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Digital Story Telling as a Catalyst for Metacognition: New Frontiers in Critical Literacy for the Digital Age

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ABSTRACT (10PT)

This mixed-methods study investigates the role of artificial intelligence (Digital Story Telling) as a catalyst for metacognition and its impact on college students' conceptions of critical literacy in the digital age. Sixty students from diverse academic backgrounds at Institut Studi Islam Muhammadiyah Pacitan, Indonesia, participated in an Digital Story Telling -based learning activity designed to facilitate literary analysis. Using pre- and post-intervention surveys and semi-structured interviews, we examined changes in students' metacognitive awareness and perceptions of Digital Story Telling 's role in developing critical literacy skills.
Results reveal significant shifts in students' metacognitive processes and understanding of critical literacy following Digital Story Telling interaction. Quantitative data show increased recognition of Digital Story Telling 's potential to enhance personalized learning (mean score increase from 3.6 to 4.12) and critical thinking skills (mean score increase from 3.05 to 3.85). Qualitative findings indicate that Digital Story Telling interaction triggered deeper metacognitive reflection, with students reporting enhanced awareness of their thinking processes during literary analysis.
Moreover, students' conceptions of critical literacy expanded to encompass Digital Story Telling literacy, recognizing the importance of effectively using and evaluating Digital Story Telling tools in the digital landscape. While privacy concerns decreased post-intervention, students maintained a nuanced awareness of potential ethical issues in Digital Story Telling -augmented learning environments.
This study contributes to our understanding of how Digital Story Telling can serve as a powerful tool for fostering metacognition and redefining critical literacy in the digital age. It highlights the need for intentional integration of Digital Story Telling in educational settings to maximize its potential as a catalyst for deeper, more reflective learning experiences. The findings have significant implications for curriculum design, teacher training, and the development of Digital Story Telling -enhanced educational tools that promote metacognitive growth and critical literacy skills essential for navigating an increasingly Digital Story Telling -infused world..

INTRODUCTION

Artificial intelligence (Digital Story Telling) is rapidly transforming education through technologies such as machine learning, natural language processing, and data analytics (Smith 2021). While much attention has been paid to Digital Story Telling 's potential for personalized learning and adaptive instruction, a crucial area of investigation is emerging: Digital Story Telling 's role in catalyzing metacognition and reshaping critical literacy for the digital age.

Specific applications of Digital Story Telling , such as intelligent tutoring systems, text analysis tools, and conversational agents, have the potential to not only enhance literacy instruction but also to fundamentally alter how students think about their own thinking processes (Jones 2019). This intersection of Digital Story Telling and metacognition opens new frontiers in critical literacy,

challenging traditional conceptions of what it means to be literate in an Digital Story Telling -infused world.

As Kumar and Vig (2019) argue, studying student interactions with Digital Story Telling provides "an invaluable window" into how humans engage with these complex technologies. This engagement goes beyond mere tool use; it potentially triggers deep reflective processes that can enhance metacognitive skills. However, integrating Digital Story Telling also poses challenges around ethics, bias, and privacy that demand thoughtful consideration (Nagle 2019, Bu 2022), particularly in how these issues impact students' critical thinking development.

Prior studies have explored student perspectives on educational technology generally, with findings suggesting both excitement for personalized learning and concerns about privacy and interpersonal connections (Williams 2016, Henderson et al. 2017). More recent investigations into student perceptions of Digital Story Telling technologies specifically have revealed a nuanced landscape of optimism tempered by wariness of over-reliance on algorithmic recommendations (Essuman 2019, Ng 2022).

However, limited work has deeply explored how engagement with Digital Story Telling systems explicitly designed for advancing literacy might trigger metacognitive processes and reshape students' understanding of critical thinking in a digital context. This study aims to address that gap by examining how college students' metacognitive awareness and conceptions of critical literacy evolve through hands-on experience with an Digital Story Telling -powered reading activity.

Specifically, this research investigates:

1) How do students conceptualize the role of Digital Story Telling in developing their metacognitive skills and critical reading capabilities?

2) How does direct engagement with an Digital Story Telling learning activity influence students' awareness of their own thinking processes and their understanding of critical literacy in the digital age?

To explore these questions, 60 college students participated in an interactive classroom session using an Digital Story Telling chatbot designed to generate critical thinking prompts for short story analysis. This experience served as a catalyst for metacognitive reflection, challenging students to reconsider their approaches to critical reading and thinking in an Digital Story Telling -augmented learning environment.

Mixed-methods data analysis revealed key themes in how students' metacognitive awareness and perceptions of critical literacy shifted after this firsthand experience. While openness to Digital Story Telling as a learning tool increased, students also demonstrated a more nuanced understanding of the metacognitive demands of engaging critically with Digital Story Telling -generated content.

Results highlight the potential of Digital Story Telling as a powerful trigger for metacognitive growth and the expansion of critical literacy skills. They also underscore the need for educational approaches that deliberately harness Digital Story Telling to foster deeper, more reflective learning experiences. This study aims to inform policies and practices that fulfill Digital Story Telling 's potential to augment human intelligence equitably, emphasizing the development of metacognitive skills and critical literacy that will serve students well in an increasingly Digital Story Telling -mediated world.

The insights gained here emphasize the need for continual open dialogue and centering of student voice in developing Digital Story Telling -enhanced learning environments. By understanding how Digital Story Telling acts as a catalyst for metacognition, we can better prepare students to navigate the complex landscape of information and technology in the digital age, fostering a new dimension of critical literacy that encompasses both human and artificial intelligence.

METHOD

This study employs a mixed-methods approach, combining quantitative surveys and qualitative semi-structured interviews, to investigate how Digital Story Telling acts as a catalyst for metacognition and reshapes college students' understanding of critical literacy in the digital age. This

methodology allows for rich, multi-faceted insights into the complex interplay between Digital Story Telling engagement, metacognitive processes, and evolving conceptions of critical literacy.

1. Participants

The study involves 60 college students purposefully selected from Institut Studi Islam Muhammadiyah Pacitan, representing a variety of disciplines and levels of prior Digital Story Telling experience. This diverse sample ensures a range of perspectives on Digital Story Telling 's role in education and its impact on thinking processes.

2. Data Collection

a. Pre-intervention Metacognitive Awareness and Digital Story Telling Perception Survey

Participants first complete a pre-intervention survey comprising 20 items:

1) 10 items from the Metacognitive Awareness Inventory (MDigital Story Telling) (Schraw & Dennison, 1994), focusing on knowledge of cognition and regulation of cognition.
2) 10 items assessing attitudes towards Digital Story Telling in education, using a 5-point Likert scale (1=strongly disagree, 5=strongly agree).

The Digital Story Telling -related items cover:

1) Perceived potential of Digital Story Telling to enhance metacognitive skills
2) Role of Digital Story Telling in developing critical literacy for the digital age
3) Anticipated impact of Digital Story Telling on students' thinking processes
4) Ethical considerations in Digital Story Telling -augmented learning environments

b. Digital Story Telling -based Learning Activity

Participants engage individually with a conversational Digital Story Telling chatbot designed for literary analysis. The chatbot, developed specifically for this study, is programmed to:

1) Facilitate critical thinking about a short story through interactive dialogue
2) Generate questions that prompt metacognitive reflection
3) Provide adaptive recommendations based on the student's responses
4) Explicitly draw attention to the student's thinking processes

This Digital Story Telling -based learning activity serves as a catalyst for metacognitive experiences, challenging students to reflect on their cognitive strategies and understanding of critical literacy in an Digital Story Telling -augmented context.

c. Post-intervention Survey and Semi-structured Interviews

Following the Digital Story Telling interaction, participants complete a post-intervention survey mirroring the pre-intervention instrument. This allows for quantitative assessment of changes in metacognitive awareness and perceptions of Digital Story Telling 's role in critical literacy development.

Subsequently, all participants engage in 30-minute semi-structured interviews. The interview protocol explores:

1) Students' metacognitive experiences during the Digital Story Telling interaction
2) Changes in their understanding of critical literacy in the digital age
3) Perceptions of how Digital Story Telling influenced their thinking processes
4) Reflections on the potential and limitations of Digital Story Telling in fostering metacognition and critical thinking

3. Data Analysis

Quantitative data from the pre- and post-intervention surveys will be analyzed using paired t-tests to assess changes in metacognitive awareness and Digital Story Telling perceptions. Effect sizes will be calculated to determine the magnitude of any observed changes.

Qualitative data from the interviews will be transcribed and analyzed using thematic coding techniques, as described by Gibson and Brown (2009). The analysis will focus on identifying recurring patterns and themes related to:

1) Metacognitive triggering by Digital Story Telling interaction
2) Evolving conceptions of critical literacy
3) Perceived impact of Digital Story Telling on thinking processes
4) Ethical considerations in Digital Story Telling -augmented learning

The mixed-methods approach allows for triangulation of data, providing a comprehensive understanding of how Digital Story Telling serves as a catalyst for metacognition and reshapes students' understanding of critical literacy in the digital age.

Throughout the research process, the study adheres to rigorous validity measures, confidentiality protections, and ethical guidelines to ensure the integrity and ethical conduct of the investigation.

FINDINGS

This study examined the metacognitive experiences and evolving perceptions of critical literacy among 60 college students as they engaged with an Digital Story Telling -based learning tool. Employing a mixed-methods approach, we collected data through pre- and post-intervention surveys and semi-structured interviews. Our primary aim was to investigate how interaction with Digital Story Telling serves as a catalyst for metacognitive processes and reshapes students' understanding of critical literacy in the digital age.

1. Pre-Intervention Survey

To establish a baseline understanding of students' metacognitive awareness and perceptions of Digital Story Telling in learning, we administered a pre-intervention survey. This instrument consisted of 15 items using 5-point Likert scales (1 = strongly disagree, 5 = strongly agree). The survey explored various dimensions, including:

1) Students' awareness of their own thinking processes (metacognition)
2) Perceptions of Digital Story Telling 's potential to enhance critical thinking and literacy skills
3) Understanding of critical literacy in the context of Digital Story Telling and digital technologies
4) Ethical considerations surrounding Digital Story Telling in education

The following table presents the mean, standard deviation, and mode for each survey item. These statistics provide insight into the central tendency, variability, and most common responses among participants before their interaction with the Digital Story Telling -based learning tool.

No.	Question	Mean	SD	Mode
1	Digital Story Telling tutors can provide personalized learning experiences similar to human teachers.	3.6	1.30	5
2	Digital Story Telling tools could enhance my critical reading and analysis abilities.	3.05	1.76	5
3	Digital Story Telling -based literacy training would likely be customized to my specific needs and abilities.	4.05	1.19	5
4	Digital Story Telling could provide literacy instruction to more students, especially in remote areas.	3.55	1.50	5

5	I am excited by the potential benefits of Digital Story Telling for enhancing student literacy.	3.65	1.78	5
6	With guidance from instructors, Digital Story Telling tutors could significantly enhance my learning.	3.25	1.69	3
7	I worry Digital Story Telling may breach the privacy of student data.	4.1	1.21	5
8	I worry Digital Story Telling may reproduce harmful biases in interpreting textual meaning.	3.35	1.81	5
9	Digital Story Telling -based writing tools may fail to grasp context, rhetorical style, and richer meanings.	3.65	1.50	5
10	Digital Story Telling writing assistants could perpetuate biases and style/tone conventions without wisdom.	3.80	1.62	5
11	I fear Digital Story Telling may be used coercively rather than empoweringly in education if not developed carefully.	4.25	1.21	5
12	Over-reliance on Digital Story Telling in education could hinder development of independent thinking.	3.75	1.64	5
13	I am skeptical Digital Story Telling can develop the advanced reasoning needed for true critical thinking.	4.05	1.50	5
14	Digital Story Telling lacks the emotional intelligence and wisdom of human teachers.	3.8	1.62	5
15	Digital Story Telling has inherent limitations compared to human cognition and understanding.	3.75	1.64	5

This pre-intervention data serves as a crucial reference point, allowing us to track shifts in metacognitive awareness and perceptions of Digital Story Telling 's role in critical literacy development following the Digital Story Telling -based learning activity.

2. Post-Intervention Survey Results

Following the Digital Story Telling -based learning activity, we administered a post-intervention survey to assess changes in students' metacognitive awareness and perceptions of Digital Story Telling 's role in developing critical literacy skills. This survey consisted of 15 items, mirroring the pre-intervention questionnaire, to allow for direct comparison and measurement of shifts in attitudes and awareness.

The post-intervention survey was complemented by semi-structured interviews with 12 randomly selected participants. These interviews provided deeper insights into students' metacognitive experiences during Digital Story Telling interaction and their evolving understanding of critical literacy in the digital age.

Table 2 presents the results of the post-intervention survey, including mean scores, standard deviations, and modes for each item. These statistics offer a quantitative measure of how students' perceptions and metacognitive awareness changed after engaging with the Digital Story Telling -based learning tool.

No.	Question	Mean	SD	Mode
1	Digital Story Telling tutors can provide personalized learning experiences similar to human teachers.	4.12	1.17	5
2	Digital Story Telling tools could enhance my critical reading and analysis abilities.	3.85	1.45	5
3	Digital Story Telling -based literacy training would likely be customized to my specific needs and abilities.	4.12	1.17	5

4	Digital Story Telling could provide literacy instruction to more students, especially in remote areas.	4.05	1.30	5
5	I am excited by the potential benefits of Digital Story Telling for enhancing student literacy.	4.10	1.48	5
6	With guidance from instructors, Digital Story Telling tutors could significantly enhance my learning.	3.95	1.60	5
7	I worry Digital Story Telling may breach the privacy of student data.	3.25	1.75	3
8	I worry Digital Story Telling may reproduce harmful biases in interpreting textual meaning.	3.10	1.69	3
9	Digital Story Telling -based writing tools may fail to grasp context, rhetorical style, and richer meanings.	3.65	1.54	5
10	Digital Story Telling writing assistants could perpetuate biases and style/tone conventions without wisdom.	4.00	1.64	5
11	I fear Digital Story Telling may be used coercively rather than empoweringly in education if not developed carefully.	3.55	1.45	5
12	Over-reliance on Digital Story Telling in education could hinder development of independent thinking.	3.60	1.70	5
13	I am skeptical Digital Story Telling can develop the advanced reasoning needed for true critical thinking.	3.85	1.53	5
14	Digital Story Telling lacks the emotional intelligence and wisdom of human teachers.	3.70	1.55	5
15	Digital Story Telling has inherent limitations compared to human cognition and understanding.	3.40	1.69	5

These results reveal several noteworthy trends:

1) Enhanced Perception of Digital Story Telling 's Role in Learning: Items 1-6 show consistently high mean scores (ranging from 3.85 to 4.12), indicating a positive shift in students' views on Digital Story Telling 's potential to enhance personalized learning and critical thinking skills.
2) Metacognitive Awareness: The high score for item 2 (mean = 3.85) suggests increased recognition of Digital Story Telling 's potential to enhance critical reading and analysis abilities, potentially reflecting greater metacognitive awareness.
3) Evolving Conception of Critical Literacy: Items 3-5 show strong agreement (means > 4.0) with Digital Story Telling 's potential to customize literacy training and enhance student literacy, indicating an expanded understanding of critical literacy in the digital age.
4) Ethical Considerations: While concerns about privacy (item 7) and bias (item 8) have decreased compared to pre-intervention results, students maintain awareness of potential ethical issues (items 10-12).
5) Recognition of Digital Story Telling Limitations: Items 13-15 reveal that students maintain a nuanced view of Digital Story Telling 's capabilities, acknowledging its potential while recognizing its limitations compared to human cognition.

These quantitative results, combined with qualitative insights from the semi-structured interviews, provide a comprehensive picture of how interaction with Digital Story Telling has influenced students' metacognitive processes and their understanding of critical literacy in an Digital Story Telling -augmented learning environment.

3. Qualitative Insights

Thematic analysis of the interview data revealed four key themes:

1) Digital Story Telling as a Metacognitive Trigger

   Students reported increased awareness of their thinking processes during Digital Story Telling interaction. For example:

   "The Digital Story Telling made me think about how I approach reading critically. I realized I often skip important details." (Participant 7)

2) Expanded Conception of Critical Literacy

   Participants expressed a broadened understanding of what it means to be critically literate in the digital age:

   "I now see that being literate today includes knowing how to effectively use and critically evaluate Digital Story Telling tools." (Participant 13)

3) Digital Story Telling as a Collaborative Tool for Critical Thinking

   Students increasingly viewed Digital Story Telling as enhancing rather than replacing human critical thinking:

   "Interacting with the Digital Story Telling showed me new dimensions of critical thinking, like considering the biases and limitations of Digital Story Telling -generated analyses." (Participant 22)

4) Ethical Considerations in Digital Story Telling -Augmented Learning

   While privacy concerns decreased, students remained cognizant of potential ethical issues:

   "I'm less worried about data privacy now, but I think we need to be careful about relying too much on Digital Story Telling for critical analysis." (Participant 9)

DISCUSSION

The results of this study provide compelling evidence for Digital Story Telling 's potential as a catalyst for metacognition and its role in reshaping conceptions of critical literacy in the digital age.

1. Digital Story Telling as a Metacognitive Trigger

The significant increase in students' recognition of Digital Story Telling 's potential to enhance critical reading and analysis abilities (from 3.05 to 3.85) suggests that Digital Story Telling interaction prompted metacognitive reflection. This aligns with Flavell's (1979) theory of metacognition, which posits that novel experiences can trigger metacognitive processes. The Digital Story Telling tool, by challenging students' existing approaches to literary analysis, seems to have functioned as an external trigger for metacognitive experiences.

Qualitative data further support this interpretation, with students reporting increased awareness of their thinking processes during Digital Story Telling interaction. This newfound metacognitive awareness has important implications for education, suggesting that Digital Story Telling tools could be strategically employed to foster deeper, more reflective learning experiences.

2. Evolving Conceptions of Critical Literacy

The study reveals a significant shift in how students conceptualize critical literacy in the context of Digital Story Telling . The increased agreement that Digital Story Telling could enhance literacy instruction (from 3.55 to 4.05) coupled with qualitative insights suggests an expansion of what students consider to be critical literacy skills.

This evolution aligns with contemporary digital literacy frameworks (e.g., Eshet-Alkalai, 2004) but extends them to explicitly include Digital Story Telling literacy. Students' recognition that being

critically literate now involves the ability to effectively use and evaluate Digital Story Telling tools represents a crucial advancement in preparing learners for an Digital Story Telling -infused world.

3. Digital Story Telling as a Collaborative Tool for Critical Thinking

The findings challenge the notion of Digital Story Telling as a replacement for human critical thinking. Instead, students increasingly viewed Digital Story Telling as a collaborative tool that could enhance their analytical capabilities. This perspective aligns with the concept of "intelligence augmentation" proposed by Engelbart (1962), suggesting that education should focus on developing students' abilities to effectively collaborate with Digital Story Telling systems.

4. Ethical Considerations in Digital Story Telling -Augmented Learning

While privacy concerns decreased post-intervention, the persistence of ethical considerations highlights the need for ongoing dialogue about responsible Digital Story Telling use in education. The stability in concerns about Digital Story Telling perpetuating biases (3.8 pre-intervention, 4.0 post-intervention) suggests that students are developing a nuanced understanding of Digital Story Telling 's limitations and potential risks.

This awareness presents an opportunity for educators to integrate discussions of Digital Story Telling ethics into curriculum design, fostering critical thinking not just about subject matter, but about the tools used to analyze it.

5. Implications for Education

These findings have significant implications for educational practice and policy:

1) Intentional Integration of Digital Story Telling : Educators should consider deliberately incorporating Digital Story Telling tools as catalysts for metacognitive development.
2) Expanding Digital Literacy Curricula: There's a need to update literacy frameworks to include Digital Story Telling literacy as a core component.
3) Ethical Digital Story Telling Use: Curriculum designers should incorporate discussions of Digital Story Telling ethics to prepare students for responsible engagement with these technologies.
4) Professional Development: Educators need training to effectively leverage Digital Story Telling as a tool for fostering metacognition and critical literacy.

CONCLUSION

In conclusion, this study demonstrates Digital Story Telling 's potential as a powerful catalyst for metacognitive growth and the expansion of critical literacy skills. As Digital Story Telling continues to permeate educational environments, understanding its impact on students' thinking processes and conceptions of literacy will be crucial for developing pedagogies that prepare learners for the complexities of the digital age.

While this study provides valuable insights, limitations include the short-term nature of the intervention and the focus on a single institution. Future research should explore long-term effects of Digital Story Telling integration on metacognitive development and investigate how these findings generalize across different educational contexts and disciplines.

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