

EMPOWERING HIGH SCHOOL TEACHERS' COMPETENCIES THROUGH DIGITAL TECHNOLOGY DESIGN PROGRAM FOR CREATIVE LEARNING IN JAKARTA

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Abstract: *This digital technology design program aims to improve the empowerment of high school teachers' competencies in Jakarta in developing digital teaching materials for more creative learning. Digital teaching materials are in the form of digital books that can be accessed openly by their students. This digital teaching book is designed with the CANVA application, where teachers can create digital books innovatively according to the concept of the material to be taught. The method used in this digital technology design program is offline training to develop participant skills. The training was conducted offline in Jakarta. The participants were 23 high school teachers in Jakarta. Implementing the digital technology design program resulted in three participant responses in the satisfaction questionnaire. Participants obtained new and original ideas to develop creative teaching materials or learning instruments. The atmosphere of the fun digital technology design program activities has been created well by the presenters. In addition, participants gain positive benefits from developing their competencies in developing creative digital teaching books after this activity. The questionnaire results showed that participants gained new ideas in developing digital books, with a percentage of 26.09% for the "strongly agree" criteria and 73.91% for the "agree" criteria. The digital technology design program has a positive impact on the empowerment and improvement of the competencies of high school teachers in supporting creative learning through innovative digital technology. Unlike other programs, this program is done with direct practice and assistance until the product is finished.*

Keywords: *Creative Learning; Design Program; Digital Technology; Teacher Competency.*

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INTRODUCTION

This digital technology design program is intended to empower teachers' competencies in developing digital books. Perspectives related to digital reading literacy are essential for creative, self-regulated learning¹. On the other hand, institutional actions strongly support rationality in the

¹ Jiangping Chen, Chin Hsi Lin, and Gaowei Chen, "A Cross-Cultural Perspective on the Relationships among Social Media Use, Self-Regulated Learning and Adolescents' Digital Reading Literacy," *Computers and Education* 175 (December 1, 2021).

decision-making process of academic librarians when using electronic digital book products². Developing electronic digital books with attractive animations can support student learning³. Therefore, the development of digital books must be given to teachers so that they can design their best digital books for students and innovative learning.

Developing digital books as an output of the digital technology design program is perfect for developing more creative learning. Electronic digital books improve students' academic achievement⁴. Digital books can also be integrated with learning applications that support teaching and learning to improve student intelligence⁵. On the other hand, electronic digital books can be integrated into several other digital platforms. Electronic digital books connected to websites online can better support students' behavioral patterns in learning⁶. Using engaging and interactive electronic digital books can improve student learning achievement⁷.

The use of digital books as an output of digital technology has different impacts on society. The impact of the use of electronic digital books can be a major driver of increased interest in reading books and an obstacle for readers regarding the adoption of the book⁸. The impact of using electronic digital books is the activity of reading books that are free and available for a fee⁹. When individuals can access digital books for free, their knowledge can increase even wider. However, the adoption of electronic digital books is not entirely available for free. Electronic digital books available for a fee can reduce individuals' interest in reading. Previous research stated that teachers very much need the development of digital learning media to increase their understanding, with a percentage strongly agreeing 34.6% and agreeing at 65.4%¹⁰. Therefore, the competence of teachers in creating attractive designs for digital books needs to be improved so that digital books can be accessed openly by their students.

The competence of teachers to independently create digital technology designs in developing

² Mei Zhang, "Rational Actions or Institutional Actions: A Study on the Rationality in Academic Librarians' Decision-Making Processes When Purchasing e-Book Products," *Library and Information Science Research* 42, no. 2 (April 1, 2020).

³ Sherry Y. Chen et al., "An Investigation of the Development of an Animated E-Book: A Gender Difference Approach," *Computers in Human Behavior* 88 (November 1, 2018): 28–36.

⁴ Najeh Rajeh Alsalhi et al., "The Role of Academic Electronic Books in Undergraduate Students' Achievement in Higher Education," *Heliyon* 6, no. 11 (November 1, 2020).

⁵ Ahmed L. Alyousify and Ramadhan J. Mstafa, "AR-Assisted Children Book for Smart Teaching and Learning of Turkish Alphabets," *Virtual Reality and Intelligent Hardware* 4, no. 3 (June 1, 2022): 263–277.

⁶ Hafed Zarzour, Sabrina Bendjaballah, and Hadjer Harirche, "Exploring the Behavioral Patterns of Students Learning with a Facebook-Based e-Book Approach," *Computers and Education* 156 (October 1, 2020).

⁷ Yi Liu, Pi Ling Chou, and Bih O. Lee, "Effect of an Interactive E-Book on Nursing Students' Electrocardiogram-Related Learning Achievement: A Quasi-Experimental Design," *Nurse Education Today* 90 (July 1, 2020).

⁸ Dongnyok Shim, Jin Gyo Kim, and Jörn Altmann, "Identifying Key Drivers and Bottlenecks in the Adoption of E-Book Readers in Korea," *Telematics and Informatics* 33, no. 3 (August 1, 2016): 860–871.

⁹ Qihua Liu, Xiaoyu Zhang, and Yiran Li, "The Influence of Information Cascades on Online Reading Behaviors of Free and Paid E-Books," *Library and Information Science Research* 42, no. 1 (January 1, 2020).

¹⁰ Abdul Hadi, Elia Zakharia, and Dewanto Zulkarnain, "Interactive Learning Media Training Using The Classpoint Application to Improve The Pedagogical Competence of Madrasah Ibtidaiyah Muslimat Nahdlatul Ulama Teachers in Palangka Raya," *Transformasi: Jurnal Pengabdian Masyarakat* 20, no. 1 (2024): 28–38.

digital books with attractive and innovative images is important to improve. Illustrated digital books are a promising intervention because readers become interested and foster their activities in reading narratively¹¹. Books can describe geometric images that are good to understand¹². On the other hand, books can also be associated with contextual case studies to visualize material concepts in supporting students' conceptual understanding¹³. It shows that developing digital books as an output of digital technology is suitable for teachers when developing their learning process.

The digital technology design program is one of the community service activities carried out to empower the competence of high school teachers in designing innovative digital teaching materials, namely digital books. The application used to develop innovative digital books is the CANVA application, where teachers can create attractive digital books that follow their teaching materials. Books are a source of mathematics learning tools that support student activity and creativity¹⁴. Gaining knowledge about creativity in designing digital mathematics books with social network analysis is very good for creating more effective learning¹⁵. Therefore, this digital technology design program will be implemented to improve the understanding and empowerment of high school teachers in Jakarta in creating creative mathematics learning through the independent creation of digital books.

METHOD

The method in this digital technology design program is offline and online training for high school mathematics teachers in Jakarta. The digital technology design program is a community service activity that aims to empower the competence of high school teachers in developing digital technology designs in the form of digital books with the help of the CANVA application. The follow-up to the digital technology design program training is online guidance for 1 month through the Zoom application. The measurement of the success of the implementation of this digital technology design program is a satisfaction questionnaire. This satisfaction questionnaire consists of three indicators. The first indicator is the acquisition of new and original ideas for the development of creative teaching materials. The second indicator is the atmosphere of the fun digital technology design program activities. The third indicator is the positive benefits of the

¹¹ Lorenz Grolig et al., "Narrative Dialogic Reading with Wordless Picture Books: A Cluster-Randomized Intervention Study," *Early Childhood Research Quarterly* 51 (April 1, 2020): 191–203.

¹² Chrysanthi Skoumpourdi and Ifigenia Mpakopoulou, "The Prints: A Picture Book for Pre-Formal Geometry," *Early Childhood Education Journal* 39, no. 3 (2011): 197–206.

¹³ Erni Yulianti et al., "An Augmented Reality-Based Science Book for Junior High School Students: Case Study on Environmental Pollution and Global Warming Topics," in *AIP Conference Proceedings*, vol. 2569 (American Institute of Physics Inc., 2023).

¹⁴ M.A. Sobel and E.M. Maletsky, *Mengajar Matematika: Sebuah Buku Sumber Alat Peraga, Aktivitas, Dan Strategi [Teaching Mathematics: A Resource Book for Teaching Aids, Activities, and Strategies]*, ed. M. Darmono (Jakarta: Erlangga, 2004).

¹⁵ Christian Bokhove, Marios Xenos, and Manolis Mavrikis, "Using Social Network Analysis to Gain Insight into Social Creativity While Designing Digital Mathematics Books," *Social Sciences and Humanities Open* 8, no. 1 (January 1, 2023): 1–11.

development of competence from the development of creative digital books. Based on the three indicators in the satisfaction questionnaire, a 5-point Likert scale is used for this program. This satisfaction questionnaire is in the form of a g.form that will be distributed to participants in this digital technology design program.

This digital technology design program consists of five main stages, namely training preparation, digital technology training offline, Monitoring products online, evaluation, and follow-up. The training preparation stage consists of permits for teachers to implement digital technology design training. In addition, the determination of the service schedule and discussion of the technical aspects of the training location are carried out at this stage. The offline digital technology design training stage lasts for two days. Participants can independently create digital technology in the form of digital books during this training. The next stage is monitoring the digital technology design products online via the Zoom platform. The final stage is the evaluation and follow-up of the digital technology design training with an analysis of the results of the satisfaction questionnaire. The benefit of participant involvement is that the digital technology design products resulting from this program can improve their students and support the quality of learning. The analysis of the results of the satisfaction questionnaire aims to determine the success of the digital technology design program to empower the competence of high school teachers in developing creative digital technology designs. The detailed stages of the digital technology design program are shown in Figure 1.

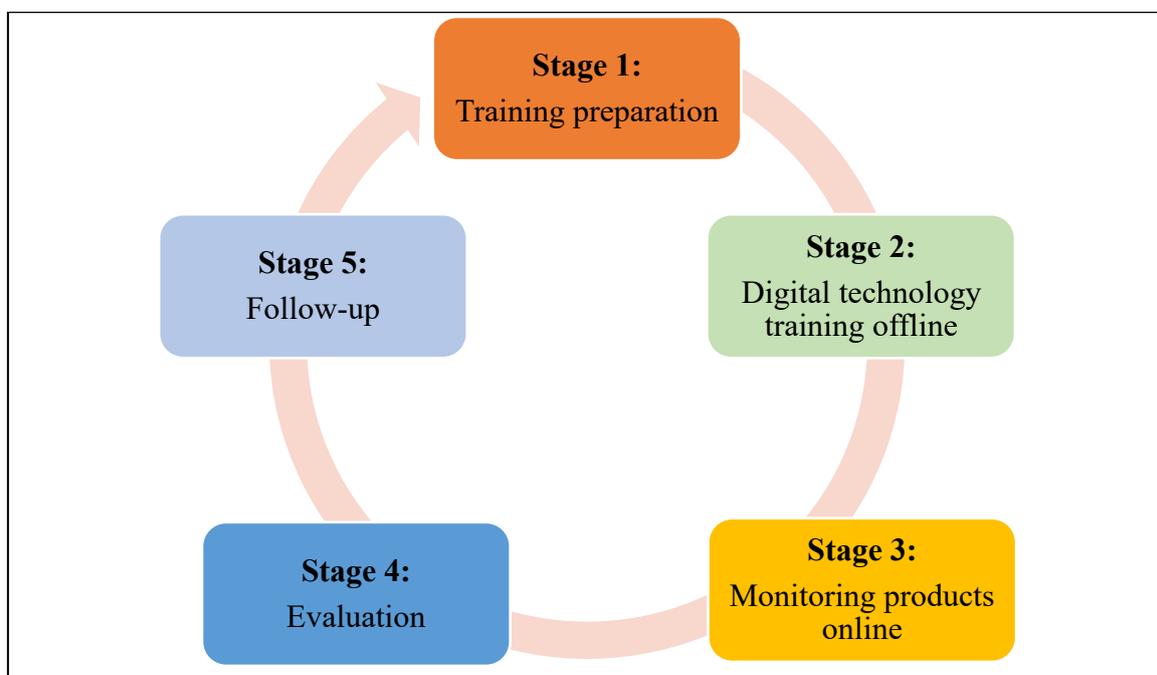


Figure 1. Stages of the Digital Technology Design Program

RESULTS AND DISCUSSION

The digital technology design program for mathematics learning is said to have succeeded in improving the competence of high school teachers. High school teachers in Jakarta can design digital books by utilizing the CANVA application. Digital books made by high school teachers are more imaginative and interesting for creative mathematics learning. This digital technology design program was attended by 23 participants from high school teachers in Jakarta, namely 13 female teachers and 10 male teachers. Female teachers dominate participants in this digital technology design program. Female teachers are more interested in developing digital technology in independent practice. Overall, these teachers have at least 5 years of teaching experience. The percentage of high school teacher participants in the digital technology design program is shown in Figure 2.

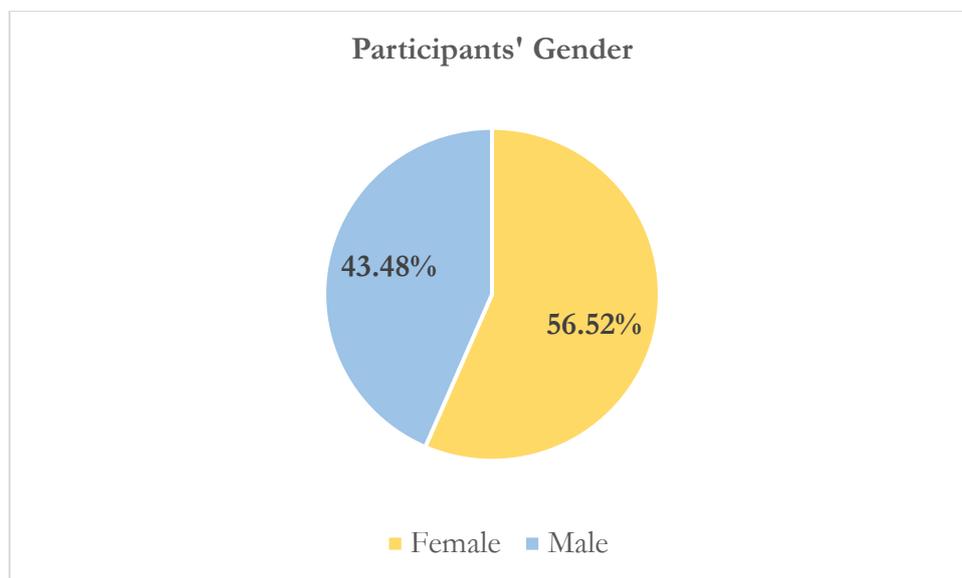


Figure 2. Gender of Participants Involved in the Digital Technology Design Program

Based on Figure 2, the results of the analysis show that the acquisition of new and original ideas for the development of creative mathematics teaching materials is dominated by the selection of scale (4) with the criteria "Agree", namely seventeen (17) votes indicating the choice of participants. Meanwhile, the second highest poll is the criterion "Strongly agree", with the collection of six votes from participants stating that they really got new and original ideas for the development of creative mathematics teaching materials. Overall, all participants showed the selection of scales (5) and (4) for the acquisition of new ideas in helping them make creative mathematics teaching materials. The practice of digital technology design programs for empowering teachers in Jakarta is shown in Figure 3.



Figure 3. Practice of Digital Technology Program Activities

Participants gained new and original ideas for creating digital books after this digital technology design program activity. Participants can use the acquisition of new and original ideas to develop creative mathematics teaching materials or learning instruments. Based on the results of the questionnaire, a percentage of 26.09% identified participants strongly agreeing that they gained new and original ideas to be used in developing creative mathematics teaching materials or learning instruments. Meanwhile, a percentage of 73.91% identified teachers agreeing that they gained new and original ideas for developing creative and interesting mathematics teaching materials. The percentage of participant questionnaire results related to the acquisition of new and original ideas to develop creative mathematics teaching materials or learning instruments is shown in Figure 4.

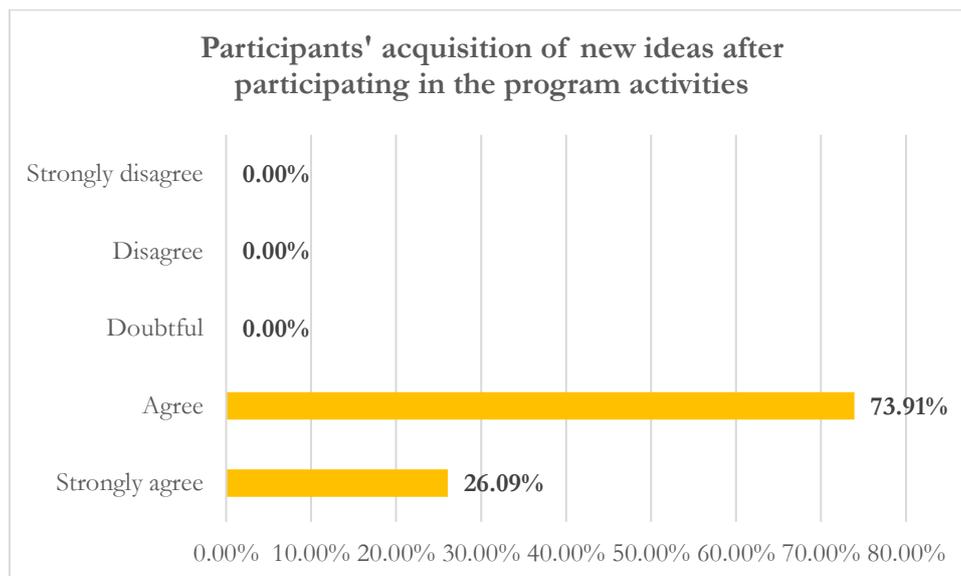


Figure 4. Percentage of Questionnaire Results related to the Acquisition of New and Original Ideas After Program Activities

The digital technology design program received a good response from high school teachers in Jakarta. The positive response results from participants showed that the presenters were able to create a pleasant atmosphere during the implementation of the digital technology design program. The percentage of 21.74% of identified participants strongly agreed that the presenters had created the atmosphere of the fun digital technology design program activities. Meanwhile, the percentage of 78.26% of identified participants agreed that the digital technology design program was designed with fun activities by the presenters. The atmosphere of the digital technology design program that is set to be fun can foster participants' interest in learning to create more interesting and innovative digital book designs. A comparison of the percentages for participant responses about the pleasant atmosphere during the digital technology design program practice is shown in Figure 5.

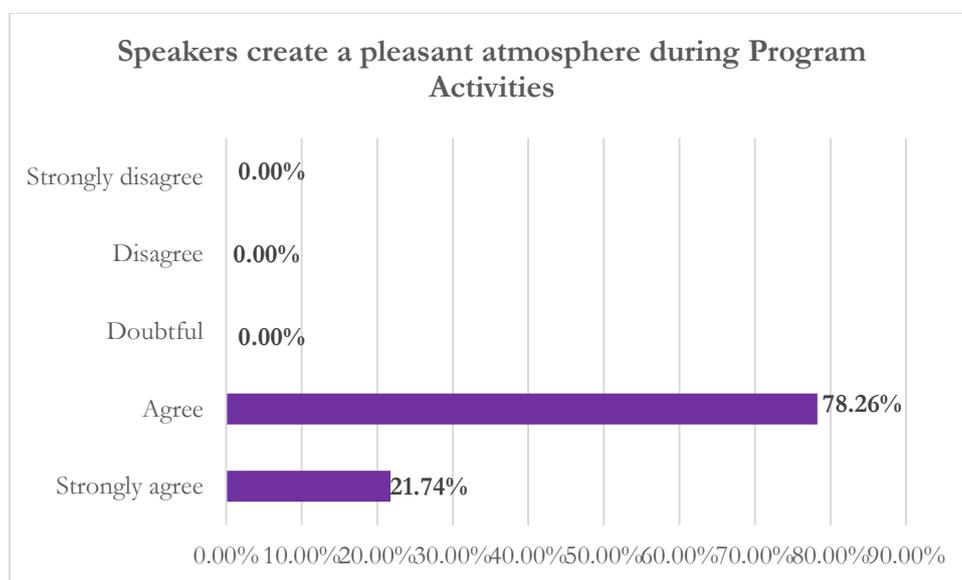


Figure 5. Percentage of Participant Responses Regarding the Pleasant Atmosphere During the Program Activities

The benefits of the digital technology design program practice were positively felt by mathematics teachers in Jakarta, where they could design digital books with quizzes, interesting illustrations, and a balanced layout for the development of creative mathematics teaching materials. The results of the participant responses identified that 30.43% of participants felt very good benefits during the digital technology design program practice. Meanwhile, 69.57% of participants felt good and positive benefits for the development of their competence in developing creative digital mathematics books after the activities of this digital technology design program practice. The percentage of participant responses related to the positive benefits of the digital technology design program practice is shown in Figure 6.

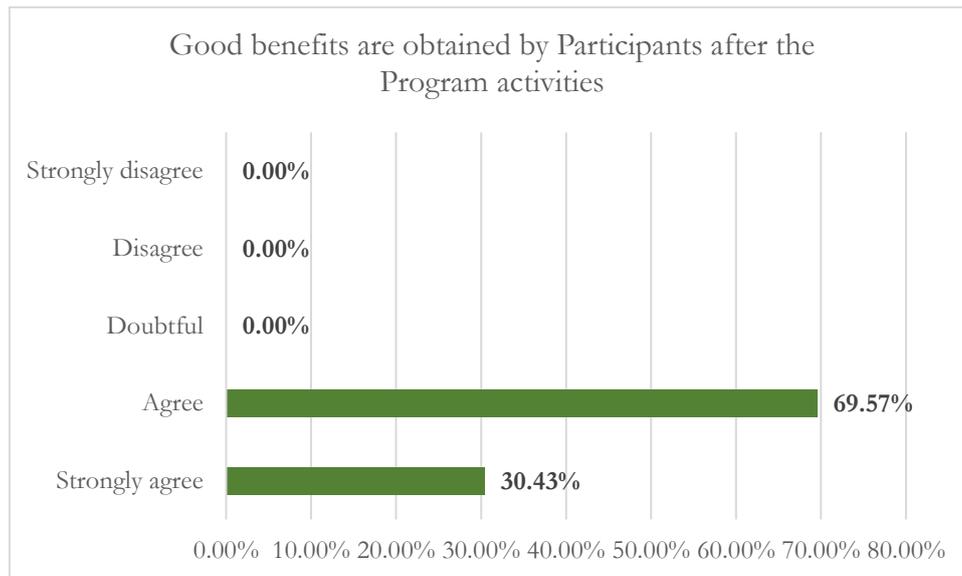


Figure 6. Percentage of Participant Responses Regarding Positive Benefits of Digital Technology Design Program Practice

Overall, the digital technology design program practice has been running well and smoothly. The results of the analysis of three participant response questionnaires showed that all participants agreed to obtain benefits and new ideas for the development of creative mathematics teaching materials. The development of creative mathematics teaching materials is intended for creative and critical mathematics learning for each participant in their education. The digital technology design program activities were carried out offline with direct practice through the CANVA program (as shown in Figure 7). After the digital technology design program practice, participants continued to receive online guidance for one month to monitor the results of their digital mathematics book development.



Figure 7. Direct Practice of Developing Digital Mathematics Books

Based on Figure 7, participants faced several challenges during the training. The results of verbal responses from participants show that teachers still have difficulty choosing an attractive and rigid layout when operating a laptop. However, intensive training and mentoring can overcome the challenges participants face during the training. Overall, the direct practice of developing digital mathematics textbooks has successfully improved teachers' competence and overcomes all challenges of digital technology among educators.

CONCLUSION

The empowerment of high school teachers' competencies through the digital technology design program for creative mathematics learning in Jakarta went well. The results of the implementation of the digital technology design program are shown from three participants' responses to the satisfaction questionnaire. The first response is related to the acquisition of new and original ideas to be used in the development of creative mathematics teaching materials or learning instruments, with a percentage of 26.09% for the "strongly agree" criteria and a percentage of 73.91% for the "agree" criteria. The second response is related to the atmosphere of the fun digital technology design program activities that have been created well by the presenters, with a percentage of 21.74% for the "strongly agree" criteria and a percentage of 78.26% for the "agree" criteria. The third response is related to the good and positive benefits for the development of their competencies in developing creative digital mathematics textbooks after this activity, with a percentage of 30.43% for the "strongly agree" criteria and a percentage of 69.57% for the "agree" criteria.

The long-term potential of implementing this program is that teachers can continue communicating with the program team to develop their competence in creating creative, engaging, and innovative digital technology designs. A practical recommendation for developing this program is implementing a creative digital mathematics textbook development program with a broader target for teachers outside Jakarta so that the quality of education in Indonesia is better and more innovative.

REFERENCES

- Alsalmi, Najeh Rajeh, Sami Al-Qatawneh, Mohd Eltahir, Fayiz Althunibat, and Khaled Aljarrah. "The Role of Academic Electronic Books in Undergraduate Students' Achievement in Higher Education." *Heliyon* 6, no. 11 (November 1, 2020).
- Alyousify, Ahmed L., and Ramadhan J. Mstafa. "AR-Assisted Children Book for Smart Teaching and Learning of Turkish Alphabets." *Virtual Reality and Intelligent Hardware* 4, no. 3 (June 1, 2022): 263–277.

- Bokhove, Christian, Marios Xenos, and Manolis Mavrikis. "Using Social Network Analysis to Gain Insight into Social Creativity While Designing Digital Mathematics Books." *Social Sciences and Humanities Open* 8, no. 1 (January 1, 2023): 1–11.
- Chen, Jiangping, Chin Hsi Lin, and Gaowei Chen. "A Cross-Cultural Perspective on the Relationships among Social Media Use, Self-Regulated Learning and Adolescents' Digital Reading Literacy." *Computers and Education* 175 (December 1, 2021).
- Chen, Sherry Y., Chih Hung Chang, Tzu Chi Yang, and Jen Hang Wang. "An Investigation of the Development of an Animated E-Book: A Gender Difference Approach." *Computers in Human Behavior* 88 (November 1, 2018): 28–36.
- Grolig, Lorenz, Caroline Cohrdes, Simon P. Tiffin-Richards, and Sascha Schroeder. "Narrative Dialogic Reading with Wordless Picture Books: A Cluster-Randomized Intervention Study." *Early Childhood Research Quarterly* 51 (April 1, 2020): 191–203.
- Hadi, Abdul, Elia Zakharia, and Dewanto Zulkarnain. "Interactive Learning Media Training Using The Classpoint Application to Improve The Pedagogical Competence of Madrasah Ibtidaiyah Muslimat Nahdlatul Ulama Teachers in Palangka Raya." *Transformasi: Jurnal Pengabdian Masyarakat* 20, no. 1 (2024): 28–38.
- Liu, Qihua, Xiaoyu Zhang, and Yiran Li. "The Influence of Information Cascades on Online Reading Behaviors of Free and Paid E-Books." *Library and Information Science Research* 42, no. 1 (January 1, 2020).
- Liu, Yi, Pi Ling Chou, and Bih O. Lee. "Effect of an Interactive E-Book on Nursing Students' Electrocardiogram-Related Learning Achievement: A Quasi-Experimental Design." *Nurse Education Today* 90 (July 1, 2020).
- Shim, Dongnyok, Jin Gyo Kim, and Jörn Altmann. "Identifying Key Drivers and Bottlenecks in the Adoption of E-Book Readers in Korea." *Telematics and Informatics* 33, no. 3 (August 1, 2016): 860–871.
- Skoumpourdi, Chrysanthi, and Ifigenia Mpakopoulou. "The Prints: A Picture Book for Pre-Formal Geometry." *Early Childhood Education Journal* 39, no. 3 (2011): 197–206.
- Sobel, M.A., and E.M Maletsky. *Mengajar Matematika: Sebuah Buku Sumber Alat Peraga, Aktivitas, Dan Strategi [Teaching Mathematics: A Resource Book for Teaching Aids, Activities, and Strategies]*. Edited by M. Darmono. Jakarta: Erlangga, 2004.
- Yulianti, Erni, Vita Ria Mustikasari, Nurhadi Muhlisin, Nor Farahwahidah Abdul Rahman, and Fatin Aliah Phang. "An Augmented Reality-Based Science Book for Junior High School Students: Case Study on Environmental Pollution and Global Warming Topics." In *AIP Conference Proceedings*. Vol. 2569. American Institute of Physics Inc., 2023.
- Zarzour, Hafed, Sabrina Bendjaballah, and Hadjer Harirche. "Exploring the Behavioral Patterns of Students Learning with a Facebook-Based e-Book Approach." *Computers and Education* 156 (October 1, 2020).
- Zhang, Mei. "Rational Actions or Institutional Actions: A Study on the Rationality in Academic Librarians' Decision-Making Processes When Purchasing e-Book Products." *Library and Information Science Research* 42, no. 2 (April 1, 2020).