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ADVANCING VOCATIONAL EDUCATION WITH VOCAR-FLIP: IMPROVING STUDENT COMPREHENSION IN THE DIGITAL ERA

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Abstract

In the 21st century, globalization and digital transformation have changed life patterns significantly. Digital technology is now at the center of almost all aspects of life, including the education sector in Indonesia. Technological skills and readiness to face the job market demands are critical. Vocational education, including vocational schools, aims to equip students for global market competition but continues to encounter obstacles in enhancing the quality and relevance of its programs. The proposed solution is the development of flipbook- based learning media with Augmented Reality (AR) to increase student engagement and skills in this digital era. This study employed a pre-experimental design with a one-group pretest-posttest approach, involving a population of 149 vocational school students from West Java. The research results show that using Flipbook with AR produces an N-gain score of 74.3%. With this N-gain value, the VocAR-Flip model effectively improves vocational school students' learning outcomes, especially in academic achievement and conceptual understanding. This research can contribute to developing more interactive and efficient learning technology for future education.

Keywords: *Augmented Reality, Digital Era, Flipbook, Vocational High School*

Introduction

The era of globalization marks the 21st century; there are significant changes in life patterns compared to the previous century. This condition is in line with the current era of digital transformation, where digital technology is at the center of almost all aspects of life (Faidlatul Habibah & Irwansyah, 2021; Özdemir et al., 2021; Plekhanov et al., 2023). Rapid adaptation and competitive skills in seeking job opportunities are significant in this digital transformation era (Trenerry et al., 2021). Information technology has become the main foundation of human life, including in the education sector in Indonesia (Amitkumar Dudhat & Ardi, 2023; Mirfani, 2019; Wahyu Widodo et al., 2021). Strong skills, especially those related to technology, are needed. In the world of work, prospective workers must have mature readiness (Fasbender et al., 2023; Irfansyah et al., 2023; D. H. Ismail et al., 2023). Therefore, individuals must thoroughly prepare themselves to face technological changes and ever-changing market demands (Popov, 2023; Rahmawati & Nurachadija, 2023). In addition, according to (A. A. Ismail & Hassan, 2019; Popov, 2023) educational institutions, primarily vocational education, must ensure that their graduates are ready to face these challenges by developing relevant skills to compete in the digital era.

Vocational education, as implemented in Vocational High Schools (SMK), is a particular type of education designed to prepare students toc enter the world of work (Fania et al., 2024; Kaenong et al., 2023; Rahayu et al., 2024; Wijaya et al., 2024; Ye et al., 2024). The primary goal of this education is to equip students with the skills required for success in the global market, including industries and the workforce, and to help them become professionals in their vocational areas (Diao & Hedberg, 2020). Vocational schools face the challenge of organizing students to develop skills that improve their quality of life, expand their abilities, and start businesses (Nduwimana & Sindayigaya, 2023). This challenge is to the goals of SMK, which include three career paths: Work, Continuing Education, and Entrepreneurship, often referred to as BMW (Pratama et al., 2022; Santika et al., 2023).

On the other hand, there is still an urgent need to strengthen the role of vocational schools in producing medium-skilled workers. Limited skills among vocational school graduates often result in low productivity (Choi et al., 2019), leading to high unemployment rates among those who have just entered the job market. Based on datafrom the Indonesian Central Statistics Agency (BPS), as of February 2023, the unemployment rate among vocational school graduates had reached 9.6%, the highest when compared to other educational levels. This indicates the necessity of enhancing the quality and relevance of vocational education to ensure that vocational school graduates are better equipped and more competitive in the workforce (Indrawati & Kuncoro, 2021; Kovalchuk et al., 2022).

Currently, industry and the world of work require competent workers who can compete to produce high-quality products. Therefore, industry and the world of work must be more careful in selecting prospective workers who suit the required skills. The demand for skilled and competent human resources is increasing now and in the future (Piwowar-Sulej, 2021). However, various factors, such as vocational school students' lack of interest in learning, cause concentration problems, which hurt the mastery of skills expected from graduates (Nupiah et al., 2022).

One factor that influences low interest and learning achievement among vocational school graduates is less than ideal and interactive learning media (Rachmadtullah et al., 2019; Sabitri, Rahayu, et al., 2024). Several methods, such as PowerPoint presentations and modules, often need to support an optimal learning process more effectively (Sabitri, Meirawan, et al., 2024). Therefore, the author proposes that this research's solution is the development of virtual-based learning media, namely flipbooks equipped with Augmented Reality (AR), called VocAR-Flip (Vocational Augmented Reality with Flipbook). This innovation is designed to meet student needs and face the challenges and demands that arise in the era of digital transformation. By utilizing the latest technology, this solution aims to increase student engagement and skills amidst the rapid changes occurring in the world of education (Chiu, 2023; Okoye et al., 2021).

Flipbooks, as simple interactive media, can improve student learning motivation (Bunari et al., 2024; P. Oronce & O. Manalo, 2021). Conversely, Augmented Reality (AR) is a technology that enables virtual objects to be projected into a real-world environment (Ahmad et al., 2022; Fitria, 2023). Flipbooks and augmented reality (AR) are combined in this media to give teachers and students an interesting and interactive learning environment. The flipbook is the primary tool used to provide educational content in both digital and physical forms in an eye-catching visual style (Setiyani & Purwati, 2025). Only specific areas of the flipbook that are thought to need more explanations or illustrations have AR trigger elements (markers) attached to them. Additional material, such as 3D animations, films, interactive simulations, or illustrative audio, will show up on the screen of the device when users scan the marker with smartphones or tablets (Yelianti et al., 2020). This combination helps teachers present material more effectively without taking away from the learning experience and enables students to comprehend difficult concepts through an immersive visual experience (Yosintha et al., 2024). This research focuses on applying flipbooks with AR as a learning tool in vocational schools, especially in vocational schools, considering that vocational school students need essential practical skills in the digital transformation era (Saari et al., 2021). This research aims to determine the effectiveness of Flipbook learning media with AR in vocational schools. The benefit of this research is that it presents alternative interactive learning media in flipbooks combined with AR, which can be applied to the learning process in vocational schools.

During the learning process, SMK has various fields of study included in the basic framework and curriculum structure. One of the subjects that covers the topic of Environmental Occupational Safety and Health (K3LH) is Dasprog. K3LH is the responsibility of everyone who works, including students in practice (Perdana, 2021; Wijanarka et al., 2019). Teachers provide K3LH material to understand and protect students while working, both at school and at work, and prevent them from accidents. Therefore, K3LH is vital in vocational schools, especially when students interact with dangerous materials, equipment, and work environments (Sanusi et al., 2023). Vocational school students must study K3LH material because understanding it helps them understand the importance of maintaining security, health, and safety in the workplace and preserving the environment (Bilgiç & Aytaç, 2024; Putri et al., 2024; Rizbudiani & Jaedun, 2021). This knowledge is essential for vocational school students before they start working.

Research Methods

This research utilized a pre-experimental approach with One-Group Pretest-Posttest design as shown in Figure 1, conducted at several vocational schools in West Java. The target participants were 10th-grade students studying elements of Occupational Safety, Health, and Environmental (K3LH) standards. Data collection utilized a test designed to measure student learning outcomes, specifically focusing on environmental, safety, and health topics. The effectiveness of the Flipbook learning media with Augmented Reality (AR) was evaluated using an N-Gain analysis technique, comparing pretest and posttest results. The N-Gain score reflects the effectiveness of the learning media by assessing the improvement in learning outcomes before and after treatment.

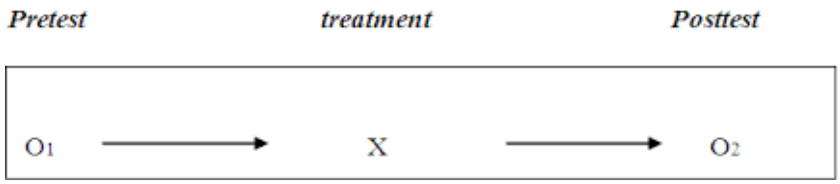

Figure 1. Pre-Experiment One Group Pretest Posttest Design

Research Results and Discussion

This research involved 149 students from several vocational schools in West Java. The research subjects were students at level X who were studying the essential elements of the curriculum, including material regarding Environmental Occupational Safety and Health (K3LH). The participants were selected based on their relevance to the study program, and the focus of this research was to evaluate the understanding and application of K3LH material in the context of the skills they were studying.

The indicators used in the study to measure the extent to which users understand K3LH (Occupational Safety, Health, and Environment) material are outlined in Table 1.

Table 1.

Topic	Assessment Indicator
Workplace Safety Definition	Understanding the definition and objectives of workplace safety
Workplace Safety Requirements	Identifying the basic safety requirements; Explaining the relationship between requirements and accident prevention
Workplace Accidents	Understanding the definition of workplace accidents; Explaining the types of workplace accidents
Factors of Workplace Accidents	Identifying factors contributing to workplace accidents
Types of Workplace Accidents	Analyzing workplace accidents based on their types
Fire and Fire Safety	Explaining the relationship between fire, fire safety, and workplace safety; Identifying fire prevention actions in the workplace
OHS Symbols	Identifying various OHS symbols; Explaining the meaning of the symbols in the context of safety
Personal Protective Equipment (PPE) Criteria	Listing the criteria for personal protective equipment and its types

Respondents came from vocational schools in West Java from the TKP and DPIB expertise programs, with details of 41.6% from SMKN 1 Cibinong, 19.5% from SMKN 1 Sukabumi, and the rest from SMKN 5 Bandung. Respondents were chosen based on predetermined criteria aligned with the objectives of the study, so the results obtained could provide in-depth insight into the level of knowledge between students from the various schools.

Table 2 indicates that the significance value of the normality test is 0.000. This suggests that the data fails to meet the normality test criteria, as the significance value is below 0.05, leading to the conclusion that the data is not normally distributed. Therefore, nonparametric tests will be used in this study for a more accurate analysis, given the data's non-normal distribution (Annisak et al., 2024).

Table 2. Normality Test Results

Test		Statistic	df	**Sig.**	Statistic	df	Sig.
Nilai	**Pre Test**	.125	149	**.000**	.949	149	.000
	Post Test	.248	149	**.000**	.767	149	.000

Table 2 shows that the significance value of the normality test is 0.000. The analysis shows that the data fails to meet the normality test criteria, as the significance value is below 0.05, indicating that the data is not normally distributed. Therefore, non-parametric tests will be applied in this study to ensure a more precise analysis (le Cessie et al., 2020).

Table 3. Homogeneity Test Results

Levene Statistic	**df1**	**df2**	**Sig.**
77.337	1	296	**.000**

In Table 3, the homogeneity test results show a Sig value of 0.000. This value indicates that the data fails to meet the homogeneity criteria, as the Sig value is less than 0.05.. Thus, the values obtained are outside the accepted limits for data homogeneity, indicating that the student data are not homogeneous.

The Wilcoxon signed-rank test is a non-parametric method employed to assess differences in unpaired data measured on an ordinal or interval scale. Still, the data is not normally distributed or homogeneous (Navarro et al., 2020). This test is also known as the match pair test.

Table 4. Wilcoxon Signed Ranks Test

		N	**Mean Rank**	**Sum of Ranks**
Posttest - Pretest	**Negative Ranks**	0[a]	0.00	0.00
	Positive Ranks	144[b]	72.50	10440.00
	Ties	5[c]		
	Total	149		

Based on the data presented in Table 4, the analysis shows that 144 students experienced an increase in posttest scores compared to pretest scores, indicating improved learning outcomes after implementing the Flipbook learning media with AR. In contrast, only five students had the same score on the pretest and posttest, meaning there was no significant change in their learning results after treatment. These findings indicate that most students benefited from the intervention implemented, while few experienced no change in their understanding or skills (Bailey, 2020). This data provides a general picture of the treatment's effectiveness in enhancing student learning outcomes, as well as showing variation in the intervention's impact across student groups (Huang et al., 2020).

Table 5. Wilcoxon Test

Z	-10.419[b]
Asymp. Sig. (2-tailed)	0.000

The Wilcoxon test results in Table 5 indicate a Z value of -10.419, with an Asymp significance value (2-tailed) of 0.000, which is less than the alpha level of 0.05, leading to the rejection of H0. This shows a significant change in the research results. In other words, the observed differences in the data are unlikely to be due to chance alone, and the presence of a treatment effect can be considered accurate and significantly influencing the results.

Following the hypothesis test with the Wilcoxon test, the n gain was assessed to evaluate the effectiveness of the learning media. According on the data in Table 10, the N-gain score is 0.74,

which means that this learning media has high effectiveness, while the N- gain percent has a value of 74.3%, which means it is effective. Using pre-tests and post-tests shows that student scores have increased after the learning process, with post-test scores being higher than pre-test scores (Arianti, 2024).

	N	Minimum	Maximum	Mean	Std. Deviation
NGain_Score	149	0.00	1.00	0.7430	0.28524
NGain_Percent	149	0.00	100.00	74.3029	28.52391

Therefore, the effective implementation of the VocAR-Flip model leads to an improvement in student learning outcomes during the learning process, as evidenced by the analysis, which shows significant improvements in students' academic achievement and conceptual understanding. The details of the learning outcome scores before implementation and after implementation are visualized in Figure 2.

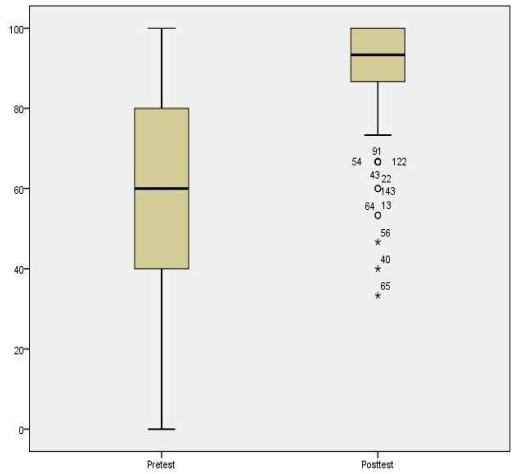

Figure 2. Box Plot of Pretest and Posttest Value Data

Based on Figure 2, a notable difference exists in the score distribution between the two tests. In the pretest, the lowest score was 0, indicating that some participants needed to reach the minimum competency standard being measured. The scores on the pretest also reflected considerable variation, with the first quartile (Q1) being at 40, indicating that 25% of participants The participants were only able to reach that score or a lower one. The median, representing the central tendency, was 60, meaning that half of the participants scored below 60, and the other half scored above it (Q3) is at 80, indicating that 75% of participants obtained a score of 80 or lower, and only 25% achieved a score above it. The highest score, or fourth quartile (Q4), was recorded at 100, the maximum achievement in this pretest.

In contrast, post-test results showed significant improvements in participants' performance. The minimum score increases drastically to 75, indicating an overall improvement in ability. The first quartile (Q1) was at 85, indicating significant improvement among participants at the bottom of the score distribution. The median increased to 90, indicating that half of the participants achieved or exceeded this figure, while the third quartile (Q3) was also at 90, indicating increasing consistency of performance among participants. The maximum score remains at 100, reflecting that although there has been a general improvement in the distribution of scores, the highest level of achievement remains unchanged, indicating that the maximum standard has been achieved and maintained by some participants. This analysis indicates a substantial score increase after the intervention or learning provided using VocAR-Flip.

Flipbooks allow lesson material to be presented in an interactive and visual format, which can help students understand complex concepts through pictures and animations (Roemintoyo & Budiarto, 2021). Students can interact with content in Flipbook, such as opening pages independently, thus providing a more personal and dynamic learning experience (Eliyasni et al.,

2021). With an attractive and interactive design, Flipbook can increase student engagement, which positively impacts information retention (Firdaus et al., 2023). Augmented Reality allows students to experience learning concepts in three-dimensional form that they can see and explore from various angles, providing a more profound understanding (Cao et al., 2023; Zulfiqar et al., 2023). Augmented Reality in learning creates unique and exciting experiences, which can increase students' motivation to learn (Khan et al., 2019; Prasetya et al., 2024). Augmented Reality can help explain abstract or complex concepts, such as human anatomy or natural phenomena, in a way that is easier to understand through direct visualization (Radu et al., 2023). Especially in K3LH learning, the use of augmented Reality can provide a direct picture of problem-solving that occurs in the field; augmented Reality allows students to learn in a realistic context, for example, seeing how a chemical reaction occurs in a virtual laboratory environment, which makes learning more relevant and accessible to remember (Garzón, 2021). Integrating Flipbook and Augmented Reality into the learning process can significantly improve student learning outcomes by providing a richer, more interactive, and practical learning experience (Abdilah & Wulandari, 2024).

Conclusion

Flipbook with Augmented Reality or VocAR-Flip has proven effective in improving vocational school student learning outcomes. The application of flipbook-based learning media with Augmented Reality has succeeded in creating a more interactive and exciting learning experience. The results showed that students who learned using VocAR-Flip significantly improved their conceptual understanding and academic achievement. The N-gain score indicates that using VocAR- Flip is included in the high category in improving learning outcomes. This media helps students understand complex subject matter more easily through visualization and direct interaction. Thus, VocAR-Flip can be an innovative solution for facing learning challenges in the digital era. In addition, the implementation of this media can be adapted by other educational institutions to improve the overall quality of education, strengthen students' readiness to enter the world of work, and encourage the development of critical and creative skills needed in a modern society increasingly dependent on advanced technology.

References

Ahmad, I., Sharma, S., Singh, R., Gehlot, A., Priyadarshi, N., & Twala, B. (2022). MOOC 5.0: A Roadmap to the Future of Learning. *Sustainability (Switzerland)*, *14*(18).

Amitkumar Dudhat, & Ardi. (2023). Application of Information Technology to Education in the Age of the Fourth Industrial Revolution. *International Transactions on Education Technology (ITEE)*, *1*(2), 131–137.

Arianti, S. F. (2024). *The effectiveness of pre-tests and post-tests for teaching industrial ecology in an engineering management program*. *14*(6), 590–597.

Bansah, A. K., & Darko Agyei, D. (2022). Perceived convenience, usefulness, effectiveness and user acceptance of information technology: evaluating students' experiences of a Learning Management System. *Technology, Pedagogy and Education*, *31*(4), 431–449.

Bilgiç, S., & Aytaç, T. (2024). Evaluation of School Occupational Health and Safety Practices Performance Indicators by School Administrators. In *Türk Akademik Yayınlar Dergisi* (Vol. 8, Issue 2).

Bunari, B., Setiawan, J., Ma'arif, M. A., Purnamasari, R., Hadisaputra, H., & Sudirman, S. (2024). The influence of flipbook learning media, learning interest, and learning motivation on learning outcomes. *Journal of Education and Learning*, *18*(2), 313–321.

Cao, H., Zhao, C., Zhu, J., & Mi, S. (2023). Overview of Artificial Intelligence Educational

Technology. *Proceedings - 2023 5th International Conference on Electronics and Communication Technologies, ECT 2023*, 124 – 129.

Chiu, T. K. F. (2023). Student engagement in K-12 online learning amid COVID-19: A qualitative approach from a self-determination theory perspective. *Interactive Learning Environments*, *31*(6), 3326–3339.

Choi, S. J., Jeong, J. C., & Kim, S. N. (2019). Impact of vocational education and training on adult skills and employment: An applied multilevel analysis. *International Journal of Educational Development*, *66*(March), 129–138.

Diao, M., & Hedberg, J. G. (2020). Mobile and emerging learning technologies: are we ready? *Educational Media International*, *57*(3), 233–252.

Eliyasni, R., Habibi, M., Rahmatina, & Azima, N. F. (2021). E-Module Flipbook Model for Designing E-Learning Materials in Higher Education. *Proceedings of the 2nd Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2020)*, *563*(Psshers 2020), 17–23.

Faidlatul Habibah, A., & Irwansyah, I. (2021). Era Masyarakat Informasi sebagai Dampak Media Baru. *Jurnal Teknologi Dan Sistem Informasi Bisnis*, *3*(2), 350–363.

Fania, M., Iriani, T., & Arthur, R. (2024). Improving Vocational Student Competencies Through Industrial Class-Based Experiantial Learning. *Jurnal PenSil*, *13*(1), 120–129.

Fasbender, U., Gerpott, F. H., & Rinker, L. (2023). Getting Ready for the Future, Is It Worth It? A Dual Pathway Model of Age and Technology Acceptance at Work. *Work, Aging and Retirement*, *9*(4), 358–375.

Firdaus, F. M., Fadhli, R., & Abidin, Z. (2023). Promoting Collaborative Learning in Elementary Mathematics through the Use of Gamification Flipbooks: A Mixed-Methods Study. *International Journal of Instruction*, *16*(4), 987–1008.

Fitria, T. N. (2023). Augmented Reality (AR) and Virtual Reality (VR) technology in education: Media of teaching and learning: A review. *International Journal of Computer and Information System (IJCIS) Peer Reviewed-International Journal*, *4*(1), 14–25. https://ijcis.net/index.php/ijcis/indexJournalIJCIShomepage-https://ijcis.net/index.php/ijcis/index

Garzón, J. (2021). An overview of twenty-five years of augmented reality in education. *Multimodal Technologies and Interaction*, *5*(7).

Huang, T., Wu, H., Yang, S., Su, B., Tang, K., Quan, Z., Zhong, W., & Luo, X. (2020). Global Trends of Researches on Sacral Fracture Surgery: A Bibliometric Study Based on VOSviewer. *Spine*, *45*(12), E721–E728.

Indrawati, S. M., & Kuncoro, A. (2021). Improving Competitiveness Through Vocational and Higher Education: Indonesia's Vision For Human Capital Development In 2019–2024. *Bulletin of Indonesian Economic Studies*, *57*(1), 29–59.

Irfansyah, A., Suparji, Suprianto, B., Kuntadi, C., & Sudarmaji, H. (2023). Factors That Affect the Quality Of Vocational Education Graduates in the 4.0 Era: Job Readiness, Skills and Digital Services. *Dinasti International Journal of Education Management And Social Science*, *4*(4), 485–496.

Ismail, A. A., & Hassan, R. (2019). Technical competencies in digital technology towards industrial revolution 4.0. *Journal of Technical Education and Training*, *11*(3), 55–62.

Ismail, D. H., Nugroho, J., & Rohayati, T. (2023). Literature Review: Soft Skill Needed by Gen Z in the Era RI 4.0 and Society 5.0. *Majalah Ilmiah Bijak*, *20*(1), 119–131.

Kaenong, H. A., Alexandri, M. B., & Sugandi, Y. S. (2023). Analysis Projection of the Fulfillment of Priority Facilities and Infrastructures for Vocational High School/Sekolah Menengah Kejuruan (SMK) Using System Dynamic to Increase School Participation Rates in Central Kalimantan Province, Indonesia. *Sustainability (Switzerland)*, *15*(24).

Khan, T., Johnston, K., & Ophoff, J. (2019). The Impact of an Augmented Reality Application on Learning Motivation of Students. *Advances in Human-Computer Interaction*, *2019*.

Kovalchuk, V., Maslich, S., Tkachenko, N., Shevchuk, S., & Shchypska, T. (2022). Vocational Education in the Context of Modern Problems and Challenges. *Journal of Curriculum and Teaching*, *11*(8), 329–338.

le Cessie, S., Goeman, J. J., & Dekkers, O. M. (2020). Who is afraid of non-normal data? Choosing between parametric and non-parametric tests. *European Journal of Endocrinology*, *182*(2), 0–3.

Mirfani, A. M. (2019). The Challenges of Implementing ICT in the Indonesia National Education System of the Industrial Revolution Era 4.0. *Journal of Physics: Conference Series*, *1387*(1), 0–7.

Navarro, A., Young, M., Allan, B., Carnell, P., Macreadie, P., & Ierodiaconou, D. (2020). The application of Unmanned Aerial Vehicles (UAVs) to estimate above-ground biomass of mangrove ecosystems. *Remote Sensing of Environment*, *242*(March), 111747.

Nduwimana, S., & Sindayigaya, I. (2023). Establishing Quality in Technical and Vocational Education in Burundi: Contribution of the National Education Forum, Edition 2022 and in Employability in Burundi. *Open Journal of Social Sciences*, *11*(09), 142–153.

Nupiah, A., McCulley, W., & He, T. (2022). The Implication of Students' Psychological Aspects on Learning Difficulties Experienced by Students in Learning in School. *Al-Hijr: Journal of Adulearn World*, *1*(3), 108–117.

Okoye, K., Rodriguez-Tort, J. A., Escamilla, J., & Hosseini, S. (2021). Technology-mediated teaching and learning process: A conceptual study of educators' response amidst the Covid-19 pandemic. In *Education and Information Technologies* (Vol. 26, Issue 6).

Özdemir, V., Springer, S., Ylldlrlm, A., Biçer, S., Kendirci, A., Sardaş, S., Klllç, H., Hekim, N., Kunej, T., Arga, K. Y., Dzobo, K., Wang, W., Geanta, M., Brand, A., & Bayram, M. (2021). Thanatechnology and the Living Dead: New Concepts in Digital Transformation and Human-Computer Interaction. *OMICS A Journal of Integrative Biology*, *25*(7), 401–407.

P. Oronce, J., & O. Manalo, D. A. (2021). Development and Validation of Flipbook in Earth and Life Science. *International Multidisciplinary Research Journal*, *3*(1), 111–117.

Perdana, R. M. (2021). Analysis of Theory of Planned Behavior (TPB) in Disobedience Behavior towards Occupational Health and Safety (K3). *Journal of Economics, Business, and Government Challenges*, *4*(02), 140–148.

Piwowar-Sulej, K. (2021). Human resources development as an element of sustainable HRM – with the focus on production engineers. *Journal of Cleaner Production*, *278*, 124008.

Plekhanov, D., Franke, H., & Netland, T. H. (2023). Digital transformation: A review and research agenda. *European Management Journal*, *41*(6), 821–844.

Popov, A. (2023). The future of work: Adapting to technological disruptions in the labor market. *Journal of Philosophical Criticism*, *0*(02), 199–217.

Prasetya, F., Fortuna, A., Samala, A. D., Rawas, S., Mystakidis, S., Syahril, Waskito, Primawati, Wulansari, R. E., & Kassymova, G. K. (2024). The impact of augmented reality learning experiences based on the motivational design model: A meta-analysis. *Social Sciences & Humanities Open*, *10*, 100926.

Pratama, R. A., Saputra, M. A., Pratiwi, I. M., & Lestari, N. I. (2022). Student Teachers's Readiness to Face Society 5.0 Challenges: Are They Ready to Teach with Competencies Needed? *Proceedings of the Universitas Lampung International Conference on Social Sciences (ULICoSS 2021)*, *628*(ULICoSS 2021), 470–476.

Putri, Y. E., Akmal, N., Elfita, A., & Anugerah, A. I. (2024). *Development of E-Modules in Sanitation Hygiene and K3 Courses in the Culinary Study Program*. *Ictvet 2023*, 22–29.

Rachmadtullah, R., Zulela, M. S., & Syarif Sumantri, M. (2019). Computer-based interactive multimedia: A study on the effectiveness of integrative thematic learning in elementary schools. *Journal of Physics: Conference Series*, *1175*(1).

Radu, I., Huang, X., Kestin, G., & Schneider, B. (2023). How augmented reality influences student learning and inquiry styles: A study of 1-1 physics remote AR tutoring. *Computers & Education: X Reality*, *2*, 100011.

Rahayu, S., Meirawan, D., Muktiarni, M., Ghinaya, Z., & Sabitri, Z. (2024). Analyzing Transferable Skills of Vocational Students To Align With Industry Demands. *Jurnal PenSil*, *13*(1), 34–46.

Rahmawati, S., & Nurachadija, K. (2023). Inovasi Pendidikan Dalam Meningkatkan Strategi Mutu Pendidikan. *BERSATU: Jurnal Pendidikan Bhinneka Tunggal Ika*, *1*(5), 1–12. https://doi.org/10.51903/bersatu.v1i5.303

Rizbudiani, A. D., & Jaedun, A. (2021). Occupational Health and Safety Management System (SMK3) at the workshop of vocational high schools. *Jurnal Pendidikan Vokasi*, *11*(2), 326–336.

Roemintoyo, R., & Budiarto, M. K. (2021). Flipbook as Innovation of Digital Learning Media: Preparing Education for Facing and Facilitating 21st Century Learning. *Journal of Education Technology*, *5*(1), 8.

Saari, A., Rasul, M. S., Yasin, R. M., Rauf, R. A. A., Ashari, Z. H. M., & Pranita, D. (2021). Skills sets for workforce in the 4th industrial revolution: Expectation from authorities and industrial players. *Journal of Technical Education and Training*, *13*(2), 1–9.

Sabitri, Z., Meirawan, D., & Rahayu, S. (2024). *Enhancing Vocational Students ' Critical Thinking Skills in Society 5 . 0 with Flipbook and Augmented Reality Learning Media*. *24*(1), 31–42.

Sabitri, Z., Rahayu, S., & Meirawan, D. (2024). The implementation of augmented reality-based flipbook learning media in improving vocational school students' critical thinking skills in the era of society 5.0. *Jurnal Pendidikan Teknologi Kejuruan*, *7*(1), 22–31.

Santika, A., Simanjuntak, E. R., Amalia, R., & Kurniasari, S. R. (2023). Peran pendidikan sekolah menengah kejuruan dalam memposisikan lulusan siswanya mencari pekerjaan 1.2.3.4. *Jurnal Kajian, Penelitian Dan Pengembangan Kependidikan*, *14*(1), 84–94.

Sanusi, F. M., Rompas, P. T. D., & Oroh, R. R. (2023). Implementation of the Occupational Safety and Health Management System in the Automotive Light Vehicle Engineering Workshop of Cokroaminoto Vocational School, Kotamobagu. *International Journal of Information Technology and Education*, *2*(4), 122–141.

Setiyani, N., & Purwati, P. D. (2025). *DEVELOPING KEMUKUS MOUNTAIN FLIPBOOK INTEGRATED WITH Ta RL APPROACH IN IMPROVING STUDENTS ' COMPREHENSION OF DESCRIPTIVE TEXTS*. *13*(1), 281–293.

Sumi, R. S., & Kabir, G. (2021). Satisfaction of e-learners with electronic learning service quality using the servqual model. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(4), 227.

Trenerry, B., Chng, S., Wang, Y., Suhaila, Z. S., Lim, S. S., Lu, H. Y., & Oh, P. H. (2021). Preparing

Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors. *Frontiers in Psychology*, *12*(March), 1–24.

Wahyu Widodo, A., Solikhatun, I., Raharja, S., Abdun Salam, A., & Sri Wartini, F. (2021). A Utilization of Information Technology on Education in Indonesia (2017-2020): A Systematic Literature Review. *Journal of Physics: Conference Series*, *1779*(1).

Wijanarka, B. S., Sukardi, T., Rahdiyanta, D., & Ngadiyono, Y. (2019). Evaluation of implementation of health and safety in industry and vocational school in Yogyakarta Special Region. *Journal of Physics: Conference Series*, *1273*(1), 0–7.

Wijaya, R., Sudaji, E., & Febrianto, I. (2024). *Game-Based Learning for Entrepreneurship in Vocational Education to Face 4 . 0 Industry Revolution*. *1*, 1–9.

Ye, J. H., He, Z., Bai, B., & Wu, Y. F. (2024). Sustainability of Technical and Vocational Education and Training (TVET) along with Vocational Psychology. *Behavioral Sciences*, *14*(10).

Yelianti, U., Anggereini, E., & Irfan, M. K. (2020). Developing Electronic Learning Media Using 3d Pageflip on the Material of Classification of Living Thingsfor the 7th Grade Students of Junior High School. *Journal of Physics: Conference Series*, *1464*(1).

Yosintha, R., Rekha, A., Nugrahaeni, D. A., & Maulani, F. (2024). Developing A Flipbook for Introduction to English Grammar Course with Project-Based Learning Approach. *Langkawi: Journal of The Association for Arabic and English*, *10*(1), 66.

Zulfiqar, F., Raza, R., Khan, M. O., Arif, M., Alvi, A., & Alam, T. (2023). Augmented Reality and its Applications in Education: A Systematic Survey. *IEEE Access*, *11*(December), 143250–143271.