Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Digital Storytelling on Cognitive Flexibility and Divergent Thinking

Prekshi Saini[1], Dr. Anshu Mathur[2], Dr. Sheena Thomas[3]
[1]*Amity Institute of Education, Amity University, Uttar Pradesh*
[2]*Amity Institute of Education, Amity University, Uttar Pradesh*
[3]*The Bhopal School of Social Sciences, Bhopal, M.P.*

ARTICLE INFO

Received: 24 Dec 2024

Revised: 12 Feb 2025

Accepted: 26 Feb 2025

ABSTRACT

Introduction:
Digital storytelling, an innovative educational tool that merges traditional narrative techniques with digital media, is increasingly being recognized for its potential to enhance students' cognitive development. This study explored how digital storytelling can influence cognitive flexibility and divergent thinking—two critical skills in fostering creativity and adaptability among middle school students.

Objective:
The primary aim was to assess the effectiveness of a digital storytelling intervention in improving cognitive flexibility and divergent thinking skills among seventh-grade students.

Method:
A post-test-only control group design was adopted. From seven sections of Class VII, two were randomly selected—one designated as the experimental group and the other as the control group. The experimental group underwent a 15-day intervention using structured digital storytelling activities. A researcher-constructed tool was employed to assess both cognitive flexibility and divergent thinking skills.

Results:
Findings revealed a significant impact of the intervention on cognitive flexibility ($p < .001$) and divergent thinking ($p < .001$), with experimental group students outperforming the control group. However, the interaction effect between creativity experience and group on divergent thinking was not statistically significant ($p = .265$).

Conclusion:
Digital storytelling was shown to be an effective strategy for enhancing essential cognitive skills in school-aged children. Its integration into classroom practices can support students in developing flexible thinking and creative problem-solving abilities, making them better prepared for the complexities of real-world learning and challenges.

Keywords: Digital Storytelling, Cognitive Flexibility, Divergent Thinking, Creativity..

INTRODUCTION

Digital storytelling combines traditional storytelling with digital technologies. It offers a versatile and autonomous approach that allows individuals to create narratives that reflect their thought processes and creative abilities. Storytelling method has been utilized in various educational settings, including primary, secondary, and higher education, to foster cognitive engagement and skill development. Studies have shown that digital storytelling has been used to enhance creative expression, promote reflective thinking, and foster cognitive flexibility. Digital storytelling is a dynamic tool for facilitating cognitive flexibility by engaging students in non-linear and alternative problem-solving strategies. Storytelling encourages the synthesis of diverse ideas and perspectives, promoting the ability to shift between different modes of thought. Research suggested a rich potential for digital storytelling in enhancing cognitive flexibility and divergent thinking skills. Building on this foundation, the present study explores

Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

how digital storytelling influences cognitive flexibility and divergent thinking. To address this, the study aims to study the effect of digital storytelling on cognitive flexibility and divergent thinking skills among students.

Digital Storytelling and Cognitive Flexibility

Digital storytelling can be used as a powerful pedagogical tool to enhance cognitive flexibility and divergent thinking skills (Smeda et al., 2014). Murad T in 2023 shows that storytelling relies less on structured written narratives and formal literacy, it offers an alternative creative expression and assessment mode (Murad et al., 2023). The storytelling approach can foster technological, visual, and media literacies while encouraging learners to develop critical and creative thinking, problem-solving, and adaptability—key components of cognitive flexibility (Robin, 2016).

Digital storytelling is widely recognized as an engaging, student-centered method that allows individuals to construct and communicate ideas in ways that mirror real-world cognitive processes (de Jager et al., 2017). It facilitates differentiated instruction, enabling educators to cater to a diverse range of cognitive styles and thought patterns (Chen et al., 2023). Through digital storytelling, learners can explore multiple perspectives, experiment with novel ideas, and refine their ability to shift between different modes of thinking—a fundamental aspect of divergent thinking (Yuliani & Hartanto, 2022). Hava K suggests that incorporating digital storytelling in educational settings can lead to increased engagement, motivation, and deeper cognitive processing (Hava, 2021). By providing learners with opportunities to articulate their ideas through multimodal narratives, digital storytelling not only enhances creative expression but also strengthens their ability to generate, evaluate, and integrate diverse ideas, reinforcing both cognitive flexibility and innovative problem-solving skills (Nair & Yunus, 2021).

Digital Storytelling and Cognitive Flexibility

Masuram J evident that digital storytelling serves as a powerful tool for fostering cognitive flexibility and enhancing divergent thinking skills (Masuram & Sripada, 2020). By providing a creative space for learners to construct and reflect on their narratives, digital storytelling encourages them to explore multiple perspectives and adapt to new ideas (Lindsay, 2023). Digital Storytelling nurtures cognitive flexibility by allowing individuals to shift between different modes of thinking, reevaluate existing beliefs, and develop a more dynamic approach to problem-solving (Cole et al., 2013; Zagita & Chih-Yuan Sun, 2021). Digital storytelling also fosters a sense of agency in learners. Students create digital narratives centered on their experiences, ideas, and thought processes, they gain ownership over their cognitive development (Karpenko & Ajtay-Horvath, 2021). Learners can experiment with novel concepts, engage in abstract reasoning, and generate innovative solutions—hallmarks of divergent thinking (Škola et al., 2024). By integrating digital storytelling into educational settings, educators can create environments where learners are more willing to take creative risks and develop adaptable thinking strategies (Rios Rincon et al., 2022; Tatlı et al., 2022). Digital storytelling has been recognized as an inclusive and flexible methodology that supports diverse learning styles. It enables students to express their ideas beyond traditional written or verbal formats, making it particularly effective for developing higher-order thinking skills (Ramalingam et al., 2022; Zhu et al., 2023). By engaging with multimedia elements such as images, videos, and voiceovers, learners refine their ability to synthesize information and approach problems from multiple angles—key components of cognitive flexibility and creative problem-solving (Robin, 2016).

The practical implementation of digital storytelling for cognitive flexibility requires access to appropriate technological resources (Çetin, 2021). Challenges such as limited access to devices, outdated infrastructure, and time constraints must be addressed to ensure that all students benefit from this approach (Choo et al., 2020; Gürsoy, 2021). Providing students with access to digital tools, integrating storytelling into the curriculum, and allowing sufficient time for creation and reflection are essential steps in leveraging digital storytelling to enhance divergent thinking and cognitive adaptability(Gürsoy, 2021) .

Digital Storytelling (DST) and Divergent Thinking Skill

Divergent thinking, characterized by the ability to generate multiple solutions to a problem, is a cornerstone of creativity and innovation. Studies have explored the efficacy of DST in fostering these essential skills among learners. Isaacs et al. (2024) underscore the effectiveness of DST in developing 21st-century skills, critical thinking, creativity, and collaboration. Their meta-aggregative analysis of 18 qualitative studies revealed that DST activities inherently

engage students in processes that enhance these competencies. The study concluded that, regardless of the specific characteristics of DST activities, there is a consistent promotion of 21st-century skills, with a pronounced impact on creativity and critical thinking (Howard & Claro, 2024). De Jager A, conducted a systematic review focusing on DST activities within classrooms. Findings of the same indicate that integrating collaborative approaches and technology in DST activities, such as story creation and problem-solving tasks, can significantly promote associative, visual, and divergent thinking skills. This highlights the potential of DST to enhance students' science learning by developing their thinking skills (de Jager et al., 2017). The integration of DST in educational settings offers a dynamic approach to learning, encouraging students to engage in non-linear and alternative problem-solving strategies (Addone et al., 2021). By synthesizing diverse ideas and perspectives, DST promotes the ability to shift between different modes of thought, thereby enhancing cognitive flexibility and divergent thinking (Polyak, 2011). This aligns with the broader educational goal of preparing students to navigate complex, real-world challenges with creativity and adaptability.

Study Context

The present study focuses on the use of digital storytelling as a pedagogical tool for enhancing cognitive flexibility and divergent thinking among Class 7 CBSE students in Social Science. The research will be conducted in selected CBSE schools, with a focus on engaging students through interactive and creative learning methodologies. The study is grounded in the National Education Policy (NEP) 2020, which emphasizes holistic and multidisciplinary learning to foster critical thinking, creativity, and problem-solving skills among school students (Vishwakarma & Singh, 2023). Digital storytelling is integrated into the Social Science curriculum to encourage students to explore historical, geographical, and civic concepts through narrative construction, multimedia elements, and personal reflections. Unlike traditional methods of rote learning, digital storytelling provides an experiential and student-centered approach, allowing learners to express their understanding of key concepts while developing essential 21st-century skills. This research employs a whole-class approach, involving all students in a structured yet flexible digital storytelling intervention.

The research involves co-designing digital storytelling activities aligned with the CBSE Class 7 Social Science syllabus. This includes incorporating historical narratives, civic debates, and geographical explorations into the storytelling framework. The study examines the impact of peer collaboration, self-reflection, and digital literacy on enhancing cognitive flexibility and divergent thinking. To ensure equitable participation, the intervention included structured access to digital tools, along with teacher-guided facilitation to support students in story development, multimedia integration, and digital content creation. By integrating digital storytelling into Social Science education, this study contributed to innovative teaching-learning practices that align with contemporary educational reforms while promoting student engagement and cognitive adaptability.

OBJECTIVES

To study the effectiveness of digital storytelling as an intervention in enhancing cognitive flexibility among seventh-grade students while controlling for creativity experience.

To study the impact of digital storytelling on the development of divergent thinking skills in seventh-grade students, taking into account their creativity experience.

HYPOTHESES

H1: Digital storytelling has a significant positive impact on cognitive flexibility, even after controlling for creativity experience.

H2: Digital storytelling has a significant positive impact on Divergent Thinking Skills, even after controlling for creativity experience.

METHODS

Research Design: The study employed a post-test with a control group design for examining the impact of an intervention on cognitive flexibility and divergent thinking skills. The independent variable in the study was the intervention program, while the dependent variables were Cognitive Flexibility and Divergent Thinking Skills.

Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Sample and Sampling Technique: A random sampling technique was used to select the participants. The study was conducted among students of Class 7 from a school with seven sections of the same class. Two sections were randomly selected, with one designated as the experimental group (n = 28) and the other as the control group (n = 28), resulting in a total sample size of 56 students.

Intervention: The experimental group underwent a 15-day structured intervention program designed to enhance cognitive flexibility and divergent thinking skills. The control group did not receive any intervention and continued with their regular curriculum.

Research Tool: A self-constructed standardized questionnaire was developed to assess Cognitive Flexibility and Divergent Thinking Skills. The tool underwent validity and reliability testing.

Reliability and Validity of the Tool: The reliability of the questionnaire was assessed using Cronbach's Alpha (α) and McDonald's Omega (ω) in JAMOVI to determine internal consistency. The overall scale demonstrated excellent reliability, with Cronbach's α = 0.956 and McDonald's ω = 0.960, both exceeding the recommended threshold of 0.70. The mean and standard deviation for the scale were 3.90 and 0.676, respectively. Item-level analysis revealed strong item-rest correlations, with Cognitive Flexibility (0.958), and Divergent Thinking Skills all contributing significantly to the overall consistency. Examining the effect of item removal, deleting Cognitive Flexibility reduced Cronbach's α to 0.895 while removing Divergent Thinking Skills slightly increased it to 0.965, indicating that all items were essential to maintaining high reliability. These results confirm that the questionnaire is highly reliable, effectively measuring cognitive flexibility, divergent thinking skills. Exploratory Factor Analysis (EFA) was conducted using JAMOVI. The Minimum Residual Extraction Method with Oblimin Rotation was applied to identify the underlying factor structure. The factor loadings for each item were assessed, demonstrating strong item contributions to their respective constructs. The factor loading for Cognitive Flexibility was 1.000, indicating an exceptionally strong contribution to the latent construct. Divergent Thinking Skills had factor loadings of 0.892, suggesting high construct relevance. The uniqueness values were also examined, with Cognitive Flexibility showing 6.25e−4 and divergent Thinking Skills 0.204, confirming that most variance in these items is explained by the latent factor.

RESULTS

First, Levene's test for homogeneity of variances was employed to know the normality of the data, and the results were significant ($F(1, 54) = 83.8$, $p < .001$), which indicates that the assumption of equal variances across groups is violated. This violation of assumption can lead to biased parameter estimates and inflated Type I errors. So, we opted for a General Linear Model (GLM) approach, which provides more flexibility in handling such assumption violations.

H_1: Digital storytelling has a significant positive impact on cognitive flexibility, even after controlling for creativity experience.

Result and Analyses: The study employed a linear model that was fitted using Ordinary Least Squares (OLS) regression to examine the effect of group (experimental vs. control) and creativity experience on cognitive flexibility. The model showed a high explanatory power, with an R^2 of 0.774, indicating that 77.4% of the variance in cognitive flexibility is explained by the independent variables. The adjusted R^2 (0.765) further confirms the model's strong fit while accounting for the number of predictors. The results indicate that the overall model was statistically significant ($F(2,53) = 90.5$, $p < .001$, $\eta^2p = 0.774$), confirming that at least one of the predictors significantly contributes to the variance in cognitive flexibility.

Group (GRP): The comparison between the experimental and control groups yielded a significant effect ($F(1,53) = 180.6$, $p < .001$, $\eta^2p = 0.773$), showing that participants in the digital storytelling group exhibited significantly higher cognitive flexibility than those in the control group. The estimated effect size ($\eta^2p = 0.773$) suggests a large impact of the intervention. The parameter estimate ($\beta = -1.382$, $t(53) = -13.44$, $p < .001$) confirms that the control group had significantly lower cognitive flexibility scores than the experimental group.

Creativity Experience: Creativity experience also emerged as a significant predictor ($F(1,53) = 37.5$, $p < .001$, $\eta^2p = 0.414$), indicating that individuals with higher creativity experience tend to have greater cognitive flexibility. The parameter estimate ($\beta = 0.900$, $t(53) = 6.12$, $p < .001$) suggests that for every unit increase in creativity experience, cognitive flexibility increases by 0.900 units. With strong statistical significance of the group effect ($p < .001$) and the

Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

large effect size ($\eta^2p = 0.773$), the alternative hypothesis (H_1) is supported. This confirms that digital storytelling significantly enhances cognitive flexibility when compared to the control condition, even after accounting for creativity experience. The study results provide strong empirical evidence for the effectiveness of digital storytelling as a tool to enhance divergent thinking and cognitive flexibility.

H2: Digital storytelling has a significant positive impact on Divergent Thinking Skills, even after controlling for creativity experience.

Result and Analyses: The model explains a substantial proportion of variance in the dependent variable, as indicated by an R^2 value of 0.544, meaning that 54.4% of the variability in Divergent Thinking Skills is accounted for by the predictors. The adjusted R^2 value of 0.526 suggests that even after adjusting for the number of predictors, the model maintains a strong explanatory power. These results indicate that both group membership (experimental vs. control) and Creativity Experience contribute significantly to the prediction of Divergent Thinking Skills.

Group Effect (GRP): The Effect of the group was statistically significant, $F(1, 53) = 58.37$, $p < .001$, $\eta^2p = 0.524$, indicating that participants in the experimental group had significantly higher divergent thinking skills compared to the control group. The large effect size (partial eta squared = 0.524) suggests a strong influence of the intervention.

Creativity Experience: The effect of Creativity Experience was not statistically significant, $F(1, 53) = 1.27$, $p = 0.265$, $\eta^2p = 0.023$, indicating that differences in prior creativity experience did not significantly influence Divergent thinking skills in this model. The residual variance (SS = 9.561) accounts for the unexplained variability in the model.

Intercept: The intercept value of 3.970 (SE = 0.0568, $p < .001$) represents the predicted Divergent Thinking Skills score for the reference group (Control Group) when Creativity Experience is at its mean level.

Group Effect (GRP1): The effect of the group was statistically significant ($\beta = -1.539$, $t(53) = -7.64$, $p < .001$), indicating that the experimental group had significantly higher divergent thinking skills than the control group. The estimated mean difference is -0.950, meaning that the control group scored lower than the experimental group by approximately 0.95 points on the Divergent Thinking Skills scale.

Creativity Experience: The effect of Creativity Experience was not statistically significant ($\beta = 0.114$, $t(53) = 1.13$, $p = 0.265$), with a 95% confidence interval ranging from -0.156 to 0.556, suggesting that the effect of Creativity Experience on Divergent Thinking Skills was weak and not reliable.

DISCUSSION

The findings of this study align with existing literature emphasizing the role of digital storytelling in enhancing cognitive and creative skills. The significant improvement in cognitive flexibility in the experimental group supports the argument that digital storytelling fosters active engagement, problem-solving, and adaptability (Choo et al., 2020). Rios Rincon suggests that storytelling, especially in digital formats, allows students to process information more effectively, thereby improving cognitive flexibility (Rios Rincon et al., 2022). While the study found a significant effect of the intervention on cognitive flexibility, the impact of creativity experience on divergent thinking skills was not statistically significant. This finding contrasts with previous research by Smeda which suggested that higher creativity experience enhances divergent thinking (Smeda et al., 2014). A possible explanation could be the short duration of the intervention (15 days), as long-term exposure to digital storytelling may yield stronger effects on divergent thinking.

These results contribute to the growing body of research advocating for technology-enhanced learning approaches in education. Digital storytelling provides a multisensory learning experience, which aligns with theories of constructivist learning (Zhu et al., 2023). Future research should consider extended interventions, longitudinal studies, and the integration of other creative tools to explore their combined effects on student cognition and learning outcomes.

Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

REFRENCES

[1] Addone, A., De Donato, R., Palmieri, G., Pellegrino, M. A., Petta, A., Scarano, V., & Serra, L. (2021). Novelette, a Usable Visual Storytelling Digital Learning Environment. IEEE Access, 9. https://doi.org/10.1109/ACCESS.2021.3137076

[2] Çetin, E. (2021). Digital storytelling in teacher education and its effect on the digital literacy of pre-service teachers. Thinking Skills and Creativity, 39. https://doi.org/10.1016/j.tsc.2020.100760

[3] Chen, Y. T., Liu, M. J., & Cheng, Y. Y. (2023). Discovering Scientific Creativity with Digital Storytelling. Journal of Creativity, 33(1). https://doi.org/10.1016/j.yjoc.2022.100041

[4] Choo, Y. B., Abdullah, T., & Nawi, A. M. (2020). Digital storytelling vs. Oral storytelling: An analysis of the art of telling stories now and then. Universal Journal of Educational Research, 8(5 A). https://doi.org/10.13189/ujer.2020.081907

[5] Cole, G., Street, K., & Felt, L. J. (2013). Storytelling in the digital age: Engaging learners for cognitive and affective gains. International Journal of Technology, Knowledge and Society, 8(6). https://doi.org/10.18848/1832-3669/cgp/v08i06/56349

[6] de Jager, A., Fogarty, A., Tewson, A., Lenette, C., & Boydell, K. M. (2017). Digital storytelling in research: A systematic review. In Qualitative Report (Vol. 22, Issue 10). https://doi.org/10.46743/2160-3715/2017.2970

[7] Gürsoy, G. (2021). Digital storytelling: Developing 21st century skills in science education. In European Journal of Educational Research (Vol. 10, Issue 1). https://doi.org/10.12973/EU-JER.10.1.97

[8] Hava, K. (2021). Exploring the role of digital storytelling in student motivation and satisfaction in EFL education. Computer Assisted Language Learning, 34(7). https://doi.org/10.1080/09588221.2019.1650071

[9] Howard, S. K., & Claro, M. (2024). Article in Technology Pedagogy and Education. https://www.researchgate.net/publication/380532569

[10] Karpenko, Y. M., & Ajtay-Horvath, M. (2021). DIGITAL STORYTELLING AS AN EDUCATIONAL TECHNOLOGY FOR ACTIVATING COGNITIVE ACTIVITY OF PRIMARY SCHOOL PUPILS IN FOREIGN LANGUAGE LESSONS. INFORMATION TECHNOLOGIES AND LEARNING TOOLS, 81(1).

[11] Lindsay, J. (2023). Documentary Film as Interreligious Dialogue: A Cognitive Perspective. Religions, 14(3). https://doi.org/10.3390/rel14030293

[12] Masuram, J., & Sripada, P. N. (2020). Digital stories to enhance cognitive abilities among learners. 11th International Conference on Advances in Computing, Control, and Telecommunication Technologies, ACT 2020.

[13] Murad, T., Assadi, J., & Badarni, H. (2023). Digital Storytelling and EFL Speaking Skill Improvement. Journal of Language Teaching and Research, 14(5). https://doi.org/10.17507/jltr.1405.06

[14] Nair, V., & Yunus, M. M. (2021). A systematic review of digital storytelling in improving speaking skills. In Sustainability (Switzerland) (Vol. 13, Issue 17). https://doi.org/10.3390/su13179829

[15] Polyak, E. (2011). STORYTELLING WITH OPEN HARDWARE: INTERACTIVE ANIMATION LEARNING FRAMEWORK. In 2011 4th International Conference of Education, Research and Innovation.

[16] Ramalingam, K., Jiar, Y. K., & Mathiyazhagan, S. (2022). Speaking Skills Enhancement through Digital Storytelling among Primary School Students in Malaysia. International Journal of Learning, Teaching and Educational Research, 21(3). https://doi.org/10.26803/ijlter.21.3.2

[17] Rios Rincon, A. M., Miguel Cruz, A., Daum, C., Neubauer, N., Comeau, A., & Liu, L. (2022). Digital Storytelling in Older Adults With Typical Aging, and With Mild Cognitive Impairment or Dementia: A Systematic Literature Review. In Journal of Applied Gerontology (Vol. 41, Issue 3). https://doi.org/10.1177/07334648211015456

[18] Robin, B. R. (2016). The power of digital storytelling to support teaching and learning. In Digital Education Review (Issue 30).

[19] Škola, F., Boskovic, D., Rizvic, S., Skarlatos, D., & Liarokapis, F. (2024). Assessing User Experience and Cognitive Workload in Virtual Reality Digital Storytelling. International Journal of Human-Computer Interaction, 40(6). https://doi.org/10.1080/10447318.2023.2247846

[20] Smeda, N., Dakich, E., & Sharda, N. (2014). The effectiveness of digital storytelling in the classrooms: a comprehensive study. Smart Learning Environments, 1(1). https://doi.org/10.1186/s40561-014-0006-3

[21] Tatlı, Z., Saylan, E., & Kokoç, M. (2022). Digital Storytelling in an Online EFL Course: Influences on Speaking, Vocabulary, and Cognitive Load. Participatory Educational Research, 9(6). https://doi.org/10.17275/per.22.130.9.6

[22] Vishwakarma, P., & Singh, D. (2023). Digitalisation of Education with NEP-2020 and its Impact on Quality of Life. International Research Journal of Engineering and Technology, 10(3).

Journal of Information Systems Engineering and Management
2025, 10(39s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

[23] Yuliani, S., & Hartanto, D. (2022). Digital Online Learning by Using Digital Storytelling for Pre-Service Teacher Students. International Journal of Language Education, 6(3). https://doi.org/10.26858/ijole.v6i3.20408
[24] Zagita, C., & Chih-Yuan Sun, J. (2021). The effect of instructional and interactive feedback on EFL students' cognitive load in digital storytelling. Proceedings - IEEE 21st International Conference on Advanced Learning Technologies, ICALT 2021. https://doi.org/10.1109/ICALT52272.2021.00091
[25] Zhu, D., Al Mahmud, A., & Liu, W. (2023). Digital storytelling intervention to enhance social connections and participation for people with mild cognitive impairment: a research protocol. Frontiers in Psychiatry, 14. https://doi.org/10.3389/fpsyt.2023.1217323