

Bibliometric Analysis of Towards Development Teaching and Learning Based on 3D Animation

Aas Nuraisah¹, Aina Febri Andini²

¹ Universitas Majalengka and aasnuraisah23@gmail.com

² Universitas Majalengka and ainafebri75@gmail.com

ABSTRACT

Learning is the process by which a person acquires new knowledge, ability, understanding, or experience through interaction with information, teachers, the environment, or their own learning experiences. In addition, its learning methods are not always relevant and are often monotonous, causing students to be bored, uninvolved or unmotivated during the learning process. This can lead to difficulty understanding and retaining the subject matter. Animated 3D-based learning has become one of the increasingly popular modern educational methods to overcome monotonous learning. This method combines 3D animation technology with the learning process to create an interactive and engaging learning environment. The concept, advantages and disadvantages of 3D animation-based learning are discussed in this article. In addition, we describe some case studies that demonstrate the use of this method in education, both in schools and in various learning institutions. 3D animation-based learning offers a new opportunity to improve students' understanding of difficult concepts by presenting the subject matter in a more visual and tangible form. The use of 3D animation in learning has great potential to improve the effectiveness of the learning process, research and development in this area can help maximize the benefits of 3D animation-based learning.

Keywords: Bibliometric, Development, Teaching Learning, 3D Animation

1. INTRODUCTION

Education in Indonesia aims to improve the ability, character, and civilization of a dignified nation to educate the nation's life. The goal is for students to become people who are faithful and devoted to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens[1]. One of the most important elements in life is education. The education of human resources determines their progress [2].

Basically, learning resources and media can be obtained from various sources, as long as they still contain elements to improve students' ability to understand ideas. This is because learning media should be developed from the beginning as it can play a very important learning role.[3]. In Indonesia, the compulsory education program has been implemented for twelve years, starting with primary, junior secondary and senior secondary education. This suggests that the development of positive social attitudes and increased understanding of knowledge competencies will depend on the early education one receives.[4].

In addition, 3D animation-based learning can be beneficial. This approach is not always relevant and is often monotonous, causing students to be bored and disengaged during the learning process. In improving student interest and achievement, Technology influences learning in schools[5]. Entering the era of information and communication technology globalization this decade, it becomes clear how important it is to use virtual technology-based learning (also known as virtual learning) to improve the quality of learning. This technology is in line with the development of theoretical literacy, communication sophistication, and technology that can ultimately help learning practices.[6].

Undoubtedly, some researchers have previously investigated and applied 3D animation learning analysis. 3D Multimedia E-Book Development Based on Mobile Learning for Geography Subjects in High School to Support Distance Learning: This e-book is created by using Kavisoft Flip Book Maker 4 Pro. It produces an e-book equipped with animations, videos, and images that can be played at any time and without limits. It is very easy for students to open it anytime[7]. In addition (Design of Learning Website Integrated with Digital Physics Module Using 3D PageFlip Professional): After changing some parts of the module, the 3D PageFlip Professional-based physical module can be displayed online on the learning website. After that, all the components of the physical module are functioning properly.[8].

As a result, with the current advances in the IT field. Various software, both free and paid, are available to use as needed and make us or teachers even more creative to develop interesting learning media.[9]. It is expected that the use of good and adequate media can stimulate the thoughts, feelings, attention, and interests of students so that the learning process can run well and stimulate. Media such as 3D animation is expected to be a new learning tool that can change the monotonous and boring learning atmosphere into interesting and entertaining learning. Because the material has been visualized and becomes easier to understand, students will be more motivated and not bored when learning.[10].

The purpose of this research is to identify ways in which biometric analysis can be used to measure and improve students' understanding and retention of information in 3D animation-based learning. System Validation and Evaluation: The aim of this research may be to validate and evaluate biometric systems used in 3D animation-based learning. This includes the creation and testing of instruments that can measure student understanding, interest, and engagement in 3D animation-based learning.

Table 1. Some bibliometric analysis that has been done by previous researchers on the topic of 3D Animation-based learning and teaching developments.

Author & Year	Number Document Analyzed	Source	Findings
[1]	39	GOOGLE SCHOLAR	The results of the validation of material experts and media experts show that VR material and media are very suitable and very feasible to use in learning, so that the VR developed is valid, practical, and effective. The experimental group's response to the use of VR and the learning outcomes of grade V students are better than those of the control group schools, which shows that VR The evaluation results show that the implementation stage is effective in improving student interest and learning outcomes. The results showed that students' interest and learning outcomes improved significantly. With an average score of 49.55 before, the product reached an average achievement of 82.08.
[2]	26	GOOGLE SCHOLAR	The results of the research and discussion described show that in the Multimedia Department of SMK Negeri 3 Singaraja, various programs or software have been used to create multimedia interactive e-learning books containing material on 3D animation techniques and 2D animation. One of the programs or

			software used is Camtasia Studio 8, released by TechSmith. In addition, book design and material placement are assisted by the software. The results of making multimedia interactive e-books show changes in the presentation of the flip. The material is done using real methods in the form of videos, both video tutorials and video illustrations. The results of validation tests conducted by validators using questionnaires show that multimedia interactive learning e-books for 3D and 2D animation techniques are in accordance with the concepts in the material discussed in each subject.
[6]	19	GOOGLE SCHOLAR	Using the academic portal siak.isi.ac.id , qualitative data from 23 students taking the Blender 3D Visual Engineering course was collected. The results show that this interactive virtual techno learning website can help students complete tasks independently guided by tutorials and assignments. The Important Performace Analysis (IPA) technique was used to measure the level of website services to assess user satisfaction and the quality of other facility services. One of the applications of e-learning digital technology is research on the development of web-based virtual technology as a learning medium for students. Electronic learning media are not intended to replace teachers' jobs or move the academic atmosphere to the internet dimension. Instead, this digital media tool serves as a digital-based instructional guide that helps students develop and hone skills independently. Students can get assistance in completing modeling assignments related to product design by using Blender 3D learning media, which is available on this academic portal website. The syllabus and Unit of Study (SAP) remain the foundation for this virtual technology learning course material. This ensures that students can complete assignments with peace of mind and explore the features and facilities.
[8]	53	GOOGLE SCHOLAR	To fulfill the research steps with 4D strategy, a form of learning website has been designed to disseminate 3D PageFlip Professional-based physical learning module. The purpose of this website is to display the 3D PageFlip Professional-based physical digital module online.
[11]	127	GOOGLE SCHOLAR	The research produced flipbooks for particle dynamics material as Islamic-based physics learning. Previous research on the development of physical flipbook learning media to improve student learning outcomes found that the products made were in the "very good" category and very suitable for use in the teaching and learning process with a percentage of 91.46%. Previous research on the development of flash Kvisovt flipbook-based e-books on educational materials found that the product was in the "very good" category, the research developed a flipbook for particle dynamics material as Islamic-based physical learning. Previous research on the development of physical

			flipbook learning media to improve student learning outcomes found that the products made were in the "very good" category and were very suitable for use in the teaching and learning process with a percentage of 91.46%.
[7]	76	GOOGLE SCHOLAR	The multimedia learning program is made to be flexible and easy to control the sequence of materials. By looking at the responses of students and validators (material experts and media experts), it can be concluded that using the developed multimedia learning products makes students happier, do not feel embarrassed if they have not understood the material, and can repeat the material without feeling embarrassed. The product is also attractive in terms of design, material, and ease of learning. By considering the above, the development of media-based geography learning has several advantages. Select and develop learning materials, set indicators, and set learning strategies and experiences. It becomes an interesting learning multimedia that suits students' learning style and PTJJ learning. Besides using Kvisof FlipBook Maker 4 Pro program as the main program and other supporting programs, you can create storyboards and flowcharts used in multimedia development. Students can learn topics through media rather than face-to-face in class by being part of a learning approach that has relatively high time efficiency.

1. How is 3D animation classified in improving learning effectiveness?
2. How is the development of 3D animation in the learning process?
3. Which research is often published about 3D animation learning?
4. What provides opportunities for further research on the application of 3D animation in learning?

Personalization of Learning: The goal of this research is to create a system that can customize 3D animation-based learning to the needs and preferences of students. This research can help improve the quality of animated content, such as character design, movement, or interaction between objects in a 3D environment. The goal of this analysis could be the use of biometric analysis to understand how students interact with 3D animation content. An understanding of the human-computer relationship: Additionally, things such as hardware used, comfort, or difficulty of interaction could be the subject of this research to gain a deeper understanding of how students interact with 3D animation interfaces. Use in Various Situations: One additional goal is to determine whether 3D animation-based learning with biometric analysis can be used in various contexts, such as skill development, business training, or formal education.

2. METHODS

Bibliometric analysis is a measurement method used to find systematic patterns of different types of literature for a particular theme. It helps researchers study the bibliographic content and analyze the citations of each article retrieved from the Publish or Perish database. This bibliometric

method is essential for identifying important research themes and determining the novelty of research. As a result, the researcher's bibliometric mapping determined the subject of the research, which is the creation of 3D animation-based learning tools.

2.1 Data Collection and Data Cleaning

Bibliometric analysis was conducted with Publish or Perish, which has collected 980 journals from Google Scholar, with estimated data collection from 2006 to 2023. Using keywords such as "Bibliometric", "Development", "Learning Education", and "3D Animation", all journals were collected through Google Scholar, which is one of the most comprehensive peer-reviewed journal databases. After the Publish or Perish metadata stored in RIS format was processed, the VOSViewer program was used to display the visualization in a bibliometric map. The bibliometric visualization technique specifically uses clusters of relationships between journals, co-authorship of authors, and the occurrence of keywords to determine related progress in the development of 3D animation-based learning media in education. Research themes can be derived from the titles and abstracts of publications or from the keywords given by authors in the journals discussed.

Double quotes can be used to find the full search result phrase. The two keyword phrases are combined to find the relationship between teaching and learning and bibliometric intelligence. This ensures that the search results match the keywords being talked about. Some articles did not have title words but did have keywords, so the title word section in the search was left blank.

Figure 1. Metadata Search Results Using Publish or Perish

Cites	Per year	Rank	Authors	Title	Year	Publication	Publisher	Type
382	191.00	1	R Arpiansah, Y Fer...	Game Edukasi VR Pengenalan Da...	2021	Jurnal Teknologi Dan ...	jim.teknokrat.ac.id	JOUR
336	56.00	2	M Mustika, EPA S...	Pengembangan media pembelaj...	2017	Jurnal Online Informatika	join.if.uinsgd.ac.id	JOUR
279	69.75	3	I Awalita, AS Pamu...	Pengembangan media pembelaj...	2019	..., Jurnal Matematika Kre...	journal.unnes.ac.id	JOUR
277	92.33	4	A Harahap, A Sucu...	Pemanfaatan Augmented Realty ...	2020	Jurnal Ilmiah Infrastruktur...	jim.teknokrat.ac.id	JOUR
261	87.00	5	S Ahdan, AT Priatn...	Perancangan Media Pembelajaran...	2020		academia.edu	PDF
248	124.00	6	AF Ramadhan, AD...	Aplikasi pengenalan perangkat ke...	2021	Jurnal Teknologi Dan ...	jim.teknokrat.ac.id	JOUR
227	113.50	7	A Sucipto, QJ Adri...	Martial art augmented reality boo...	2021	Jurnal Sisfokom (Sistem ...	jurnal.atmaluhur.ac.id	JOUR
225	28.13	8	S Hayati, AS Budi, ...	Pengembangan media pembelaj...	2015	Prosiding Seminar Nasion...	jurnal.unj.ac.id	JOUR
199	24.88	9	D Tarigan, S Siagian	Pengembangan media pembelaj...	2015	Jurnal teknologi informasi...	jurnal.unimed.ac.id	PDF
189	189.00	10	I Ahmad, S Samsu...	Penerapan Augmented Realty Pa...	2022	Jurnal Teknoinfo	ejournal.teknokrat.ac.id	JOUR
175	25.00	11	FZ Adami, C Budi...	Penerapan Teknologi Augmented...	2016	Jurnal Teknik Komputer A...	ejournal.bsi.ac.id	PDF
172	86.00	12	NL Andriyani, NW...	Development of learning videos ...	2021	Journal of Education ...	ejournal.undiksha.ac.id	JOUR
163	20.38	13	RE Saputro, DIS Sa...	Pengembangan media pembelaj...	2015	Jurnal Buana Informatika	ojs.usaj.ac.id	PDF
157	39.25	14	VH Saputra, E Febr...	Media Pembelajaran Berbasis Mu...	2019	Mathema: Jurnal Pendidik...	ejournal.teknokrat.ac.id	JOUR
132	33.00	15	TD Kurmia, C Lati, ...	Model addie untuk pengembang...	2019	Prosiding Seminar ...	academia.edu	PDF
131	18.71	16	M Khairani, D Febr...	Pengembangan media pembelaj...	2016	Jurnal Ipteks Terapan	ejournal.ildikti10.id	JOUR
129	18.30	17	IBM Mahendra	Implementasi augmented reality...	2016	Jurnal Ilmiah II M I K O M P	ejournal.uns.ac.id	PDF

To increase the number of searches, you can fill in how many journals you want. After searching according to certain criteria, 980 journals were found. The number of citations, author name, title, year of publication, and publisher are among the data collected.

Once the data was collected, the data cleaning process was carried out. Since the data used for the research was only in English and Indonesian, the results of data cleaning were used to obtain relevant journals.

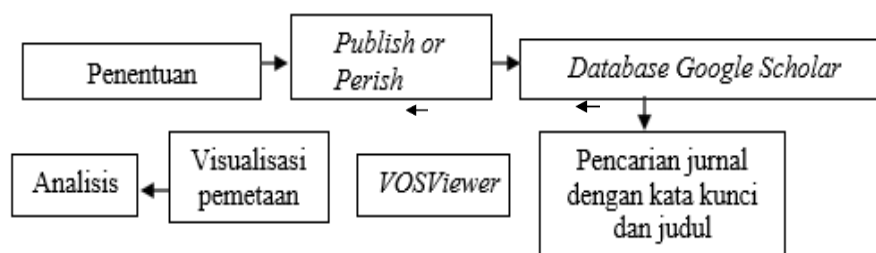
2.2 Data Analysis and Mapping

Studying the development and mapping that can be done with the VOSviewer application comes next after the data has been gathered. Data visualization tools like Network Visualization, Overlay Visualization, and Density Visualization are available in this application

Various information about the most recent, largest, and smallest studies can be seen based on the visualization results displayed. VOSviewer allows visualization of mapping results as well as information on clusters and items within them. How to use the VOSViewer program is as follows:

- 1) Turn on the VOSViewer software on your laptop or PC.
- 2) Select the create button on the file tab until a dialog box appears.
- 3) Select the data create a map based on text data, then select the next button.
- 4) Select the data source read data from reference manager files and select the next button.
- 5) Select the RIS tab then select files and select 3 research themes of article metadata from Publish or Perish that have been saved, then select the next button.
- 6) Select title and abstract fields then select the next button.
- 7) Select binary counting and then select the next button.
- 8) Then fill the threshold with 6, then select next.
- 9) Then choose finish, a visualization of bibliometric mapping of the three research themes will appear.

Figure 2: Research flow of Bibliometric Analysis



3. RESULTS AND DISCUSSION

From 2006 to 2023, research on Teaching and Learning Based on 3D Animation continues to grow. Interestingly, in 2023 the number of Teaching and Learning Based on 3D Animation journals is growing rapidly with research published in scientific journals. This significant increase is due to the Teaching and Learning Based on 3D Animation trend on social media and its potential influence in the future. Based on the discussion above. The purpose of this study is to understand how students interact with 3D animation content. This can increase students' success rate in learning. Understanding Human - Computer interaction: This research has also included a deeper understanding of how students interact with 3D animation interfaces. An additional goal is to determine whether 3D animation-based learning with bibliometric analysis can be used in various situations, such as skill development, business training, or formal education.

3.1 Journal Reputation

At this stage, some of the better-ranked journals on teaching and learning with 3D animation were selected.

Table 2. Journal Profiles with The 6 Best Rankings on The Topic of 3D Animation "Teaching and Learning"

Num	Author	Title	Cites By
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[12]	R Arpiansah, Y Fernando, J Fakhrurozi	Educational Game Vr Introduction and Prevention of Covid-19 Virus Using Mdlc Method for Early Childhood	382
[13]	M Mustika, EPA Sugara, M Pratiwi	Creating Interactive Educational Content Using the Multimedia Development Life Cycle Approach	336
[14]	I Awalia, AS Pamungkas, TP Alamsyah	Creation of Powtoon Animation Learning Resources for Class IV SD Mathematics Subjects	279
[15]	A Harahap, A Sucipto, J Jupriyadi	Utilization of Augmented Reality (AR) on Android-based Electronic Component Introduction Learning Media	277
[16]	S Ahdan, AT Priandika, F Andhika, FS Amalia	Learning Resources for Fundamental Volleyball Skills Using Augmented Reality Technology Based on Android	261
[17]	AF Ramadhan, AD Putra, AD Surahman	Android-based Computer Hardware Introduction Application Using Augmented Reality (Ar)	248

Table 3. Top 6 Ranked Journals on The Topic Of 3D Animation

Point of View	JTSI	JOIN	KREANO	JITI	JBBM	JTSI
Publisher	TEKNORAT	TI UINS GD	ASC	TEKNO RAT	Academia .edu	TEKNORAT
First published	2021	2017	2019	2020	2006	2021
Last published	2021	2017	2019	2020	2006	2021
Scopus Indexed	No	No	Yes	No	No	No
Impact factor by Sinta,	-	6.6	-	-	-	-

3.2 Journal Metrics Information

Table 4. Metric information of all journals in PoP

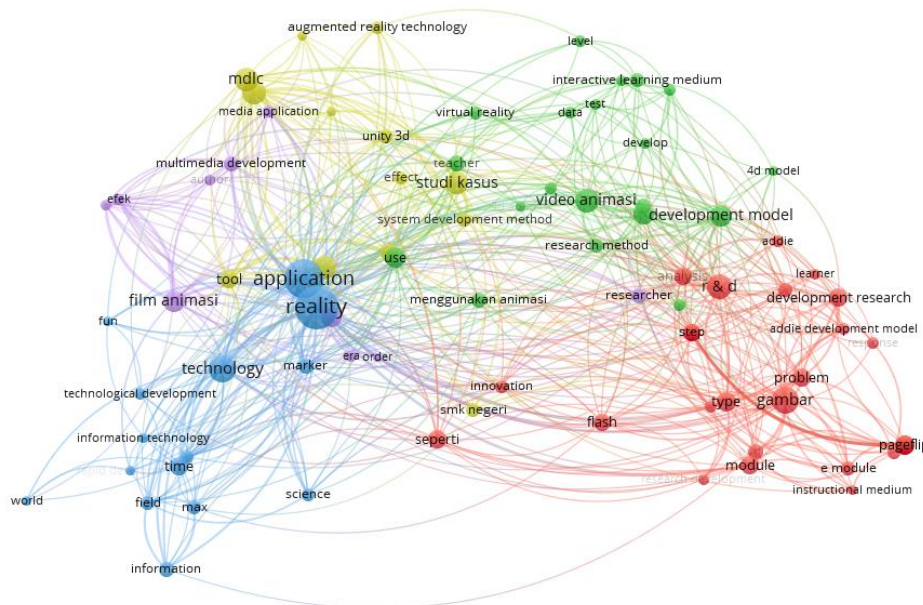
Metrics data	Citation Metric
Publication years	2006-2023
Citation years	17 (2006-2023)
Papers	980
Citations	9917
Cites/year	583.35
Cites/paper	10.12
Authors/paper	4686.91
h-index	48

g-index	85
hI,norm	34
hI,annual	2.00
hA-index	24

3.3 VOSViewer Results

To achieve the first objective of this paper, which is how the classification of 3D animation in improving learning effectiveness, I downloaded several journals based on Publish or perish and then retrieved the csv database from Google Scholar. Next, I used VosViewer software to conduct my analysis. I created a map based on the text data using the title and abstract fields, and the binary counting method found 4700 terms. 135 thresholds were found with a minimum number of 6 occurrences. However, a relevance score will be calculated for each of the 135 terms. The result is the 135 most relevant words, with 60% of them selected automatically.

Figure 3. Network visualization map of keywords

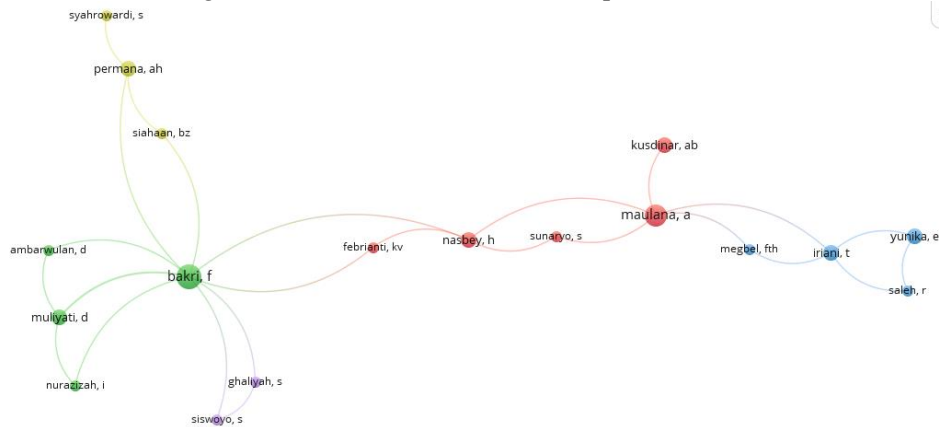


Several clusters are indicated in Figure 3 by the colors blue, yellow, red, green, and purple. Certain words within the clusters are the most common based on the total number of articles. These clusters show that there are currently five categories for published articles. Table 5 has additional details.

Table 5. Clusters and keywords therein

Cluster	Total items	Most frequent keywords (occurrences)	Keywords
1	23	Image(43), r&d(35), type(23), development research(20), module(20), problem(20)	Addie, addie development model, addie model, analysis, audio, development research, e module, flash, Image, innovation, instructional medium, learner, module, pageflip, problem, r&d, r d, research development, response, like, step, teaching material, type.

Figure 5. Network visualization map of authors



Based on Figure 5, it can be seen that there are two big names from each cluster which are marked with large dots in each cluster. They are Bakri and Maulana. In the figure, only authors related in their publications are shown. It can be seen that the journal on learning using 3D animation has been around since 2006 while the latest one on the development of learning using 3D animation was researched recently around 2023.

Further research could focus on a more in-depth evaluation of the effectiveness of using 3D animation in improving comprehension and retention of learning materials. More sophisticated research methodologies could be used to measure the long-term impact of using 3D animation on students' academic achievement and skill development. The research could also focus on developing an optimal learning model using 3D animation. This involves in-depth research on how to best integrate 3D animations into the curriculum, identifying learning situations where they are most effective, and designing practical guides for educators.

CONCLUSION

The results from the discussion using bibliometric analysis that have been examined show an increase in research interest in the development of 3D animation-based teaching and learning. There has been a significant growth in the number of publications addressing this topic, reflecting its relevance in the educational domain.

The sources of information used include various journals, conferences and other publications. This reflects the diversity of the literature on which the study is based, showing that the authors drew on a variety of sources to strengthen the theoretical and methodological foundation.

This journal may have practical implications for educational practitioners, helping them understand how to effectively integrate 3D animation in teaching and learning. It may provide guidelines for curriculum development, teacher training, and technology implementation in educational contexts.



ACKNOWLEDGEMENTS

The author would like to thank all colleagues who have been willing to support. Thank you for your prayers so that the author can complete this research smoothly and on time.

REFERENCES

- [1] R. K. Dewi, "Pemanfaatan Media 3 Dimensi Berbasis Virtual Reality Untuk Meningkatkan Minat Dan Hasil Belajar Ipa Siswa Kelas V Sd," *J. Pendidik.*, vol. 21, no. 1, pp. 28–37, 2020, doi: 10.33830/jp.v21i1.732.2020.
- [2] A. A. Sanuaka, K. U. Ariawan, and W. Sutaya, "Pengembangan Media Pembelajaran Electronic Book (E-Book) Interaktif Multimedia Dalam Mata Pelajaran Teknik Animasi 3D Dan Teknik Animasi 2D Di Jurusan Multimedia Smk Negeri 3 Singaraja," *J. Pendidik. Tek. Elektro Undiksha*, vol. 6, no. 2, 2017, doi: 10.23887/jjpte.v6i2.20234.
- [3] T. Setyono, L. E. Afri, and H. Deswita, "Jurnal – Pengembangan Media Pembelajaran Matematika dengan Menggunakan Macromedia Flash pada Materi Bangun Ruang Kelas VIII SMP," *J. Mat.*, vol. 2Setyono, no. 1, pp. 1–10, 2011.
- [4] W. A. Prasetya, I. I. W. Suwatra, and L. P. P. Mahadewi, "Pengembangan Video Animasi Pembelajaran Pada Mata Pelajaran Matematika," *J. Penelit. dan Pengemb. Pendidik.*, vol. 5, no. 1, pp. 60–68, 2021, [Online]. Available: file:///D:/Semester 7/jurnal kajian relevan/32509-78001-1-PB (1).pdf
- [5] A. Sadikin, A. Johari, and L. Suryani, "Pengembangan multimedia interaktif biologi berbasis website dalam menghadapi revolusi industri 4.0," *Edubiotik J. Pendidikan, Biol. dan Terap.*, vol. 5, no. 01, pp. 18–28, 2020, doi: 10.33503/ebio.v5i01.644.
- [6] B. S. Banindro, "Pengembangan Techno Virtual Berbasis Website sebagai Media Pembelajaran Rekayasa Visual Blender 3D bagi Mahasiswa Desain Produk," *ANDHARUPA J. Desain Komun. Vis. Multimed.*, vol. 5, no. 01, pp. 102–114, 2019, doi: 10.33633/andharupa.v5i01.1965.
- [7] M. Alwan, "Pengembangan Multimedia E-Book 3D Berbasis Mobile Learning Untuk Mata Pelajaran Geografi SMA Guna Mendukung Pembelajaran Jarak Jauh," *At-Tadbir J. Manaj. Pendidik. Islam*, vol. I, no. 2, pp. 26–40, 2018.
- [8] F. Bakri, B. Z. Siahaan, and A. H. Permana, "Rancangan Website Pembelajaran Terintegrasi dengan Modul Digital Fisika Menggunakan 3D PageFlip Professional," *J. Penelit. Pengemb. Pendidik. Fis.*, vol. 2, no. 2, p. 113, 2016, doi: 10.21009/1.02215.
- [9] F. F. N. Fisabilillah and N. C. Sakti, "Pengembangan Video Animasi Sebagai Upaya Peningkatan Minat Belajar Peserta Didik Materi Perpajakan di Sekolah Menengah Atas," *Edukatif J. Ilmu Pendidik.*, vol. 3, no. 4, pp. 1271–1282, 2021, doi: 10.31004/edukatif.v3i4.562.
- [10] S. Azizah, "Pengembangan media pembelajaran matematika berbasis muvizu di kelas 2 sekolah dasar," *Jkpm*, vol. 01, no. 02, pp. 180–192, 2016, [Online]. Available: https://scholar.google.co.id/scholar?q=Pengembangan+media+pembelajaran+matematika+berbasis+muvizu+di+kelas+2+sekolah+dasar&hl=en&as_sdt=0&as_vis=1&oi=scholar
- [11] R. Diani and N. S. Hartati, "Flipbook Berbasis Literasi Islam: Pengembangan Media Pembelajaran Fisika dengan 3D Pageflip Professional," *J. Inov. Pendidik. IPA*, vol. 4, no. 2, pp. 234–243, 2018, [Online]. Available: <http://journal.uny.ac.id/index.php/jipidoi:https://doi.org/10.21831/jipi.v4i2.20819https://doi.org/10.21831/jipi.v4i2.0819>
- [12] R. Arpiansah, Y. Fernando, and J. Fakhrurozi, "Menggunakan Metode Mdlc Untuk Anak Usia Dini," *J. Teknol. dan Sist. Inf.*, vol. 2, no. 2, p. 88, 2021, [Online]. Available: <http://jim.teknokrat.ac.id/index.php/JTISI>
- [13] M. Mustika, E. P. A. Sugara, and M. Pratiwi, "Pengembangan Media Pembelajaran Interaktif dengan Menggunakan Metode Multimedia Development Life Cycle," *J. Online Inform.*, vol. 2, no. 2, p. 121, 2018, doi: 10.15575/join.v2i2.139.
- [14] I. Awalita, A. S. Pamungkas, and T. P. Alamsyah, "Pengembangan Media Pembelajaran Animasi Powtoon pada Mata Pelajaran Matematika di Kelas IV SD," *Kreano, J. Mat. Kreat.*, vol. 10, no. 1, pp. 49–56, 2019, doi: 10.15294/kreano.v10i1.18534.
- [15] A. Harahap, A. Sucipto, and J. Jupriyadi, "Pemanfaatan Augmented Reality (Ar) Pada Media Pembelajaran Pengenalan Komponen Elektronika Berbasis Android," *J. Ilm. Infrastruktur Teknol. Inf.*, vol. 1, no. 1, pp. 20–25, 2020, doi: 10.33365/jiiti.v1i1.266.
- [16] S. Ahdan, A. Thyo Priandika, F. Andhika, and F. Shely Amalia, "Perancangan Media Pembelajaran Teknik Dasar Bola Voli Menggunakan Teknologi Augmented Reality Berbasis Android Learning Media for Basic Techniques of Volleyball Using Android-Based Augmented Reality Technology," *Education*, vol. 8, no. 3, pp. 1–16, 2020, [Online]. Available: <http://journalbalitbangdalamampung.org>
- [17] H. F. Dalimunthe and P. Simanjuntak, "Aplikasi Pengenalan Perangkat Keras Komputer Berbasis Android Menggunakan Augmented Reality," *Comput. Sci. Ind. Eng.*, vol. 9, no. 2, pp. 24–31, 2023, doi: 10.33884/comasiejournal.v9i2.7624.

BIOGRAPHIES OF AUTHORS

 A portrait of Aas Nuraisah, a young woman wearing a black hijab and a blue university jacket, set against a blue background.	<p>Aas Nuraisah, 5th Semester Informatics Engineering Student, University of Majalengka, E-mail: aasnuraisah23@gmail.com</p>
 A portrait of Aina Febri Andini, a young woman wearing a black hijab and a blue university jacket, set against a blue background.	<p>Aina Febri Andini, 5th Semester Informatics Engineering Student, University of Majalengka, E-mail : ainafebri75@gmail.com</p>