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Strengthening Teachers' Digital Media Competence: A Community-Based Training on Powtoon for Mathematics Educators in Tanjung Jabung Barat

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Abstract
This community-based training initiative aims to enhance the digital media competencies of mathematics teachers using Powtoon for developing engaging educational content. The program was implemented in sequential phases: planning, action, observation and evaluation, and reflection. During the planning phase, coordination was established with partner schools and core implementation teams were formed. The training program was then introduced and collaboratively scheduled with the participants. In the action phase, teachers participated in hands-on workshops focused on designing instructional media using the Powtoon application. Observations during the implementation showed active teacher engagement and progressive skill acquisition. The evaluation and reflection phases highlighted the program's effectiveness and areas for improvement. Follow-up mentoring ensured sustainability by guiding teachers in independently producing animated learning content. Conducted at Senior High School Number 2 Tanjung Jabung Barat—home to the senior high school mathematics teacher's association (MGMP in Bahasa)—this program successfully enabled senior high school mathematics teachers to integrate Powtoon into their instructional practices. The training not only fostered digital creativity but also promoted collaborative professional development. This initiative demonstrates a scalable model for empowering educators in rural areas with relevant digital tools to enhance teaching quality.

Keywords: Community Engagement, Digital Literacy, Educational Media, Powtoon Application, Teacher Training

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INTRODUCTION

The rapid advancement of digital technology has reshaped the landscape of education, compelling educators to adopt innovative teaching approaches that foster student engagement and improve learning outcomes (Haleem et al, 2022; Ghanbaripour et al., 2024). In this context, the integration of digital media into instructional practices is no longer optional but a necessity, particularly in mathematics education where abstract concepts often require visual reinforcement (Kaiser, 2020; Sinclair & Robutti, 2020; Pan et al., 2022; Cirneanu et

al., 2024). One promising approach is the use of animated learning media, which has demonstrated the potential to increase student comprehension, motivation, and retention (Ho, 2019; Coskun & Cagiltay, 2021).

The incorporation of information and communication technology (ICT) in school-based learning processes is crucial; therefore, educators should be proficient in various software applications that facilitate the creation of instructional media to support effective teaching and learning activities (Mumtaz, 2000; Razak et al., 2018). Nonetheless, many teachers seldom employ such media during instruction, resulting in less meaningful educational experiences. In this ICT era, employing instructional media is indispensable for enhancing teaching quality as anticipated (Rusman, 2012). Educational media can be defined as any tool or resource that systematically conveys messages from a source to create a conducive learning environment where learners can engage efficiently and effectively (Asyhar, 2012).

Despite the growing availability of educational technologies, many teachers—especially in under-resourced or rural areas—continue to rely on traditional tools such as Microsoft PowerPoint, limiting the diversity and interactivity of their instructional methods (Hennessy et al., 2015; Barbetta, 2022; Waang, 2023; Zemuy et al., 2024). Preliminary interviews with members of the MGMP in Tanjung Jabung Barat revealed a general lack of familiarity with animation-based applications like Powtoon, despite their pedagogical potential. This reflects a broader gap in digital literacy among educators, which can hinder the effective implementation of ICT in classrooms (Abedi, 2023; Gouseti et al., 2023; Reddy et al., 2023; Zhang & Zhang, 2024).

Prior studies have highlighted the benefits of multimedia learning. Mayer (2014) and Heo & Toomey (2020) established that multimedia integration significantly enhances understanding and information retention. Similarly, Hattie & Clarke (2018) and Ainsworth et al. (2008) emphasized the value of animation in simplifying complex content and supporting cognitive processing. Additionally, research by Winarni et al. (2021) and Nada (2023) found that animated media can increase student motivation and classroom engagement. However, few studies have addressed the challenge of equipping teachers with the practical skills to create such media, especially through sustainable, community-based training models.

However, existing research tends to focus on the effects of multimedia on students, with relatively less attention given to equipping teachers with the skills to design and implement such tools. This reveals a critical gap: without adequate professional development, teachers may struggle to integrate digital media into their instruction, regardless of the evidence supporting its efficacy (Haug & Mork, 2021). Addressing this issue requires structured training initiatives that are both practical and contextually relevant to educators' needs and environments (Darling-Hammond et al., 2019; Zydney et al., 2019; Hertz et al., 2022).

To bridge this gap, the present study introduces a community-based training initiative aimed at enhancing the digital media competencies of mathematics teachers using Powtoon (Oulaich, 2020; İspir & Yıldız, 2023). This user-friendly application enables educators to create animated instructional videos without requiring advanced technical expertise (Rahmawati & Ramadhan, 2021; Yuliantini, 2021; Kleftodimos, 2024). The program was designed to be collaborative, adaptive, and sustainable emphasizing not only technical skill development but also ongoing mentorship and peer support.

The main objective of this study is to assess the effectiveness of the training program in empowering

teachers to create engaging, multimedia-based instructional content. By focusing on community engagement and capacity building, this initiative contributes a practical and replicable model for integrating ICT into mathematics education. It also advances the discourse on professional development for educators, particularly in rural or resource-constrained settings, where access to digital tools and training is often limited.

METHODS

Design Approach

This study employed a participatory action research approach, which is well-suited for community-based training programs aiming to improve teacher competencies (Meyer et al., 2015). Action research enables iterative improvements through collaborative planning, implementation, evaluation, and reflection. This approach was chosen to directly involve mathematics teachers in the process of developing and integrating digital media into their instructional practices, thereby fostering ownership and sustainability of the outcomes.

Procedure

The implementation of the training program followed a structured four-phase process: planning, action, observation and evaluation, and reflection. During the planning phase, preliminary coordination meetings were conducted with school principals and selected teacher representatives from two partner institutions to discuss the training's objectives, intended outcomes, and delivery strategies. Subsequently, the program was formally introduced to all participating educators and school leaders. A comprehensive needs assessment was also carried out to identify specific challenges related to instructional media use, forming the basis for a context-responsive training curriculum centered on Powtoon as an animation-based learning tool. In the action phase, training was delivered through interactive workshops and mentoring sessions. Teachers were organized into subject-specific groups and introduced to the fundamental features and pedagogical functions of Powtoon. They then engaged in hands-on practice to create instructional media aligned with the national curriculum, which was subsequently piloted in mathematics and science classrooms. Throughout the observation and evaluation phase, facilitators systematically gathered data on participants' progress, challenges encountered, and skill acquisition through structured field notes. The instructional media produced by participants were assessed for clarity, content relevance, visual coherence, and student engagement during classroom implementation. Finally, in the reflection phase, feedback from both participants and trainers was collected to evaluate the overall effectiveness of the program and to identify areas for enhancement. These reflections informed revisions to the training model and contributed to the development of recommendations for future scalability and sustainable integration.

Participants

The participants consisted of 30 mathematics teachers affiliated with the MGMP in Tanjung Jabung Barat, Indonesia. These teachers were from both public and private senior high schools, representing a range of teaching experiences and institutional settings. Participation was voluntary and coordinated through local educational authorities and school leadership.

Data Collection

Data collection employed to ensure comprehensive evaluation of the training program's effectiveness. First, a satisfaction questionnaire was administered following the completion of the training sessions. This instrument was designed to capture participants' perceptions regarding the usefulness, clarity, and practical relevance of both the training content and delivery methods. Second, a project assignment required each participant to create an instructional video for mathematics using the Powtoon application. These projects served as a practical assessment tool to evaluate participants' understanding of the training material and their proficiency in applying Powtoon for educational purposes. Together, these instruments provided valuable insights into both participant satisfaction and learning outcomes.

Data Analysis

The data analysis focused primarily on qualitative approaches to gain a deeper understanding of participant's experiences and outcomes. Descriptive summaries of the satisfaction questionnaires were used to provide an overview of participants' perceptions of the training's relevance and effectiveness. Meanwhile, qualitative data, including structured field notes and participants' project outputs—were analyzed thematically to uncover emerging patterns related to teacher engagement, skill development, and obstacles encountered during the creation of instructional media. The final media projects were assessed using analytic rubrics that emphasized key aspects such as instructional design quality, content relevance, creativity, and alignment with established learning objectives.

RESULTS AND DISCUSSION

The community-based training program in mathematics education, implemented by the Faculty of Teacher Training and Education (FKIP), Universitas Jambi (UNJA), was held at Senior High School (SHS) Number 2 Tanjung Jabung Barat. This school serves as the central meeting point for the MGMP in mathematics, making it a strategic location for community engagement initiatives. The training received a highly positive response from participants, as indicated by the full attendance of 30 senior high school mathematics teachers from both public and private institutions across the region.

The training activities focused on enhancing teachers' digital literacy, specifically using Powtoon, an animation-based platform for creating instructional media. Participants were introduced to the basic features of Powtoon, including its interface, available templates, and step-by-step guidance on how to create learning content. The training was designed to be interactive, combining presentations with collaborative, hands-on practice in small groups.

The training program yielded several key outcomes that highlight its impact on participants' professional development and instructional practices. First, there was a noticeable increase in knowledge and awareness among mathematics teachers regarding the functionalities and pedagogical potential of Powtoon. Through structured demonstrations and hands-on exploration, participants became acquainted with the platform's tools and

how they can be effectively integrated into classroom instruction. Second, the program facilitated collaborative media development, with teachers organized into small groups to encourage peer learning and joint content creation. Each group successfully developed basic animated educational videos tailored to specific mathematics topics, promoting both creative engagement and a deeper understanding of the instructional value of animation-based media. Lastly, the training enhanced participant motivation and provided ongoing guidance, as teachers reported greater enthusiasm for using digital tools in their teaching. Continuous support from facilitators enabled participants to design instructional videos that were both simple and pedagogically sound, contributing to a professional environment that encouraged innovation and sustained learning.

Despite these encouraging results, the evaluation phase revealed that many teachers were still in the early stages of developing proficiency with Powtoon. Several participants exhibited hesitancy in using the platform independently, indicating a need for continued practice and follow-up mentoring to build fluency and confidence.

At the time of reporting, the final outputs of the training—namely, the analysis and compilation of teacher-produced media—had not yet been completed, as the descriptive evaluation and accountability processes were still underway. Therefore, a more detailed assessment of media quality and classroom implementation impact will be reported in subsequent phases.

It is important to note that this training program was implemented in conjunction with other community service initiatives organized by different groups within the Department of Mathematics Education of FKIP UNJA. The opening ceremony, held in the assembly hall of SHS Number 2 Tanjung Jabung Barat, marked the official start of the collaborative community service activities (PPM), bringing together multiple community service teams and MGMP mathematics teachers for a shared commitment to professional development and educational improvement (See Figure 1).

Figure 1. Mathematics Education PPM Team

In the opening session of the community service initiative, representatives from four Mathematics Education PPM from UNJA participated. The event was formally welcomed by the chair of the SHS for mathematics MGMP in Tanjung Jabung Barat, along with all MGMP members who served as both hosts and training participants. Given

time constraints and the concurrent execution of multiple PPM programs, activities were distributed across the available sessions in coordination with all teams involved.

The specific training program on developing instructional media using Powtoon was scheduled following the opening ceremony. Prior to the implementation, preliminary coordination and needs assessment had been conducted, revealing a recurring trend in teachers' reliance on Microsoft Office applications—particularly PowerPoint—for media presentation in classroom settings. While teachers were generally proficient in PowerPoint, there was limited familiarity with more dynamic and animation-based tools such as Powtoon. This gap presented an opportunity to introduce a tool that could enrich teaching materials and foster greater creativity among educators.

The training began with an introductory session on the Powtoon platform, designed to familiarize participants with its features and potential educational applications. To support the training process, facilitators prepared a comprehensive set of materials, including digital presentation slides and printed user guides that outlined step-by-step instructions for using the software. These resources were tailored to address the varying levels of digital proficiency among participants and to ensure that the training could be conducted effectively and flexibly within the allocated timeframe.

Figure 2. Instructor Introducing Powtoon Software to Participants

Figure 2 illustrates the instructor presenting the foundational concepts of the Powtoon software. The presentation covered various aspects, including the application's capabilities, the functions of individual tools within the platform, and the step-by-step process for creating educational videos using Powtoon. The image depicts members of the community service team actively engaging with the teachers, explaining how to utilize Powtoon effectively for the development of instructional media.

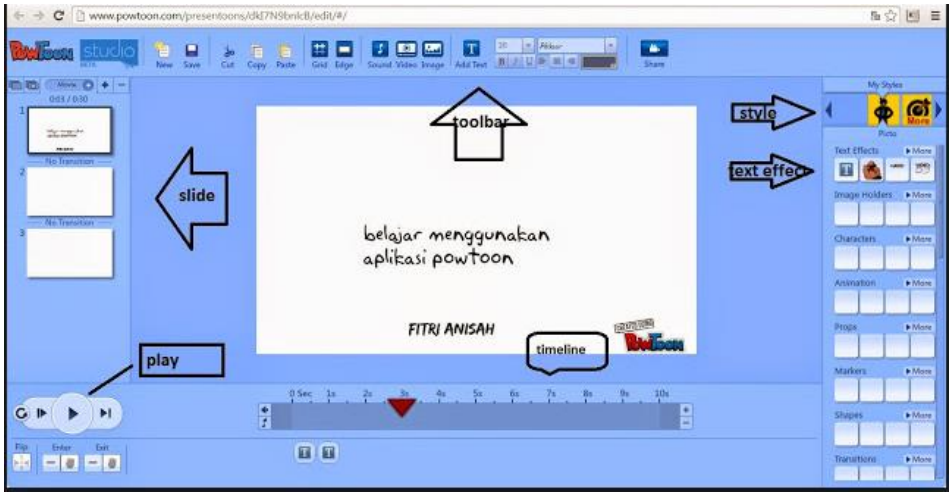

Figure 3. User Interface of the Powtoon

Figure 3 shows the user interface of the Powtoon application in use. Key components of the interface include the toolbar, slide editor, timeline, style options, text effects, and the play button. Users can add new slides as necessary and customize the duration of each element within the slides to suit their needs. Mastery of these features is essential for creating dynamic and effective educational media.

Figure 4. A Draft of a Video within the Powtoon Workspace

Figure 4 displays a draft of a video within the Powtoon workspace. Once finalized, the video can be exported in MP4 format, with a maximum resolution of 1080p, ensuring high-quality output suitable for educational use.

Figure 5. Participants Actively Engaged to the Presented Material

The training activity garnered a positive response from the participants, as evidenced in Figure 5, which shows participants actively engaged and listening attentively to the presented material. Furthermore, 80% of the participants successfully completed the assigned tasks within the designated timeframe.

Teacher training is a critical step in enhancing the quality of education, particularly in the digital age. As educators face the challenge of presenting content in an engaging and effective manner, it is imperative for them to become proficient in utilizing educational technologies. Training that focuses on creating animated learning media offers teachers a valuable opportunity to enhance their creativity (Octavianingrum, 2018; Riskiawan et al., 2016), while also improving student motivation and engagement (Eriyanti et al., 2022; Putri et al., 2022; Raharjo & Karimah, 2021). In the context of the Mathematics MGMP at SMA Tanjung Jabung Barat, such training fosters collaboration among teachers, enabling them to collectively improve their competencies and develop effective teaching practices (Busran, 2023; Pratama et al., 2022).

The application of animated videos as instructional media holds significant promise, particularly in the teaching and learning of mathematics in Tanjung Jabung Barat. Animated videos have been proven to help students understand abstract mathematical concepts that are often challenging (Nurwahidah et al., 2024; Santoso et al., 2020). Several studies indicate that the use of interactive animated videos can lead to improved learning outcomes and better retention of information when compared to traditional teaching methods (Nursanti et al., 2023; Qurrotaini et al., 2020; Tama, 2022). As a result, this method of teaching is increasingly seen as an effective strategy for addressing the complexities of mathematics education.

The training provided to MGMP teachers in Tanjung Jabung Barat enables them to create innovative and engaging teaching media that meets the contemporary demands of education. Powtoon, a versatile and user-friendly software, was introduced as a powerful tool for creating animated videos without requiring advanced graphic design skills. The software offers an array of templates and interactive features, such as animated text and voiceovers, that can enhance the educational experience (Anggita, 2021). Moreover, Powtoon's capability to export videos in MP4 format allows teachers to distribute the content via various digital platforms, including school

websites and social media channels, making it easier to share resources with students (Hud et al., 2022).

In addition to its ease of use, Powtoon's versatility has the potential to stimulate the creativity of teachers. By incorporating animated videos into their lessons, educators are better equipped to present abstract and complex mathematical concepts in a more accessible and engaging way (Nusantara et al., 2024). This aligns with the broader trend in education, where multimedia tools, including animated videos, have been shown to foster greater student engagement and enhance learning outcomes (Mayer, 2014; Hattie & Clarke, 2018). As digital technologies become increasingly integrated into education, the adoption of tools like Powtoon is becoming a necessary step for educators to remain effective and relevant in today's rapidly evolving teaching environment.

However, despite the positive response to the Powtoon training, there are certain limitations that need to be considered. First, while the training equipped teachers with the basic skills to use Powtoon, the proficiency levels of teachers varied, with some still facing challenges in fully mastering the software. This highlights the need for ongoing support and additional training sessions to ensure that teachers can confidently incorporate Powtoon into their teaching practices (Gouseti et al., 2023). Furthermore, while Powtoon is a powerful tool for creating animated videos, its effectiveness may be limited by the technical infrastructure available in schools, particularly in rural or under-resourced areas (Abedi, 2023; Hennessy et al., 2015). Teachers in such contexts may struggle with internet connectivity or access to devices that are necessary for the full implementation of digital media in the classroom.

CONCLUSION

This study demonstrates that the community-based training initiative has significantly enhanced teachers' competencies in utilizing information and communication technology, specifically in creating animated video-based learning media using Powtoon. The fact that 80% of participants successfully completed their assignments on time serves as evidence of this improvement. The development of teachers' digital media skills is expected to lead to better mathematics instruction, which will likely improve students' learning experiences. This initiative underscores the importance of accessible ICT tools in advancing educational practices, especially in resource-constrained settings. However, limitations such as varying proficiency levels among teachers and challenges related to technological infrastructure indicate the need for ongoing support, follow-up training, and enhanced school resources. Future study should focus on assessing the long-term impact on student outcomes and exploring the scalability of this model across different educational contexts. In conclusion, this study provides valuable insights into the integration of digital tools in education and offers a replicable model for promoting teacher collaboration, creativity, and innovation in the classroom.

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REFERENCES

Abedi, E. A. (2023). Tensions between technology integration practices of teachers and ICT in education policy expectations: implications for change in teacher knowledge, beliefs and teaching practices. *Journal of Computers in Education*, *11*(4), 1215–1234. https://doi.org/10.1007/s40692-023-00296-6

Asyhar, R. (2012). *Creatively Developing Learning Media* [in Bahasa]. Jakarta: Gaung Persada Press Group.

Ainsworth, S., Robinson, D. H., & Schraw, G. (2008). How Do Animations Ifluence Learning? *Recent Innovations in Educational Technology That Facilitate Student Learning*. http://gateway.webofknowledge.com/gateway/Gateway.cgi?GWVersion=2&SrcAuth=ORCID&SrcApp=OrcidOrg&DestLinkType=FullRecord&DestApp=WOS_CPL&KeyUT=WOS:000268166700003&KeyUID=WOS:000268166700003

Anggita, Z. (2021). Using powtoon as a learning media solution during the Covid-19 pandemic [in Bahasa]. *Jurnal Konfiks*, *7*(2), 44–52. https://doi.org/10.26618/konfiks.v7i2.4538

Barbetta, P. M. (2022). Technologies as tools to increase Active Learning during Online Higher-Education instruction. *Journal of Educational Technology Systems*, *51*(3), 317–339. https://doi.org/10.1177/00472395221143969

Busran, B. (2023). The role of subject teachers' association (MGMP) in improving teacher professionalism competence [in Bahasa]. *JURNAL SIPATOKKONG BPSDM SULSEL,* *3*(4), 140–153. https://doi.org/10.58643/sipatokkong.v3i4.172

Cirneanu, A., & Moldoveanu, C. (2024). Use of digital technology in integrated mathematics education. *Applied System Innovation*, *7*(4), 66. https://doi.org/10.3390/asi7040066

Coskun, A., & Cagiltay, K. (2021). A systematic review ofeye-tracking-basedresearch on animated multimedia learning. *Journal of Computer Assisted Learning*, *38*(2), 581–598. https://doi.org/10.1111/jcal.12629

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2019). Implications for educational

practice of the science of learning and development. *Applied Developmental Science*, *24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Eriyanti, R. W., Cholily, Y. M., Rahardjanto, A., Masduki, M., & Andriyana, A. (2022). Increasing teacher creativity in utilizing digital learning media through collaborative lesson study. *Fon: Jurnal Pendidikan Bahasa Dan Sastra Indonesia*, *18*(1). https://doi.org/10.25134/fon.v18i1.5724

Ghanbaripour, A. N., Talebian, N., Miller, D., Tumpa, R. J., Zhang, W., Golmoradi, M., & Skitmore, M. (2024). A Systematic review of the impact of emerging technologies on student learning, engagement, and employability in built environment education. *Buildings*, *14*(9), 2769. https://doi.org/10.3390/buildings14092769

Gouseti, A., Lakkala, M., Raffaghelli, J., Ranieri, M., Roffi, A., & Ilomäki, L. (2023). Exploring teachers' perceptions of critical digital literacies and how these are manifested in their teaching practices. *Educational Review*, 1–35. https://doi.org/10.1080/00131911.2022.2159933

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, 275–285. https://doi.org/10.1016/j.susoc.2022.05.004

Hattie, J., & Clarke, S. (2018). Visible learning: Feedback. In *Visible Learning: Feedback*. https://doi.org/10.4324/9780429485480

Haug, B. S., & Mork, S. M. (2021). Taking 21st century skills from vision to classroom: What teachers highlight as supportive professional development in the light of new demands from educational reforms. *Teaching and Teacher Education*, *100*, 103286. https://doi.org/10.1016/j.tate.2021.103286

Hennessy, S., Haßler, B., & Hofmann, R. (2015). Challenges and opportunities for teacher professional development in interactive use of technology in African schools. *Technology Pedagogy and Education*, *24*(5), 1–28. https://doi.org/10.1080/1475939x.2015.1092466

Heo, M., & Toomey, N. (2020). Learning with multimedia: The effects of gender, type of multimedia learning resources, and spatial ability. *Computers and Education*, *146*. https://doi.org/10.1016/j.compedu.2019.103747

Hertz, B., Clemson, H. G., Hansen, D. T., Laurillard, D., Murray, M., Fernandes, L., Gilleran, A., Ruiz, D. R., & Rutkauskiene, D. (2022). A pedagogical model for effective online teacher professional development—findings from the Teacher Academy initiative of the European Commission. *European Journal of Education*, *57*(1), 142–159. https://doi.org/10.1111/ejed.12486

Ho, L., Sun, H., & Tsai, T. (2019). Research on 3D painting in virtual Reality to improve students' motivation of 3D animation learning. *Sustainability*, *11*(6), 1605. https://doi.org/10.3390/su11061605

Hud, N. M., Yudhi, Fran, F., Helmi, Pasaribu, M., Yundari, Prihandono, B., Kusumastuti, N., Kiftiah, M., & Noviani, E. (2022). Training on optimizing the creation of learning media using the powtoon application [in Bahasa]. *Jurnal Pengabdian Kepada Masyarakat Nusantara (JPkMN)*, *3*(2). https://ejournal.sisfokomtek.org/index.php/jpkm/article/view/442

Husni, P. (2021). The influence of using animated video media on students' learning motivation at state junior high school 5, Kota Jambi [in Bahasa]. *Published Undergraduate Thesis, UIN Sultan Thaha: Jambi.* https://www.scribd.com/document/697699538/SKRIPSI-padilatul-husni-2

İspir, B., & Yıldız, A. (2023). An overview of digital storytelling studies in classroom education in Turkey. *Journal of Qualitative Research in Education*, *23*(35). https://doi.org/10.14689/enad.35.1714

Kaiser, G. (2020). Mathematical modelling and applications in education. In: Lerman, S. (eds) *Encyclopedia of*

Mathematics Education. Springer, Cham. (pp. 553–561). https://doi.org/10.1007/978-3-030-15789-0_101

Kleftodimos, A. (2024). Computer-Animated Videos in Education: A Comprehensive Review and Teacher Experiences from Animation Creation. *Digital*, *4*(3), 613–647. https://doi.org/10.3390/digital4030031

Mayer, R. E. (2014). Incorporating motivation into multimedia learning. *Learning and Instruction, 29.* https://doi.org/10.1016/j.learninstruc.2013.04.003

Meyer, G. M., Wood., Andrews, D. (2015). Exploring Community Partnershipfor Service-learning in Creative Arts Education through Participatory Action Research. *Published Dissertation.* North-West University: Kirkland.

Minarni, F., Mustofa, M., & Nursafira, M. S. (2023). Breaking textbook barriers: PowToon videos in engaging ICT learning for young EFL learners. *Elsya : Journal of English Language Studies*, *5*(3). https://doi.org/10.31849/elsya.v5i3.14923

Mumtaz, S. (2000). Factors affecting teachers' use of information and communications technology: a review of the literature. *Journal of Information Techology for Teacher Education*, *9*(3), 319–342. https://doi.org/10.1080/14759390000200096

Nada, A. Q., & Indrawan, D. (2023). Using Powtoon media to improve mathematics learning outcomes with teaching techniques [in Bahasa]. *FONDATIA*, *7*(1), 65–79. https://doi.org/10.36088/fondatia.v7i1.2955

Nursanti, F., Haryaka, U., & Untu, Z. (2023). Improving students' mathematics learning outcomes through problem based learning model assisted by animated video media [in Bahasa]. *Primatika : Jurnal Pendidikan Matematika*, *12*(2). https://doi.org/10.30872/primatika.v12i2.2721

Nurwahidah, Syaharuddin, Vera, M., & Abdillah. (2024). Effectiveness of animation-based mathematics learning modules on students' cognitive intelligence [in Bahasa]. *Seminar Nasional Paedagoria*, *4*, 453–463. https://journal.ummat.ac.id/index.php/fkip/article/view/25669

Nusantara, D. S., Zulkardi, N., & Putri, R. I. I. (2024). How to design PISA-like digital mathematics problems: A preliminary study. *AIP Conference Proceedings*, *3104*, 020002. https://doi.org/10.1063/5.0194756

Octavianingrum, D. (2018). Teacher creativity: Utilization of videoscribe software-based learning media [in Bahasa]. *Prosiding Seminar Nasional Pendidikan Administrasi Perkantoran (SNPAP)*, 60. https://jurnal.uns.ac.id/snpap/article/viewFile/27900/21758

Oulaich, S. (2020). Pedagogy in the Digital Age: Making Learning Effective and Engaging for Students. In: Ben Ahmed, M., Boudhir, A., Santos, D., El Aroussi, M., Karas, İ. (eds) Innovations in Smart Cities Applications Edition 3. SCA 2019. Lecture Notes in Intelligent Transportation and Infrastructure. Springer, Cham. https://doi.org/10.1007/978-3-030-37629-1_14

Pan, Y., Ke, F., & Xu, X. (2022). A systematic review of the role of learning games in fostering mathematics education in K-12 settings. *Educational Research Review*, *36*, 100448. https://doi.org/10.1016/j.edurev.2022.100448

Pratama, A., Saputra, I., Al Kautsar Aidilof, H., Habib, M., & Nasruddin, N. (2022). Multimedia-based learning media development training to improve the quality and creativity of teachers at SMA Negeri 1 Lhokseumawe [in Bahasa]. *RAMBIDEUN : Jurnal Pengabdian Kepada Masyarakat*, *5*(3), 261–270. https://doi.org/10.51179/pkm.v5i3.1470

Putri, L., Mujib, A., & Padmo Putri, D. A. (2022). The influence of information communication technology-based training and pedagogical competence on teacher professionalism [in Bahasa]. *Jurnal Pendidikan Glasser*, *6*(1). https://doi.org/10.32529/glasser.v6i1.1317

Qurrotaini, L., Sari, T. W., Sundi, V. H., & Nurmalia, L. (2020). Effectiveness of using powtoon-based video media

in online learning [in Bahasa]. *Seminar Nasional Penelitian LPMM UMJ*, 1–7. https://jurnal.umj.ac.id/index.php/semnaslit

Raharjo, J. F., & Karimah, N. I. (2021). E-learning training and digital textbook creation for improving the role of millennial teachers [in Bahasa]. *JAMU : Jurnal Abdi Masyarakat UMUS*, *1*(02). https://doi.org/10.46772/jamu.v1i02.368

Rahmawati, F., & Ramadan, Z. H. (2021). Improving High-Level Thinking Skills in Students through Powtoon-Based Animation Video Media. *Journal of Education Technology*, *5*(4), 654–662. https://doi.org/10.23887/jet.v5i4.41037

Razak, N. A., Jalil, H. A., Krauss, S. E., & Ahmad, N. A. (2018). Successful implementation of information and communication technology integration in Malaysian public schools: An activity systems analysis approach. *Studies in Educational Evaluation*, *58*, 17–29. https://doi.org/10.1016/j.stueduc.2018.05.003

Reddy, P., Chaudhary, K., & Hussein, S. (2023). A digital literacy model to narrow the digital literacy skills gap. *Heliyon*, *9*(4), e14878. https://doi.org/10.1016/j.heliyon.2023.e14878

Riskiawan, H. Y., Setyohadi, D. P. S., & Arifianto, A. S. (2016). Multimedia-based learning media development training to improve the quality and creativity of high school teachers [in Bahasa]. *Jurnal Pengabdian Masyarakat J-DINAMIKA*, *1*(1), 48–52. https://doi.org/10.25047/j-dinamika.v1i1.134

Rusman. (2012). *Information and Communication Technology Based Learning* [in Bahasa]. Depok: RajaGrafindo Persada.

Santoso, B., Utomo, B. T. W., & Dewi, S. A. K. (2020). Development of android-based m-learning applications as a supporting tool for classroom learning. *SMATIKA JURNAL*, *10*(01). https://doi.org/10.32664/smatika.v10i01.444

Sinclair, N., Robutti, O. (2020). Teaching Practices in Digital Environments. In: Lerman, S. (eds) Encyclopedia of Mathematics Education. Springer, Cham. https://doi.org/10.1007/978-3-030-15789-0_153

Tama, N. S. (2022). Analysis of student needs for animated video media in mathematics learning [in Bahasa]. *AKSIOMA : Jurnal Matematika dan Pendidikan Matematika*, *13*(2). https://doi.org/10.26877/aks.v13i2.12498

Waang, G. P. (2023). Maximizing the potential of multimedia in Indonesia: enhancing engagement, accessibility, and learning outcomes. *Academic Society for Appropriate Technology*, *9*(3), 235–245. https://doi.org/10.37675/jat.2023.00409

Winarni, S., Kumalasari, A., Marlina, M., & Rohati, R. (2021). The effectiveness of mathematics learning videos to support students' numeracy and digital literacy skills [in Bahasa]. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(2), 574. https://doi.org/10.24127/ajpm.v10i2.3345

Yuliantini, P. (2021). The use of Powtoon as media to enhance EFL students' English skill. *Journal of Educational Study*, *1*(2), 28–37. https://doi.org/10.36663/joes.v1i2.150

Zemuy, M., Tsegay, S.M. & Aihui, P. (2024). PowerPoint-based lectures and students' experiences in Eritrean Higher Education Institutions. *SN Soc Sci 4*, 162. https://doi.org/10.1007/s43545-024-00959-w

Zhang, J., & Zhang, Z. (2024). AI in teacher education: Unlocking new dimensions in teaching support, inclusive learning, and digital literacy. *Journal of Computer Assisted Learning*, *40*(4), 1871–1885. https://doi.org/10.1111/jcal.12988

Zydney, J. M., Warner, Z., & Angelone, L. (2019). Learning through experience: Using design based research to redesign protocols for blended synchronous learning environments. *Computers & Education*, *143*, 103678. https://doi.org/10.1016/j.compedu.2019.103678