

DOCUMENTARY FILM VIDEO GAMES AS A LEARNING MEDIUM TO INCREASE AWARENESS OF CLIMATE CHANGE

Tony Wibowo¹⁾, Winsen Khoesasi²⁾, Stivani Ayuning Suwarlan³⁾

^{1,2,3}Computer Science Faculty, Information System, Universitas Internasional Batam

Email: 2131097.winsen@uib.edu

Abstrak

Perubahan iklim adalah masalah serius yang mengancam seluruh umat manusia di bumi. Seperti yang diketahui, fenomena pemanasan global yang meningkat telah menyebabkan perubahan iklim, yang berdampak negatif pada semua aspek kehidupan manusia. Sebagai tanggapan terhadap ancaman global ini, pada tahun 2015, para pemimpin dunia menyepakati Agenda 2030 untuk Pembangunan Berkelanjutan, yang mencakup 17 Tujuan Pembangunan Berkelanjutan (SDGs). SDGs mencakup berbagai aspek kehidupan, terutama pendidikan, kesehatan, kesetaraan gender, dan penanggulangan perubahan iklim. Pendekatan pendidikan tradisional cenderung gagal melibatkan audiens yang beragam, sehingga individu merasa terputus dari realitas perubahan iklim. Video game telah menjadi alat pembelajaran yang efektif di berbagai konteks pendidikan. Penggunaan game dalam pendidikan, yang dikenal sebagai pembelajaran berbasis game (game-based learning), memanfaatkan sifat game yang interaktif dan menarik untuk meningkatkan pengalaman pendidikan. Film dokumenter tentang video game dapat digunakan untuk mengajarkan berbagai aspek keberlanjutan dan perubahan iklim secara interaktif dan menyenangkan. Metode yang digunakan dalam penelitian ini adalah Multimedia Development Life Cycle (MDLC). Metode ini dipilih dan digunakan dalam proses perancangan video dokumenter karena melibatkan elemen multimedia seperti teks, gambar, video, dan animasi, sehingga sesuai untuk diproses menggunakan pendekatan ini. Video yang disediakan memungkinkan orang untuk memperdalam pemahaman mereka dari berbagai sumber pembelajaran. Ketika individu, terutama siswa, disediakan berbagai sumber, mereka dapat memperkaya pemahaman mereka. Namun, penelitian berkelanjutan tentang dampak jangka panjang multimedia terhadap hasil belajar sangatlah penting. Memahami bagaimana multimedia memengaruhi sikap dan perilaku dari waktu ke waktu dapat memberikan informasi untuk strategi pendidikan dan desain game di masa depan. Melalui upaya meneliti efektivitas elemen multimedia yang berbeda, pendidik dan pengembang dapat menciptakan alat yang semakin efektif yang dapat menggugah para pembelajar dan mendorong perubahan positif.

Kata Kunci: Perubahan iklim, SDG, Video game, Film dokumenter, Media pembelajaran

Abstract

Climate change is a serious problem that poses a serious threat to all people on earth. As is well known, the increasing phenomenon of global warming has led to climate change, which negatively affects all aspects of human life. As a response to these global threats, in 2015, world leaders agreed on the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs). The SDGs cover many aspects of life, especially education, health, gender equality, and combating climate change. Traditional education approaches tend to fail in engaging diverse audiences, leaving the individuals feeling disconnected from climate change realities. Video games have become effective learning tools in a variety of educational contexts. The use of games in education, known as game-based learning, leverages the engaging and interactive nature of games to enhance the educational experience. Documentary films about video games can be used to teach different aspects of sustainability and climate change in an

interactive and fun way. The method employed in this research is the Multimedia Development Life Cycle (MDLC). This method was selected and utilized in the design process of the documentary video film because it involves multimedia elements such as text, images, videos, and animations, making it suitable for processing using this approach. The video provided allows people to develop their understanding deeper from various learning resources. When people provided various resources, especially students, they are able to enrich their understanding. However, ongoing research into the long-term impacts of multimedia on learning outcomes is crucial. Understanding how multimedia influences attitudes and behaviors over time can inform future educational strategies and game designs. Through the act of examining the effectiveness of different multimedia elements, educators and developers can create increasingly effective tools that resonate with learners and drive positive change.

Keywords: *Climate change, SDG, Video game, Documentary film, Learning medium*

Correspondence author: *Author, Email , Batam City, Indonesia*



This work is licensed under a CC-BY-NC

INTRODUCTION [Times New Roman 11pt, Bold]

Climate change is a serious problem that poses a serious threat to all people on earth. As is well known, the increasing phenomenon of global warming has led to climate change, which negatively affects all aspects of human life (Author, Year) Rising global temperatures, changes in weather patterns, and increased frequency of natural disasters are some of the tangible impacts of climate change that are being felt around the world. According to past research, greenhouse gas emissions continue to increase, and the global temperature in 2017 reached 1°C above pre-industrial levels (Author, Year), As a response to these global threats, in 2015, world leaders agreed on the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs).The SDGs provide a unique global vision for a safe, equitable and sustainable world for all (Author, Year). The SDGs are designed to address a range of global challenges, including poverty, inequality, and climate change, using an integrated and comprehensive approach. The Sustainable Development Goals (SDGs) are a set of global goals adopted by the United Nations to end poverty, protect the planet and achieve prosperity for all by 2030.The SDGs cover many aspects of life, especially education, health, gender equality and combating climate change (Author, Year), (Author, Year). SDG 14 focuses on the conservation and sustainable use of the oceans, seas and marine resources for sustainable development. Oceans play a vital role in regulating the global climate and providing essential resources for human life. However, the oceans are currently facing many threats, including pollution, overfishing and climate change. Research shows that climate change could undermine efforts to achieve other SDGs, including SDG 14, due to its significant impacts on marine ecosystems (Author, Year). The impacts of climate change on SDG 14 have caused various problems for marine ecosystems, such as coral bleaching, declining fish populations and changes in ocean currents that negatively affect marine life and the human livelihoods that depend on it (Author, Year), (Author, Year). According to research, traditional methods of disseminating information on climate change have often be proven ineffective in raising awareness as well as inspiring action (Author, Year). traditional education approaches tend to fail in engaging diverse audiences, leaving the individuals feeling disconnected from climate change realities (Author, Year). Previous research suggests that such a more interactive yet innovative approach is an necessary elements to communicate effectively on those complex issues and motivate behavioural change (Author, Year), (Author, Year).

Video games have become effective learning tools in a variety of educational contexts. The use of games in education, known as game-based learning, leverages the engaging and interactive nature of games to enhance the educational experience. Research indicates that this method is able to perform a significant increase towards student engagement and motivation, while facilitating the understanding of complex concepts (Author, Year). In an era where the attention spans tend to be short and distractions are numerous, the implementation of game-based learning offers such a unique and favourable opportunity to capture students' interest (Author, Year). Previous research also stated that with the integration of gameplay elements, including the rewards as well as challenges, and interactive narratives, educators are able to create such immersive experiences that promote active participation (Author, Year). This engagement is particularly crucial when addressing significant global issues like climate change and sustainability (Author, Year).

Educational games about the SDGs have been used to teach various topics, including sustainability and climate change, with positive results (Author, Year). Moreover, these games also tend to be a powerful tool to convey critical information, increasing empathy, as well as encouraging players to consider their own roles in the global community. Previous research stated that games which stimulate environmental challenges, including resource depletion, pollution, or the impacts of climate change, allow players to experience the consequences of their decisions in a controlled environment (Author, Year). This experiential learning promotes a deeper understanding of the interconnectedness of human actions and environmental outcomes. By engaging with these issues through gameplay, students can better comprehend the complexities of sustainability and the importance of collective action. Similar research also stated that the presence of such games which allow the players in managing ecosystems and navigating the challenges of sustainable resource management able to illustrate such balance needed to protect the planet (Author, Year). Besides only educating the players about the climate change science, this game is able to empower them in thinking critically regarding the personal choices as well as the broader implications of those choices on the environment (Author, Year).

In addition, video games can be used to teach different aspects of sustainability and climate change in an interactive and fun way. Hence, a solution that can be proposed to raise awareness about climate change is to create a documentary that highlights the use of video games as a learning medium (Author, Year).

Documentary films with environmental themes can be distinguished according to the tone of response that the makers represent (Author, Year). This documentary can show how games can be used to teach important concepts about climate change and sustainability to different groups of people (Author, Year). On the other words, this documentary is able to feature interviews with game developers, students, as well as educators, by providing such insights into the implementation and design of educational games. It could explore various case studies, by demonstrating how different institutions and organizations successfully integrated the video games into their own curriculum in teaching about sustainability and climate change. By sharing these stories, the documentary can highlight the transformative power of games in fostering environmental awareness.

RESEARCH METHOD

The method employed in this research is the Multimedia Development Life Cycle (MDLC). This method was selected and utilized in the design process of the documentary video film because it involves multimedia elements such as text, images, videos, and animations, making it suitable for processing using this approach.

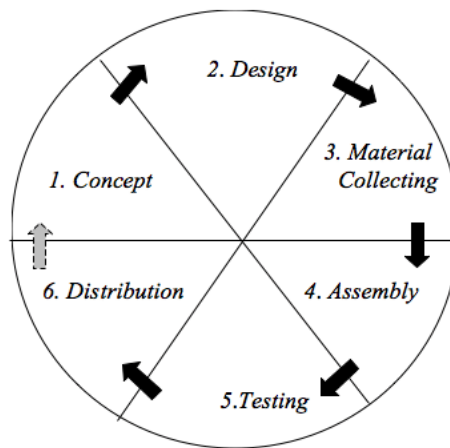


Figure 1. Research flow

A. Concept

Concept At this stage we will design the idea of the video you want to make, the video will take a type of video game video documentary uploaded by YouTube and create a script so you can experience how the video will be made.

B. Design

In this phase we will develop a timeline as well as a storyboard to outline the video's mood and structure. This will help us in clarifying the video flow as we progress to later stages of the production. Through visualizing transitions and key scenes, we able to ensure such cohesive narrative which aligns to our objectives.

C. Material Collecting

In this phase, the editor will collect videos and songs from 3 sources: Youtube, Pexel and Pixabay according to the timeline and storyboard that has been created so that the publisher can collect materials more easily.

D. Assembly

In this phase, we will create a video by combining materials sourced from platforms including Pexels, YouTube, and Pixabay. During this phase, we edited music, voice recordings, as well as video footage step by step, aligning to the storyboard and script. The primary editing tool was Adobe Premiere Pro 2023, whereas the plugins from Mixkit for motion graphics were employed to improve the overall quality. When all elements were integrated and refined, the completed video was exported in MP4 format for distribution.

E. Testing

In this phase, the video will go through a review phase, where incorrect sequences, inappropriate songs, and incorrect wording for subtitles will be edited again until the video is ready for upload.

F. Distribution

At this point, the resulting video will be uploaded to one of the social media platforms, namely Youtube, which will be uploaded to our university Youtube Channel.

RESULTS AND DISCUSSION**Concept**

Based on the objectives and the visual concept of the project, then the concept was carried out by developing storyboard and the script. Script and storyboard are shown in Figure 2.

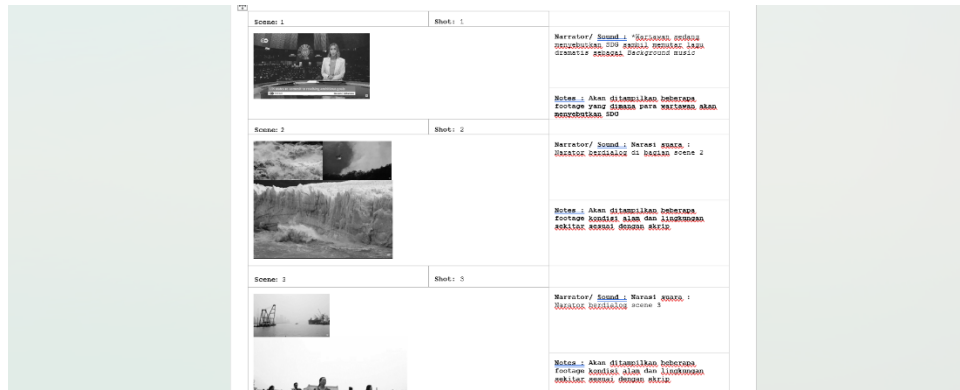


Figure 2. Storyboard

Design

Following the conceptual development, we focused on the design phase, in which we refined the visual approach to align with the documentary style that we aimed to achieve. This included the activity of planning aesthetic elements, tone, as well as overall video narrative flow.

Material Collecting

During the material collection phase, we obtained assets from various sources, such as YouTube, Pexels, and Pixabay. Those platforms provided such a range of video footage, images, and audio resources necessary for our project. The specific assets included in it, including relevant clips and sound bites on YouTube, high quality stock images and videos in Pexels, as well as additional video graphics and footage in Pixabay.

Assembly

An assembly was carried out to create video by combining the materials that were obtained from Youtube, Pexel, and Pixabay. Voice recording, music, video footages were edited step by step according to the script and storyboard to delivered through visual and music. In order to enhance the flow of the video, we performed various transition techniques, such as cross dissolve for soft blends between clips, fade-ins and fade-outs for smooth openings and closings, and slide transitions to maintain viewer engagement. For color grading, we employed the Lumetri Color Panel to adjust exposure, contrast, saturation, and color balance. Once all elements were refined and integrated, the final video was rendered in MP4 format using a high-quality codec for optimal playback across various platforms. Figure 4 demonstrates the production process.

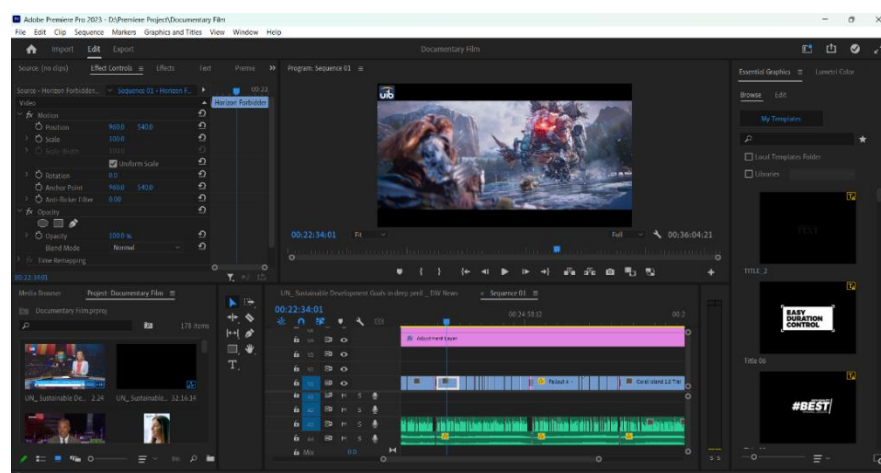


Figure 4. Development of Documentary film using Adobe Premiere Pro 2023

Testing

The results of the development would be checked by playing the video that has been developed. Testing phase of the video was carried out after the video was developed. Testing phase was conducted by playing the video to assess its overall quality and effectiveness. There were two phases at this level, specifically revision and final phase. During the revision phase, we focused on identifying any issues with the video, such as text errors, incorrect footage, as well as audio inconsistencies. The feedback was gathered from team members due to evaluate several aspects, including clarity of the visuals, the transitions appropriateness, as well as subtitles accuracy. Key revisions addressed included the act of adjusting cuts timing, refining transitions to perform a smoother flow, and ensuring that all of the credits were correctly displayed.

Distribution

Final phase was done by checking all of the video to ready to publish in YouTube. This activity included verifying all of the elements, including credits and subtitles, that were clearly legible and be properly synced. Moreover, we also do checked for any last-minute adjustments needed for audio levels and visual quality. By meticulously going through these aspects, we aimed to ensure that the final product met our standards for clarity and professionalism before its public release. The results of the published videos are shown in Figures 5.

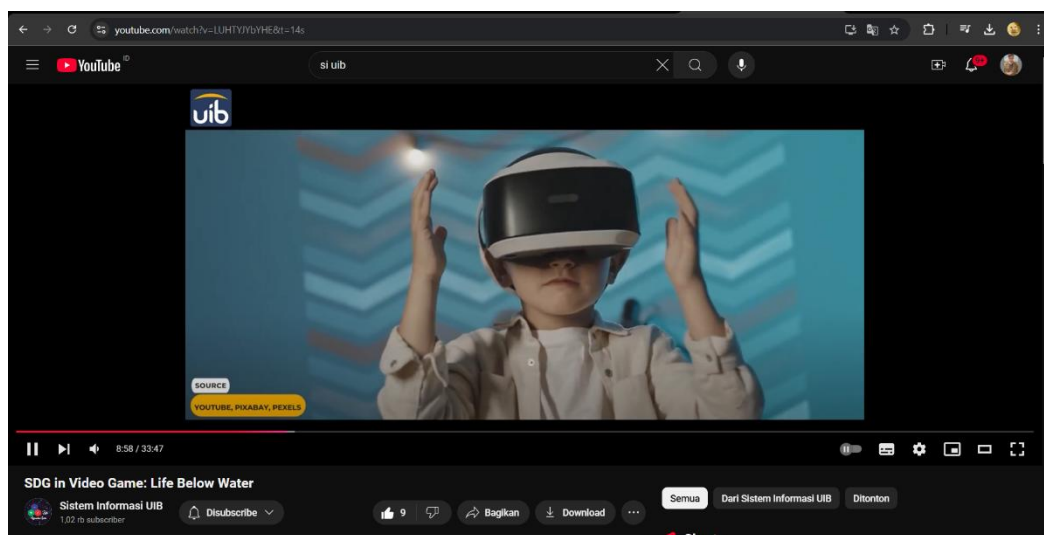


Figure 5. Published Documentary film

The initial video tells the background of environmental conditions and climate change which have become the biggest challenges facing humanity, followed by an explanation of important events such as melting of the poles, burning forests, devastating floods and deadly droughts. as a result of global warming. So various scientists are carrying out various efforts to face the urgent climate crisis, including with world governments which are simultaneously starting to adopt sustainable development goals (SDGs). Then, the video explains about games that are relevant to achieving SDGs, namely Subnautica which has been developed by Unknown World Entertainment since 2024, which is a game set under the sea, which allows underwater adventure games, where players can explore the environment. the seabed, diving into it, exploring underwater caves, and interacting with various amazing sea creatures. Then, in this game, players will be given a quest to restore the condition of marine biota, carrying out rescue missions for marine ecosystems that have been damaged by human activities.

The next game is *Beyond Blue*, which is a game developed by Studio E-Line Media Game, which is an open world game that allows players to act as a marine researcher who is carrying out underwater exploration using advanced technology to study marine life. The development team collaborates with marine scientists and environmental experts to ensure accuracy in the representation of underwater life and related environmental issues. Next, there is *Abzu*, which is an adventure video game developed by Giant Squid Studios, which allows players to explore the beauty and mystery of the vast and deep underwater environment. The game also conveys messages related to the importance of protecting and preserving marine ecosystems.

The next game is *Forbidden West*, which is an action role playing game developed by Guerrilla Games. This game is also an open world type, which uses a post-apocalyptic setting in the western United States which is recovering from the impact of the extinction event caused by the Horizon robot. In this game, players will act as survivors to explore the border to find mysterious sources, along with efforts to fight between various types of machines, both small and giant. The video also shows the game *Fallout 4*, which is a video game developed by Bethesda Game Studios, where players can play the role of *Soul Survival* in an area called the American Commonwealth, to be able to carry out actions ranging from fighting against mutant creatures to building and managing human settlements. In relation to the SDGs context, in terms of resource management and human life under extreme ecological pressure. *Coral Island* is a life simulation game developed by Stairway Games since 2023, set on a tropical island, where in this game players can manage an organic farm, fish and collect natural resources, and are tasked with maintaining the balance of the ecosystem. Finally, there is the *Endless Ocean Luminous* game developed by Arika, which has just been released on May 2 2024, where the background is in the vast ocean and in this game players can play the role of divers who will explore the sea and carry out research regarding the animals and plants there. The presence of these games can be an effective platform for raising players' awareness regarding the importance of protecting natural ecosystems and realizing SDGs principles by showing concern for the condition of the surrounding environment.

Bagian ini menyajikan hasil penelitian. Hasil penelitian dapat dilengkapi dengan tabel, grafik (gambar), dan/atau bagan. Bagian pembahasan memaparkan hasil pengolahan data, menginterpretasikan penemuan secara logis, mengaitkan dengan sumber rujukan yang relevan.

DISCUSSION

The multimedia developed was based on setting goals according to the MDLC steps. Multimedia developed in this study were videos that could be used by any age of people in learning context. The material contained in multimedia are videos, game footage, music, and recorded voice to the related material being studied. The results of multimedia development according to experts were declared valid and attractive to people. This is because multimedia displays videos, images, illustration videos, and recorded voice that are attractive to people for motivating and learning. Interesting learning media could motivate and offers students meaningful learning (Author, Year), (Author, Year).

Also, the video provided allows people to develop their understanding deeper from various learning resources. When people provided various resources, especially students, they are able to enrich their understanding (Author, Year). Raising awareness about the Sustainable Development Goals (SDGs) is crucial, particularly among Generation Z, who are known for their digital savviness and strong sense of social responsibility (Author, Year). This generation is more likely to engage with content that aligns with their values, making video games an effective medium for promoting SDG awareness. By integrating themes related to sustainability and environmental stewardship into gameplay, developers can cultivate a sense of urgency and responsibility in younger players (Author, Year). Moreover, video games can serve as powerful propaganda tools, shaping the mindset of a generation through immersive storytelling and interactive experiences. By presenting players with moral dilemmas and environmental challenges, games can influence attitudes and behaviors toward real-world issues. For example, games that focus on conservation and the impact of human actions on ecosystems can inspire players to take action in their own

lives, reinforcing the principles behind the SDGs (Author, Year). This huge potential lies in its ability to entertain as well as provoking reflection and critical thinking. When the players confront choices which shown tangible consequences within the game, they are usually prompted to draw parallels to their lives, enhancing a wider understanding related to the action implications. As an addition to environmental themes, a lot of video games allow to address SDGs, which includes quality education, gender equality, as well as reduced inequalities (Author, Year). By the act of featuring diverse narratives and characters which reflect these games and goals able to promote inclusivity and challenge stereotypes, contributing to such equitable society. In instance, games which able to portray diverse cultural backgrounds not only provide representation but also encourage players to empathize with different perspectives. This inclusivity enriches the gaming experience and empowers players to recognize the value of diversity in the real world, promoting a culture of respect and understanding (Author, Year). The integration of Environmental, Social, and Governance (ESG) issues into video games can enrich the industry, promoting responsible practices and awareness (Author, Year). However, there is a fine line, as the commercialization of these themes can sometimes dilute their significance (Author, Year). The challenge lies in ensuring that the portrayal of ESG issues remains authentic and impactful, rather than merely serving as marketing gimmicks. This authenticity can enhance players' connection to the content, fostering genuine concern for the environment (Author, Year). The content of video games often reflects and supports various SDGs, from clean water and sanitation to life below water. Games that incorporate sustainability themes not only educate players about these issues but also demonstrate practical solutions for achieving the goals. For instance, titles that focus on resource management can teach players about conservation practices and the importance of biodiversity (Author, Year). In addition to environmental themes, many video games displayed above address other SDGs, such as gender equality, quality education, and reduced inequalities. By featuring diverse characters and narratives that reflect these goals, games can promote inclusivity and challenge stereotypes, contributing to a more equitable society (Author, Year). The integration of multimedia as well as video games in education handle a huge potential to raise the awareness of achieving SDGs (Author, Year). Through the act of leveraging the engaging nature of those platforms, developers and educators able to foster the creation of such meaningful learning experiences which highly resonate with today's digital-savvy youth (Author, Year). As we shown the commitment to continue refining and exploring on those tools, maintaining authenticity as well as focus on the real-world implications tend to be a critical aspect. By inspiring generation in understanding the importance of social responsibility and sustainability, video games able to serve as a change catalysts, empowering the players in making a difference in the communities and beyond it (Author, Year). Hence, future studies should explore the effects of video games and multimedia on spreading awareness of the SDGs. Research could focus on the long-term impacts of gameplay on players' attitudes and behaviors regarding sustainability and social responsibility. Understanding how these interactions shape perceptions and inspire action will be crucial in harnessing the potential of video games as educational tools in the fight for a sustainable future. This can lead to more targeted game design strategies that effectively engage and inform players about pressing global issues. Moreover, the collaboration performed between the educators, game developers, as well as social scientists are able to perform such innovative approaches which leverage gameplay mechanics to teach several critical concepts. The integration of real-world data into such game narratives able to present the players with a clearer understanding related to environmental challenges and solutions. Through the focus on interdisciplinary research, future initiatives able to foster such an educational landscape where video games are recognized as a valuable tools for the social change, equipped to inspire as well as mobilizing the next generation in the more sustainable world.

CONCLUSION

Multimedia development using the MDLC model consists of concept, design, material collecting, assembly, testing, and distribution. Based on the test results, the developed multimedia is declared

feasible. Multimedia that has been developed to documentary film that can be used learning medium for any age which is expected to increase people interest. People interest in learning can be increased through interactive and contextual media especially students or teenagers. Moreover, the video also can be used as increasing awareness of climate change. Furthermore, the multimedia project is strongly aligned with broader educational goals, particularly the Sustainable Development Goals (SDGs). Through the act of raising awareness regarding climate change, the project contributes to Goal 14, which emphasizes the need for urgent action to combat climate change and its impacts. It also fosters a sense of social responsibility among learners, encouraging them to think critically about their actions and their effects on the planet. This alignment with global initiatives underscores the potential of multimedia as a tool for promoting not only academic learning but also foster engagement. The testing phase of the multimedia development process provided valuable feedback from experts and potential users. This feedback is essential for refining the content and ensuring that it meets the needs of the target audience. Engaging with stakeholders during the testing phase not only enhances the quality of the multimedia but also fosters a sense of ownership among users. When learners feel that their input has contributed to the development of educational resources, they are more likely to engage with the content meaningfully. In addition, ongoing research into the long-term impacts of multimedia on learning outcomes is crucial. Understanding how multimedia influences attitudes and behaviours over time can inform future educational strategies and game designs. Through the act of examining the effectiveness of different multimedia elements, educators and developers can create increasingly effective tools that resonate with learners and drive positive change.

DAFTAR PUSTAKA

- Brannon, L., Gold, L., Magee, J., & Walton, G. (2021). The potential of interactivity and gamification within Immersive Journalism & Interactive Documentary (I-docs) to explore climate change literacy and inoculate against misinformation. *Journalism Practice*, 16(2–3), 334–364. <https://doi.org/10.1080/17512786.2021.1991439>
- Campbell, B. M., Hansen, J., Rioux, J., Stirling, C. M., Twomlow, S., & (Lini) Wollenberg, E. (2018). Urgent action to combat climate change and its impacts (SDG 13): transforming agriculture and food systems. *Current Opinion in Environmental Sustainability*, 34, 13–20. <https://doi.org/10.1016/j.cosust.2018.06.005>
- Christensen, A. J. (2024). Comparative Benefits of Science Documentary Films and Games. <https://hdl.handle.net/2142/124456>
- Fernández Galeote, D., & Hamari, J. (2021). Game-based Climate Change Engagement: Analyzing the Potential of Entertainment and Serious Games. *Proceedings of the ACM on Human-Computer Interaction*, 5(CHI PLAY), 1–21. <https://doi.org/10.1145/3474653>
- Fernández Galeote, D., Legaki, N.-Z., & Hamari, J. (2023). From traditional to game-based learning of climate change: A media comparison experiment. *Proceedings of the ACM on Human-Computer Interaction*, 7(CHI PLAY), 503–525. <https://doi.org/10.1145/3611039>
- Fuso Nerini, F., Sovacool, B., Hughes, N., Cozzi, L., Cosgrave, E., Howells, M., Tavoni, M., Tomei, J., Zerriffi, H., & Milligan, B. (2019). Connecting climate action with other sustainable development goals. *Nature Sustainability*, 2(8), 674–680. <https://doi.org/10.1038/s41893-019-0334-y>
- Hwang, H., An, S., Lee, E., Han, S., & Lee, C. (2021). Cross-societal analysis of climate change awareness and its relation to SDG 13: A knowledge synthesis from text mining. *Sustainability*, 13(10), 5596. <https://doi.org/10.3390/su13105596>
- Ibrahim, I. M., Suryadi, K., Darmawan, C., & Nurbayani, S. (2024). The Use of the Natuna Game About the Natural Wealth of the Natuna Marine on National Awareness of the Post-millennial Generation.

- ASEAN Journal of Science and Engineering, 4(2), 237–250.
<https://doi.org/10.17509/ajse.v4i2.71223>
- K Kumala, F. N., & Setiawan, D. A. (2019). Local Wisdom-Based E-Encyclopedia as a Science Learning Medium in Elementary School. *Journal of Physics: Conference Series*, 1402(6).
<https://doi.org/10.1088/1742-6596/1402/6/066061>
- Kumala, F. N., Setiawan, D. A., & Shaleha, P. R. (2020). Contextual-Based Animal Encyclopedia: HOTS on Elementary School's Students. <https://doi.org/10.2991/assehr.k.200318.025>
- Kwok, R. (2019). Can Climate Change Games Boost Public Understanding? *Proceedings of the National Academy of Sciences of the United States of America*, 116(16), 7602–7604.
<https://doi.org/10.1073/pnas.1903508116>
- Luqman, Y. (2022, November 16). Seeing the Issue of the Climate Crisis from the Lens of an Indonesian Documentary Video. <https://doi.org/10.4108/eai.14-9-2021.2321399>
- Luthfia, A. R. (2019). Penguatan Literasi Perubahan Iklim di Kalangan Remaja. *Jurnal Abadimas Adi Buana*, 3(1), 39–42. <https://doi.org/10.36456/abadimas.v3.i1.a1941>
- McCormack, C. M., K. Martin, J., & Williams, K. J. (2021). The full story: Understanding how films affect environmental change through the lens of narrative persuasion. *People and Nature*, 3(6), 1193–1204.
<https://doi.org/10.1002/pan3.10259>
- Pereira, J. A., Pleguezuelos, E., Merí, A., Molina-Ros, A., Molina-Tomás, M. C., & Masdeu, C. (2007). Effectiveness of Using Blended Learning Strategies for Teaching and Learning Human Anatomy. *Medical Education*, 41(2), 189–195. <https://doi.org/10.1111/j.1365-2929.2006.02672.x>
- Pineda-Martínez, M., Llanos-Ruiz, D., Puente-Torre, P., & García-Delgado, M. Á. (2023). Impact of video games, gamification, and game-based learning on sustainability education in Higher Education. *Sustainability*, 15(17), 13032. <https://doi.org/10.3390/su151713032>
- Roosen, L., & Klockner, C. (2020). Art and Documentaries in Climate Communication: Experiencing the Reality of Climate Change and Leading the Way to Change. *Art/Research International: A Transdisciplinary Journal*, 5(2), 2020. <https://doi.org/10.18432/ari29520>
- Seelig, M. I. (2019). Popularizing the Environment in Modern Media. *Communication Review* 22(1), 45-83. <https://doi.org/10.1080/10714421.2019.1569449>
- Smith, M. S., Cook, C., Sokona, Y., Elmqvist, T., Fukushi, K., Broadgate, W., & Jarzebski, M. P. (2018). Advancing Sustainability Science for the SDGs. In *Sustainability Science*. 13(6), 1483-1487. Springer Tokyo. <https://doi.org/10.1007/s11625-018-0645-3>
- Sood, S., Riley, A. H., & Birkenstock, L. (2024). Entertainment-Education and Climate Change: Program Examples, Evidence, and Best Practices from Around the World. In *Storytelling to Accelerate Climate Solutions*. Springer International Publishing. https://doi.org/10.1007/978-3-031-54790-4_2