). One research has identified numerous cultural wisdom and character values in various types of TSG in Indonesia (Rusmana et al., 2022).

Considering the characteristics of digital natives and the various opportunities for utilizing ICT, introducing TSG can be integrated with an approach using online digital video games. Despite the recent developments in TSG innovations, few studies have attempted to explore the development of 3D-based online multiplayer digital games that can be used cooperatively and played in real-time. However, digital online multiplayer 3D games have significant potential and are well-suited for the digital native generation, considering their characteristics, especially when these games are developed for mobile devices. Incorporating TSG into interactive online digital video games presents an excellent opportunity to engage digital natives in discovering and experiencing traditional culture. 3D technology and multiplayer features allow for immersive gameplay and real-time interactions among players, making the experience more enjoyable and appealing to the digital native generation. Furthermore, developing these games for mobile devices makes them more accessible and convenient for digital natives, as they are already deeply connected to mobile technology. This approach has the potential to bridge the gap between traditional culture and digital technologies, ensuring that the cultural heritage of TSG is not lost to the modern era but instead becomes more widely appreciated and preserved among the younger generations. By leveraging the advantages of online digital video games, TSG can be introduced and preserved in a contemporary and engaging manner, appealing to the interests and preferences of digital natives. This innovative approach promotes the appreciation of cultural heritage and fosters a deeper sense of identity and connection to traditional values among the younger generation, paving the way for the preservation and continuity of TSG for generations to

come.

Gobak Sodor, one of the national cultural heritages, represents a traditional sport and game (TSG) in Indonesia. This research aims to develop a design for a 3D Cooperative Multiplayer Online Game to introduce the traditional sport of Gobak Sodor. This stage focuses on the initial design, which will be followed by further research adapting to the chosen methods. The proposed game design will be a digital representation of Gobak Sodor, utilizing 3D technology to provide players with an immersive and engaging experience. The cooperative multiplayer feature will enable real-time interactions among players, promoting teamwork and collaborative gameplay, which aligns with the values of "gotong-royong" inherent in the traditional game. The ultimate goal of this research is to create an effective and interactive platform to introduce Gobak Sodor and preserve its cultural significance among the younger generations, especially for students in formal education or even in alternative education such as natural schools mentioned by Widiastuti & Budiyanto (2022), particularly digital natives. By transforming traditional culture into a contemporary digital form, the game can bridge the gap between traditional practices and modern technology, ensuring the continued appreciation and understanding of Gobak Sodor as a part of Indonesia's cultural heritage.

Research Method

This research method used research and development based on the Multimedia Development Life Cycle (MDLC) steps, which consist of concept, design, material collecting, assembly, and testing (Luther, 1994). Each stage can be contextualized in the following detail:

- 1) Concept: In this stage, the application's objectives were determined and then formulated into a conceptual description of the application. This description included the game's title, the target user profile, images, material requirements, gameplay or rules, necessary assets and their profiles, potential devices, and types of interactions to be used.
- 2) Design: In this stage, the program's architectural design, style, appearance, and material or resource needs were determined. A storyboard was also created, providing an overall depiction of the application, consisting of scenes and descriptions.
- 3) Material Collecting: This stage involved collecting all the necessary assets for the media that will be developed. It included creating custom 3D assets, gathering additional 3D assets, and collecting background music (BGM) and sound effects (SFX). The collected 3D assets encompassed polygon models, material types, and textures.
- 4) Assembly: In this stage, the application's development was initiated, including features, visual elements, and gameplay, through scripting, coding, or programming. Subsequently, all the collected assets were organized and integrated with the created scripts or code to produce the final product.
- 5) Testing: This stage involved conducting validation on media/game by a media expert. Adjustments to the product may be necessary at each testing stage based on respondent feedback before the product was released and published.
- 6) Distribution: After going through a series of testing stages and being deemed suitable, the application could be distributed.

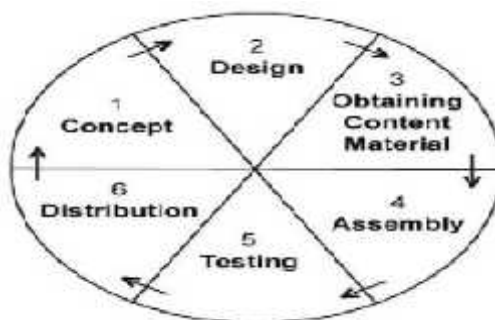


Figure 1. Multimedia Development Life Cycle

Results and Discussion

As established, the initial product was developed by adapting the first four stages of the MDLC development method. To facilitate the game development process, especially within the team, a Game Design Document (GDD) is necessary. The GDD serves as a shared reference for developing the related game. The GDD can be used to record several important aspects, such as the Game Concept, Game Mechanics, Interface, and other technical details.

Concept

In this stage, several elements were determined, such as the game's identity in the form of Game Concept (including objectives, description, key features, genre, and platform), Game Mechanics (including gameplay rules, game characters, player behaviors identified based on gameplay rules, and game elements.), required devices, and the determination of game asset needs. The result of the Game Concept is presented in Table 1.

In Table 1, the game's title and objectives align with the background issues in this research. To introduce Traditional Sports and Games (TSG), specifically Gobak Sodor, with the target audience being digital natives, a mobile platform can be utilized, considering that digital natives are a generation exposed to technology from an early age. A study has also found that most respondents, who are predominantly digital natives, still use information technology through smartphones for entertainment and gaming (Hariyadi et al., 2021). It presents an opportunity to utilize smartphones to introduce TSG through digital video games.

Rusmana (2022) presents various TSG and has identified values such as attention, cooperation, and interpersonal skills closely related to the cultural values of mutual cooperation present in TSG. Cooperative attitudes among players can be implemented in real-time by designing a digital video game that allows real-time multiplayer gameplay. To enable players to play together in real-time and cooperatively to achieve victory together, the game can be designed as an Online Multiplayer game, where cooperative attitudes can be demonstrated both in the game and in the real environment.

Several key features were derived based on the needs required in group gameplay, such as playing in teams, the lobby, the waiting room, and the game room. That is because Gobak Sodor is a regional game played in two opposing teams, where one team acts as the attacking team and the other as the defending team.

Table 1. Game Concept

Game Title	GOLEN (Gobak Sodor Online)
Goal	Introduce Traditional Sports and Games (TSG) in Indonesia for formal and non-formal learning, aiming to raise digital natives' awareness without compromising educational values. Use technology, like digital video games, to engage them while preserving cultural heritage and promoting teamwork.
Description	Gobak Sodor Online accommodates a maximum of 10 players as the main players in the game. The players are divided into two teams, meaning each team can have a maximum of 5

players. All players are placed on a digital field according to their roles within the team. Team A is tasked with defending, while Team B is responsible for attacking or vice versa. Both teams compete for victory by following a set of Gobak Sodor game rules played in real-time through the online game.

Key Feature	• Playing in teams • 3D graphics • Camera perspective • Lobby, Waiting Room, and Game Room
Genre	• Sport • Online Multiplayer Game • Cooperative
Platform	Smartphone

Meanwhile, the graphics were created in 3D form, and the camera perspective is set slightly above the player, similar to the First Person Shooter (FPS) games. This was done considering that TSG required players' spatial perception to train their alertness and concentration on the conditions around them, such as the distance of opponents/enemies and the safe and inaccessible areas on the field. In their research, Setyarini et al. (2017) have proven that cognitive stimuli in the form of 3D visualization significantly influence the improvement of spatial abilities, such as spatial relationships, spatial orientation, and spatial visualization.

The game mechanics in this case study were based on a set of rules from the Gobak Sodor game itself. These rules described when a team was declared the winner when a team was declared the loser, what a team must do to achieve victory, and what should not be violated by a team to achieve victory. Based on the Gobak Sodor game rules, there were at least two teams: the attacking and the defending teams. Therefore, two game characters were needed to represent players in the attacking or defending team. Following the game rules can determine the mechanisms that players can perform as part of the attacking and defending teams.

The playing field is one of the essential gameplay elements in Gobak Sodor TSG. Without the playing field, the game cannot be conducted, as the defending team must guard the boundary lines while the attacking team must cross those lines guarded by the defending team. Figure 2 represents an overview of the Gobak Sodor playing field. The software required for game development includes Unity 3D as the game engine to integrate all game components, Blender 3D as the software for modeling 3D objects, and Photoshop or similar software for creating textures and editing digital images. The main library needed to create the online game is Photon Unity Networking (PUN). Shi et al., (2016), Qi et al., (2017), Pan et al., (2020), Jiang & Zhuang (2021), and Arif et al., (2020, 2021) also use PUN to create a multiuser/multiplayer shared virtual environment in a different kind of project.

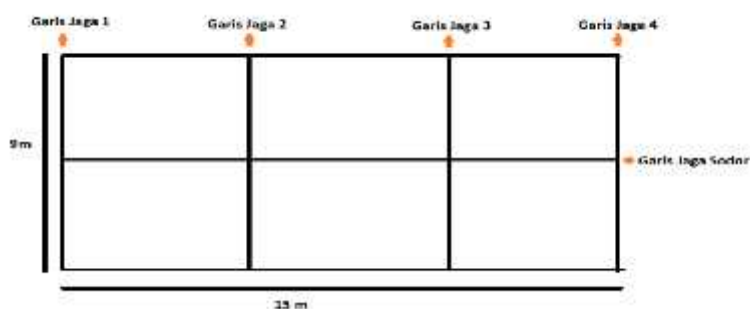


Figure 2. Gobak sodor playing field

Design

The program's architectural design, style, appearance, and material or resource needs are determined at this stage. A storyboard is also created, providing an overall depiction of

scenes and their descriptions. Utilizing PUN for cooperative game purposes, there are several components, such as Master Server, Room, and Player. The Master Server handles the matchmaking process (connecting multiple players for online gameplay sessions) for a specific region or cluster (Glossary, n.d.).

As mentioned in Table 1, one of the concepts embraced in game development is the sports genre. Therefore, there is a need for a player control design that can represent the concepts outlined in Table 1. To facilitate the gameplay, there are several functional requirements related to Gobak Sodor, covering the initial process from when the player wants to play the game until the player finishes the game. The design flow of scenes can be illustrated in Figure 6, where the main scenes required for the game are marked in green. Based on this flow, a storyboard can be created, as shown in Table 2. Furthermore, to enhance players' understanding of the rules of "Gobak Sodor," a notification panel should be added. This panel aims to make players more aware of their own actions and those of other players, as well as the reasons and consequences of these actions. It particularly focuses on clarifying which actions lead to a player's failure or success in the game so the players will learn the rules indirectly. This treatment is provided considering that the research conducted by Börner et al. (2014) has demonstrated that attention-aware display design attracts and retains user attention more effectively and that there is a positive relationship between knowledge gain and user attention.

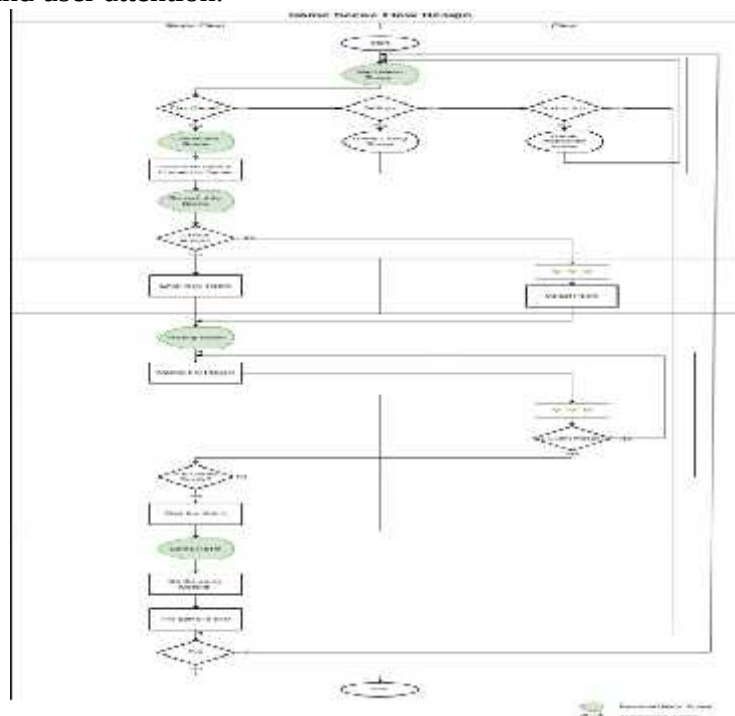
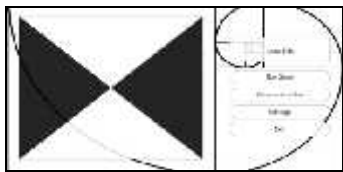
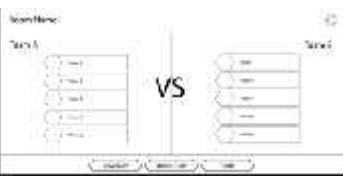


Figure 3. Game scene flow design

Table 2. Game Storyboard

No	Visual Layer	Navigation	Information
1		Play Game: Directing players to the Connection scene. Game Instruction: Directing player to the game instruction scene. Settings: Directing player to the game config scene to Set the audio volume.	Main menu scene, containing game menus.

2		- Exit Game Connect: Connecting players to the online game.	Connection Scene. Players enter their player names and click a button to connect to the online game.
3		Room Name (right): the list of available rooms. Create Room (left): to create a new room.	Game Lobby Scene. Players can view the list of available rooms. They also have the option to create a new room.
4		Leave Team: Leaving the Team, Returning to the Game Lobby Scene Change Team: Switching from Team A to B Team B or vice versa Ready/Start	Waiting Room Scene. In the Waiting Room scene, players can view the list of team members who will be playing Gobak Sodor together.
5		Notification Panel: Enhance player awareness Catch: This button can be used when the player takes on the role of the guarding team. Run: Player able to run using this button. Jump: Player able to jump using this button.	Game Room Scene. The Game Room scene will be displayed after the Master Client starts the game.

Material Collecting

The material collecting phase can be executed in parallel with the assembly phase to expedite the development process based on the dynamic priorities of the game's development. The collected and created assets include those required for each game scene. Essential functional assets include the player, which should be differentiated into two types of models to represent Team A and Team B, as depicted in Figure 4.

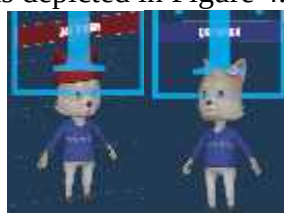


Figure 4. Two types of character models to represent each of the team

The game arena is also a functional asset, considering that the Gobak Sodor game requires a clear boundary line for the defending team to occupy and the attacking team to pass. The asset for the game arena in this game looks like Figure 5. Audio elements such as background music are collected during this stage.



Figure 5. Game playing field and texture.

Assembly

Assembly is the process of creating the application, starting from its features, visuals, and gameplay through scripting, coding, and programming. The collected assets are organized and integrated with the scripts and code to produce a final product. Some of the results of the assembly process for the main modules can be seen in:



Figure 6. Sample of assembly phase result

Testing

For expert testing, several assessment aspects, for example, shown in Table 3 and used by Andani (2022), were adopted with some adjustments. The indicators for the graphic aspect include assessment components such as the presentation of the game, font consistency, placement of visual elements (text, image, or video), and clarity of visual elements. In terms of effectiveness, the assessment components include the game's effectiveness in communicating the information or messages, the game's ability to increase the user understanding, its ability to create motivation and enjoyment for the user, and the ability to attract the user interest in learning about Traditional Sports Game Gobak Sodor. For the interactive aspect, the assessment components involve the use of the game to be played in groups in specific conditions and time, the ability to give real-time feedback to the user, and the ability to enhance students' understanding of Gobak Sodor game flow and concept. Regarding the media display aspect, the assessment indicators encompass the media's supportive features (resolution and responsiveness toward different screen sizes), the ability of audio, user interface, and video to deliver the game atmosphere, as well as the game's navigation. In this study, two media experts (M1 and M2) were appointed to conduct testing using those aspects.

Table 3. Feasibility criteria (Andani, 2022)

Score Range In Percentage	Qualitative Category
<21%	Very infeasible
21% - 40%	Infeasible
41% - 60%	Marginally Feasible
61% - 80%	Feasible
81% - 100%	Highly Feasible

Table 4. Media expert feasibility test results

Aspect	Result by M1	Result by M2
Graphic aspect	83,33%	75%
Effectiveness aspect	91,67%	83,33%
Interactivity aspect	100%	83,33%
Media display aspect	80%	80%
Overall Aspect	83,93%	

As shown in Table 4, the media expert feasibility test resulted in a score of 83,93%. Knowing this result, we can conclude that this game falls into the highly feasible category based on the feasibility criteria mentioned in Table 3.

Based on the information in Table 4, the lowest score is in the graphic aspect. Both M1 and M2 give almost the same suggestion that the font size presented in the game should be bigger. Font which are too small can cause users to squint (perhaps causing eyestrain), force them to decipher the characters one by one, spelling enough of the word to recognize it, and then comprehend it (Hartley, 1993). In the case of the effectiveness aspect, even though the experts give relatively high scores compared to the other aspect, there are still some recommendations added, especially in the instruction scene (user guide). M2 emphasizes that the instruction should be made clearer, while M1 suggests using tutorial videos as a complement. Rubiyati et al. (2022) claim that the use of tutorial videos is effective in improving learning outcomes in their case study. The interactivity aspect has the highest score compared to the other aspects. This outcome is possible due to the nature of the online game, which provides multiplayer gameplay. Moreover, players are enabled to explore any scenario relevant to the gameplay, which may result in different outcomes. This kind of activity can be categorized as an experiential learning activity. Based on research done by Davis and Summers (2015), experiential activities significantly enhanced learning outcomes. The provided interactions support users in understanding the flow of the game and building knowledge about the rules of the local game (gobak sodor). The other researchers also stated that the more concrete a student's learning is, the better their understanding becomes because they gain direct learning experiences (Qodr, 2020). Media display aspects gain average scores compared to the other aspects. M1 noted that the character navigation should be improved.

Conclusion

In this study, a design of a Cooperative 3D Online Multiplayer Game for Introducing Traditional Sport Gobak Sodor has been developed. The initial product was developed by adapting the first four stages of the MDLC development method, which are concept, design, material collecting, and assembly. The media expert feasibility test resulted in a score of 83,93%. Knowing this result, we can conclude that this game falls into the highly feasible category.

Recommendation

The research produced a design for traditional game media. This media can be used as a means of preserving traditional game culture. It is hoped that further research will be related to developing other traditional games. For further development, the graphic aspect should be enhanced, especially by choosing the appropriate font size.

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References

- Andani, T. (2022). Analisis Validasi Media Pembelajaran E-Book Berbasis Flip PDF Professional pada Materi Gelombang Bunyi di SMA. *Jurnal Kumparan Fisika*, 4(3), 213–220. <https://doi.org/10.33369/jkf.4.3.213-220>
- Arif, Y. M., Firdaus, M. N., & Nurhayati, H. (2021). A Scoring System For Multiplayer Game Base On Blockchain Technology. *2021 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob)*, 200–205. <https://doi.org/10.1109/APWiMob51111.2021.9435249>



- Arif, Y. M., Pradana, R. P., Nurhayati, H., Nugroho, S. M. S., & Hariadi, M. (2020). A Blockchain-Based Multiplayer Transaction For Tourism Serious Game. *2020 International Conference on Computer Engineering, Network, and Intelligent Multimedia (CENIM)*, 138–143. <https://doi.org/10.1109/CENIM51130.2020.9297837>
- Börner, D., Kalz, M., & Specht, M. (2014). Lead me gently: Facilitating knowledge gain through attention-aware ambient learning displays. *Computers & Education*, 78, 10–19. <https://doi.org/10.1016/j.compedu.2014.04.017>
- Combi, M. (2016). Cultures and Technology: An Analysis of Some of the Changes in Progress—Digital, Global and Local Culture. In *Cultural Heritage in a Changing World* (pp. 3–15). Springer International Publishing. https://doi.org/10.1007/978-3-319-29544-2_1
- Davis, B., & Summers, M. (2015). Applying Dale’s Cone of Experience to increase learning and retention: A study of student learning in a foundational leadership course. *Engineering Leaders Conference 2014 on Engineering Education*. <https://doi.org/10.5339/qproc.2015.elc2014.6>
- Dwiyoga Widianoro, A., Sanjaya, R., Rachmat Djati Winarno, A., Rahardjo, T., & School, G. (2018). *Increase Student Awareness of People’s Cultural Heritage Using Internet Technology*. <https://doi.org/10.1>
- Glossary. (n.d.). Retrieved May 20, 2023, from <https://doc.photonengine.com/pun/current/reference/glossary#masterclient>
- Hariyadi, Handoko, K., & Noviliza, A. (2021). The Influence of Information Technology and Communication Advancement Especially Smartphone on Muhammadiyah University of West Sumatera’s Students Year 2019. *Journal of Physics: Conference Series*, 1779(1). <https://doi.org/10.1088/1742-6596/1779/1/012083>
- Hartley, R. (1993). Guidelines for multimedia usage. *Proceedings of the 11th Annual International Conference on Systems Documentation - SIGDOC '93*, 95–106. <https://doi.org/10.1145/166025.166045>
- Hartshorne, R., Van Fossen, P. J., & Friedman, A. M. (2012). MMORPG roles, civic participation and leadership among generation Y. In *International Journal of Gaming and Computer-Mediated Simulations* (Vol. 4, Issue 1, pp. 55–67). <https://doi.org/10.4018/jgcms.2012010103>
- Jiang, T., & Zhuang, Z. (2021). A Multi-person collaborative Simulation System For Circuit Experiment System Base on Virtual Reality. *2021 International Conference on Intelligent Transportation, Big Data & Smart City (ICITBS)*, 253–259. <https://doi.org/10.1109/ICITBS53129.2021.00071>
- Luther, A. C. (1994). *Authoring Interactive Multimedia*. AP Professional.
- Maryuni, M., & Nasrulloh, A. (2022). *Research Study on Traditional Game Sports* (Vol. 43).
- Pan, Y., & Mitchell, K. (2020). PoseMMR: A Collaborative Mixed Reality Authoring Tool for Character Animation. *2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 758–759. <https://doi.org/10.1109/VRW50115.2020.00230>
- Pratalaharja, E., & Dirgantoro, B. (2021). Re-Introducing Indonesian Traditional Games through an Interactive Multiplayer Table Game - Gobak Sodor. *Journal of Games, Game Art, and Gamification*, 6(1), 27–31. <https://doi.org/10.21512/jggag.v6i1.7324>
- Qi, Q., Zhao, S., Wang, S., Lai, L., Lei, Z., & Song, H. (2017). Avatars’ Skeleton Connection and Movement Data Network Synchronization. *2017 International Conference on Virtual Reality and Visualization (ICVRV)*, 402–403. <https://doi.org/10.1109/ICVRV.2017.00096>



- Qodr, T. S. (2020). Media Pembelajaran Game Geograpiea untuk Anak Sekolah Dasar di Era Digital. *Journal of Curriculum Indonesia*, 3(2), 45. <https://doi.org/10.46680/jci.v3i2.29>
- Rachmawati, N., Muhyi, M., Wiyarno, Y., Pendidikan, P., Pascasarjana, J., Pgri, U., & Surabaya, A. B. (2020). Pengembangan Permainan Olahraga Tradisional untuk Meningkatkan Nilai Peduli dalam Pembelajaran Pendidikan Jasmani Olahraga dan Kesehatan di Sekolah. *Jurnal Pendidikan Kesehatan Rekreasi*, 6(2), 125–137. <https://doi.org/https://doi.org/10.5281/zenodo.3873171>
- Rubiyati, Nurlaela, L., & Rijanto, T. (2022). Efektivitas Penggunaan Video Tutorial untuk Meningkatkan Kinerja Siswa SMK. *Jurnal Ilmiah Pendidikan Citra Bakti*, 9(1), 117–128. <https://doi.org/10.38048/jipcb.v9i1.644>
- Rusmana, N., Nur, L., Purwati, P., Mashudi, E. A., & Malik, A. A. (2022). Identification of character education values inherent to traditional games in Indonesia: A pilot study. In *Innovation on Education and Social Sciences* (pp. 105–110). Routledge. <https://doi.org/10.1201/9781003265061-14>
- Setiawan, A., Kartikadarma, E., & Haryanto, H. (2013). Preservation of Gobak Sodor traditional games using augmented reality computer game simulation. *2013 International Conference of Information and Communication Technology (ICoICT)*, 235–240. <https://doi.org/10.1109/ICoICT.2013.6574579>
- Setyarini, M., Liliyasi, L., Kadarohman, A., & A. Martoprawiro, M. (2017). EFEKTIVITAS PEMBELAJARAN STEREOKIMIA BERBASIS VISUALISASI 3D MOLEKUL UNTUK MENINGKATKAN KEMAMPUAN SPASIAL. *Jurnal Cakrawala Pendidikan*, 36(1). <https://doi.org/10.21831/cp.v36i1.11082>
- Shi, Y., Du, J., Lavy, S., & Zhao, D. (2016). A Multiuser Shared Virtual Environment for Facility Management. *Procedia Engineering*, 145, 120–127. <https://doi.org/10.1016/j.proeng.2016.04.029>
- Summerley, R. (2020). The Development of Sports: A Comparative Analysis of the Early Institutionalization of Traditional Sports and E-Sports. *Games and Culture*, 15(1), 51–72. <https://doi.org/10.1177/1555412019838094>
- UNESCO. (n.d.). *Traditional Sports and Games*. En.Unesco.Org. Retrieved January 23, 2023, from <https://en.unesco.org/themes/sport-and-anti-doping/traditional-sports-and-games>
- Widiastuti, I., & Budiyanto, C. W. (2022). Pembelajaran STEM Berbasis Engineering Design Process untuk Siswa Sekolah Alam di Kabupaten Klaten. *DEDIKASI: Community Service Reports*, 4(2). <https://doi.org/10.20961/dedikasi.v4i2.64923>