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Virtual Collaborative Learning to Develop Elementary Students' Skills in The Digital Era

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Abstract: This study aims to analyze the effectiveness of virtual collaborative learning in developing elementary students' skills in the digital era. Using a qualitative research method with a case study approach, the research was conducted on 28 fifth-grade students in Surakarta. Data were collected through virtual observation, interviews, and documentation over one semester. The results indicate that virtual collaborative learning enhances students' digital, communication, creativity, and collaboration skills. Virtual learning platforms integrated with collaborative activities proved effective in building active student engagement and developing 21st-century skills.

Keywords: collaborative learning, virtual learning, digital skills, elementary school, digital era.

Introduction

The digital era has fundamentally transformed the education system, especially at the elementary school level, shifting students' learning patterns and demanding a paradigm change in education ((Torres Chávez & García Martínez, 2019). A longitudinal study by (Olmanson et al., 2021) shows that digital technology impacts elementary school students' learning activities,



reflecting a significant shift from conventional learning methods. Teacher-centered learning approaches are becoming less relevant in preparing students to face future challenges. A study by Xu et al. (2020), revealed that 65% of the skills essential for the future are not taught in elementary schools. On the other hand, Chamidah et al. (2024) and Chandra Wijaya (2024) identify a gap between traditional learning approaches and the digital skills needed by students. Studies by Ng et al. (2023) also emphasize that digital skills development should start at the elementary education level to equip students for the Society 5.0 era.

In the rapidly evolving Society 5.0 era, education must leverage digital technology to enhance critical thinking and creativity skills for the digital generation. As stated by Lasmana et al. (2024) virtual collaborative learning that utilizes digital technology is not only effective in improving students' critical thinking skills but also enriches their creativity. This technology provides an interactive and contextual learning environment, highly relevant to the demands and needs of today's digital age (García-Martínez et al. (2019). By integrating virtual collaborative learning, students can collaborate in broader and more dynamic contexts, allowing them to develop critical thinking skills while enhancing their creativity in solving problems and challenges faced in the digital world ((Lim, 2023)). However, the implementation of virtual collaborative learning in elementary schools still faces various challenges, including limitations in technological infrastructure, digital skills of both teachers and students, and a lack of student interaction in class management ((Chien & Hwang, 2022; Lim, 2023; Parr & Hawe, 2022).

Shankar et al. (2022) propose a conceptual data model for multimodal learning analysis, enabling the collection and interpretation of data from various sources to support more effective learning. Imran & Almusharraf (2024) review the needs and application of quality 4.0 learning necessary to face future educational challenges, emphasizing the importance of using digital technology to create more relevant and quality education. On the other hand, Irhamni & Ashari (2023) systematically review the literature showing that the integration of digital platforms can accelerate the development of more adaptive and innovative education. These three studies provide valuable insights into the role of technology in supporting educational development in the digital era, whether through learning data analysis, the application of 4.0 quality, or innovations in using digital platforms in elementary schools.

Research Aim and Research Questions

The aim of this study is to analyze the effectiveness of virtual collaborative learning in developing digital skills, communication, creativity, and collaboration among elementary school students in the digital era. This study aims to evaluate the impact of using virtual learning platforms in enhancing students' active engagement, as well as to provide insights into the achievement of 21st-century skills within the context of elementary education.

Based on the stated aim, the research questions in this study are as follows:

1. What is the impact of virtual collaborative learning on the development of digital skills among elementary school students?



2. To what extent does virtual collaborative learning enhance communication, collaboration, and creativity skills among elementary school students?
3. What factors influence the success or challenges in implementing virtual collaborative learning to develop students' skills?
4. What is the distribution of skill achievement (digital, communication, collaboration, creativity) among students participating in virtual collaborative learning?

Research Results

Virtual collaborative learning is based on the theory of social constructivism in a digital context. This approach emphasizes that knowledge is constructed through social interaction mediated by technology. Recent studies indicate that virtual collaborative learning plays a crucial role in the development of 21st-century skills, especially at the elementary education level. This framework is supported by recent research findings, which show a significant increase in student engagement when learning is conducted collaboratively in a virtual environment. The results of these studies include:

Table 1

Descriptive Statistical Analysis

Component	Mean	SD	Min	Max	Mode
Attendance	90.75	03.21	85	98	92
Discussion Participation	04.07	00.05	3	5	4
Task Completion	04.14	00.59	3	5	4
Collaboration	04.03	0,30416667	3	5	4
Creativity	04.11	0,32291667	3	5	4
Digital Skills	04.14	00.59	3	5	4

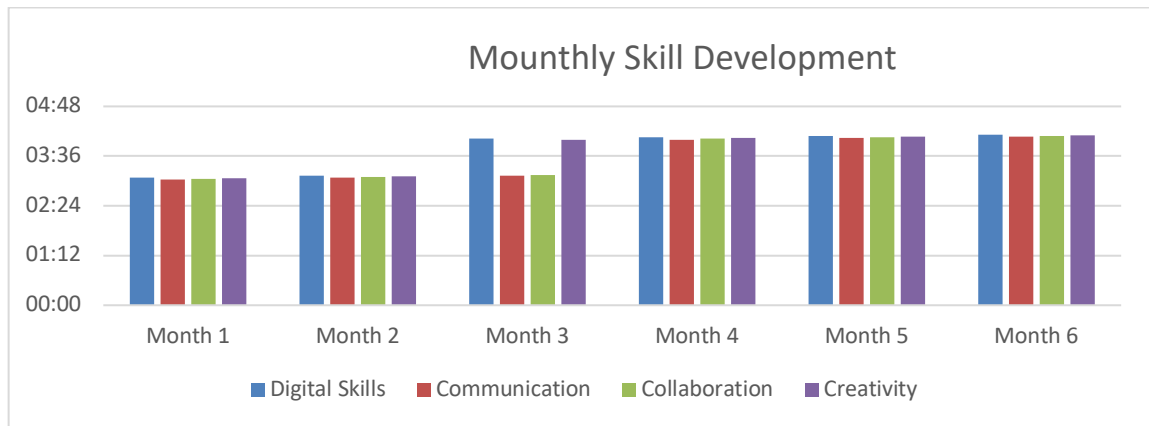
Source: author's own development

The table indicates that student attendance is very good, with an average of 90.75 out of 100, reflecting high consistency in attendance with little variation. Discussion participation is also quite active, with an average of 4.07 out of 5 and very little variation, suggesting that nearly all students participate in the discussions. For the task completion component, the average is 4.14 out of 5, indicating that the majority of students are able to complete tasks well, though there is slight variation among students. Collaboration has an average of 4.03, showing that students are able to work effectively together. Student creativity is also quite good, with an average of 4.11 out of 5 and small variation, reflecting consistent creativity among students. Meanwhile, digital skills have an average of 4.14 out of 5, indicating that most students possess strong digital skills. Overall, the average scores and the dominant mode of 4 in almost all components suggest stable and good performance by the students in every aspect.



Figure 1

Student Skills Development Data



Source: author (s) own development

The diagram illustrates the development of skills over six months, showing improvements across all components: digital skills, communication, collaboration, and creativity. In Month 1, the average skill level in each component was slightly above 3, indicating that students' abilities were at a moderate level initially. By Month 2, all components showed a slight increase, but a significant improvement began to emerge starting from Month 3, especially in digital skills and creativity, which each rose to 4.01 and 4.00, respectively. From Month 4 to Month 6, all components continued to experience steady growth, with average scores exceeding 4. By the end of the period in Month 6, the average digital skills score reached 4.07, communication 4.04, collaboration 4.05, and creativity 4.06. This consistent improvement indicates significant positive development in all measured skills, reflecting students' enhancement in digital skills, communication, collaboration, and creativity over the months.

Table 2

Distribution of Skill Achievement Levels (N=28)

Category	Total students	Percentage
Very Good (4.5-5.0)	6	21.4%
Good (3.5-4.4)	18	64.3%
Satisfactory (2.5-3.4)	4	14.3%
Poor (1.5-2.4)	0	0%
Very Poor (<1.5)	0	0%

Source: author (s) own development

Based on the available data, the majority of students demonstrate good performance, with 64.3% or 18 students falling within the "Good" category (3.5-4.4). A total of 21.4% or 6 students achieved the "Excellent" category (4.5-5.0), indicating that they met the highest standards of



assessment. Meanwhile, 14.3% or 4 students were categorized as "Satisfactory" (2.5-3.4), suggesting that there is potential for improvement to reach higher categories. There were no students in the "Needs Improvement" category (1.5-2.4) or "Very Poor" category (<1.5), indicating that all students met the minimum standards and did not face significant challenges in achieving learning outcomes. Overall, this data illustrates that the majority of students performed well, with only slight improvements needed

Conclusions

This study shows that virtual collaborative learning is effective in developing elementary school students' skills in the digital era. The results reveal a significant improvement in students' digital skills, communication, creativity, and collaboration. The high attendance rate (90.75%) and active participation in discussions (average of 4.07) indicate strong engagement. Additionally, students' abilities to complete tasks, collaborate, and work together were also recorded as excellent, with average scores of 4.14 and 4.03, respectively. Students' creativity and digital skills consistently improved, reaching average scores of 4.11 and 4.14. The distribution of skill achievement shows that the majority of students (85.7%) fall within the "Good" and "Excellent" categories, indicating the success of virtual collaborative learning in supporting 21st-century skills. The skill improvement over the six months reflects steady and positive development in digital skills, communication, collaboration, and creativity. Overall, virtual collaborative learning has proven effective in preparing students to face the challenges of the digital era, developing the skills necessary for the future.

References

- Chamidah, D., Suwono, H., Susilo, H., Sulisetijono, S., Munzil, M., & Zubaidah, S. (2024). NAVIGATING THE GLOBAL LANDSCAPE ON PROJECTBASED LEARNING AND 21ST-CENTURY SKILLS RESEARCH (2020-2023): A BIBLIOMETRIC ANALYSIS. *Malaysian Journal of Learning and Instruction*, 21(2), 179-230. <https://doi.org/10.32890/mjli2024.21.2.7>
- Chandra Wijaya, A. (2024). The Effectiveness of Traditional and Modern Memorization Techniques for Quranic Learning in Indonesia. *Edu Spectrum: Journal of Multidimensional Education*, 1(1), 38-47. <https://doi.org/10.70063/eduspectrum.v1i1.27>
- Chien, S., & Hwang, G. (2022). A question, observation, and organisation-based SVVR approach to enhancing students' presentation performance, classroom engagement, and technology acceptance in a cultural course. *British Journal of Educational Technology*, 53(2), 229-247. <https://doi.org/10.1111/bjet.13159>
- García-Martínez, I., Fernández-Batanero, J. M., Cobos Sanchiz, D., & Luque de la Rosa, A. (2019). Using Mobile Devices for Improving Learning Outcomes and Teachers' Professionalization. *Sustainability*, 11(24), 6917. <https://doi.org/10.3390/su11246917>
- Imran, M., & Almusharraf, N. (2024). Digital Learning Demand and Applicability of Quality 4.0 for Future Education: A Systematic Review. *International Journal of Engineering Pedagogy (IJEP)*, 14(4), 38-53. <https://doi.org/10.3991/ijep.v14i4.48847>



- Irhamni, H., & Ashari, M. K. (2023). Digital Platform-Based Learning Innovation in Elementary Schools in The Industry 4.0 Era: Systematic Literature Review. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, 15(2), 945-958. <https://doi.org/10.37680/qalamuna.v15i2.3327>
- Lasmana, O., Festiyet, F., Razak, A., & Fadilah, M. (2024). Transforming Education in the 5.0 Era: Utilizing Technology to Improve Critical Thinking and Creativity in The Digital Generation. *Proceedings of the 1st International Conference on Social Science (ICSS)*, 3(2), 285-294. <https://doi.org/10.59188/icss.v3i2.208>
- Lim, J. (2023). Exploring the relationships between interaction measures and learning outcomes through social network analysis: the mediating role of social presence. *International Journal of Educational Technology in Higher Education*, 20(1), 14. <https://doi.org/10.1186/s41239-023-00384-8>
- Ng, D. T. K., Leung, J. K. L., Su, J., Ng, R. C. W., & Chu, S. K. W. (2023). Teachers' AI digital competencies and twenty-first century skills in the post-pandemic world. *Educational Technology Research and Development*, 71(1), 137-161. <https://doi.org/10.1007/s11423-023-10203-6>
- Olmanson, J., Liu, X., Heselton, C. C., Srivastava, A., & Wang, N. (2021). Chinese character recognition and literacy development via a techno-pedagogical pivot. *Educational Technology Research and Development*, 69(2), 1299-1324. <https://doi.org/10.1007/s11423-021-09976-5>
- Parr, J., & Hawe, E. (2022). Student pedagogic voice in the literacy classroom: a review. *Research Papers in Education*, 37(6), 773-796. <https://doi.org/10.1080/02671522.2020.1864769>
- Shankar, S. K., Rodríguez-Triana, M. J., Prieto, L. P., Ruiz-Calleja, A., & Chejara, P. (2022). CDM4MMLA: Contextualized Data Model for MultiModal Learning Analytics. In *The Multimodal Learning Analytics Handbook* (pp. 205-229). Springer International Publishing. https://doi.org/10.1007/978-3-031-08076-0_9
- Torres Chávez, T. E., & García Martínez, A. (2019). Reflexiones sobre los materiales didácticos virtuales adaptativos. *Revista Cubana de Educación Superior*, 38(3).
- Xu, B., Chen, N.-S., & Chen, G. (2020). Effects of teacher role on student engagement in WeChat-Based online discussion learning. *Computers & Education*, 157, 103956. <https://doi.org/10.1016/j.compedu.2020.103956>