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Interactive Animated Multimedia as Cognitive Scaffolding: The Process of Story-Plot Comprehension and Narrative Creativity through Project-Based Learning

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ABSTRACT

This qualitative case study explored the process of story-plot comprehension and the creative process of 15 fourth-grade students at UPT SD Negeri Panyuran 2 Palang during Indonesian language learning using interactive animated multimedia integrated with Project-Based Learning (PjBL). Data were collected through participatory observation across five sessions, semi-structured interviews with three key student informants and one classroom teacher, and documentation of student projects. Data were analyzed interactively using data reduction, coding, data display, and conclusion drawing.

The findings indicate that plot comprehension occurs in four stages: observing visualization, identifying structure, analyzing cause-and-effect relationships, and reconstructing the plot. Meanwhile, the students' creative process comprises five stages: idea generation, outline development, drafting, product refinement, and presentation. Interactive multimedia provides significant cognitive support in visualizing and organizing story information, whereas PjBL and collaboration foster story development, revision, and project completion. This study provides a process-level contribution explaining how the integration of multimedia and PjBL operates effectively in primary classroom settings.



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INTRODUCTION

Narrative literacy is an important foundation for elementary school students, not only as a skill for absorbing information but also as a means of communicating ideas accurately (Odi et al., 2025). In Indonesian language learning, the ability to understand story plots and narrative creativity is an important indicator because it reflects higher-order cognitive abilities in processing textual meaning while developing ideas imaginatively (Sa'adi & Wiranti, 2023). However, most studies on narrative literacy in elementary schools still focus on measuring learning outcomes through test scores as indicators of instructional success, while the cognitive and creative processes accompanying such improvement are rarely explored in depth (Qondias et al., 2025).

A previous quantitative study involving the same subjects and setting, namely fourth-grade students at UPT SD Negeri Panyuran 2, Palang District, demonstrated that the implementation of interactive animated multimedia based on Project-Based Learning (PjBL) significantly improved students' story-plot comprehension and narrative creativity, with N-Gain scores in the moderate category for both variables (Alfiyanti et al., 2026). These findings confirm the effectiveness of the intervention statistically, but they do not explain how learning occurred to produce the improvement. Questions concerning the mechanism how and why students were able to understand story plots better and produce more creative narrative works require deeper investigation that cannot be answered solely through numerical data.

Narrative information presented abstractly through text alone tends to impose a cognitive burden on elementary school students' working memory. Cognitive Load Theory explains that learning occurs optimally when the demands placed on short term working memory do not exceed its capacity (Sweller, 2023). Meanwhile, the Cognitive Theory of Multimedia Learning emphasizes that combining verbal and visual

components can optimize how the brain processes information and strengthen students' memory of learning materials (Mayer, 2024), consistent with findings that interactive multimedia can significantly improve elementary students' cognitive learning outcomes (Ulfa et al., 2024). These theoretical frameworks indicate that interactive animated multimedia may function as cognitive support (scaffolding) for students when processing complex narrative information. However, how this function manifests concretely in classroom interaction has not been widely examined through qualitative approaches. In addition, the improvement of students' narrative creativity needs to be understood through a constructivist perspective, which views knowledge and creativity as actively constructed by students through meaningful learning experiences (Setiawan et al., 2021). PjBL provides such a context through authentic project work that requires students to generate ideas, develop outlines, draft stories, and present their work. Several studies have demonstrated that integrating interactive multimedia with PjBL can improve student engagement and learning outcomes, including multimedia developed with Articulate Storyline (Marpelin et al., 2023; Nasril & Desyandri, 2023), interactive storyboards for creative thinking skills (Sulhaliza et al., 2024) and digital technology-based multimedia in thematic learning (Darma et al., 2024; Eka Yulianti et al., 2024; Lisa Ariyani et al., 2025; Widianita & Sujana, 2024).

Nevertheless, most previous studies generally stop at demonstrating statistical effects or effectiveness, without describing in detail the stages students experience when understanding story structures or the creative processes they undergo during project-based learning. Understanding these processes is important for teachers in designing more targeted instruction, not merely knowing that an intervention "works," but also understanding "how" and "why" the success occurs (Telaumbanua, 2024).

The research gap lies in the limited number of studies that simultaneously trace the stages of story-plot comprehension and narrative creativity within a single sequence of interactive multimedia and PjBL learning. The novelty of this study does not lie in claiming that multimedia or PjBL is generally effective, but in identifying process stages that can be observed and traced through observation, interviews, and documentation. Thus, the new contribution is a process model showing that multimedia primarily supports visualization, structural recognition, and organization of story information, while PjBL provides a context for developing, revising, and communicating narrative works.

Theoretically, the function of multimedia is examined using Cognitive Load Theory (CLT) and the Cognitive Theory of Multimedia Learning (CTML). CLT explains that working-memory capacity is limited, so instructional design needs to manage information complexity and processing activities (Sweller, 2023). CTML emphasizes that multimedia learning involves verbal and visual channels with limited capacity as well as active processes for selecting, organizing, and integrating information (Mayer, 2024).

This study does not directly measure cognitive load; therefore, the terminology used is cognitive support or an indication of a scaffolding role, rather than a claim that the media has been proven to reduce cognitive load. This approach is more appropriate to the qualitative nature of the data collected.

For the creativity dimension, constructivism is used to explain that knowledge is constructed through experience and interaction. PjBL provides opportunities for students to work with problems or questions, develop products, receive feedback, and reflect. This finding is consistent with empirical research indicating that Project-Based Learning (PjBL) tends to have a positive direction of influence on academic achievement and higher-order thinking skills (HOTS), although the quality and variation of evidence across studies

should still be considered based on classroom characteristics and the readiness of the instructional syntax (Umayroh & Siregar, 2024). Within this framework, the study does not treat multimedia and PjBL as two independent treatments, but analyzes which parts of the process are more directly supported by multimedia and which emerge primarily through project activities and collaboration.

Based on the discussion above, the objectives of this study are: (1) to describe the stages of students' process in understanding fictional story plots during learning using interactive animated multimedia based on PjBL; (2) to describe the stages of students' creative processes in developing narrative projects; and (3) to explain the division of roles between multimedia as cognitive support and PjBL as a collaborative context in these processes.

RESEARCH METHOD

This study employed a qualitative approach with a case study design. The case was clearly bounded to the narrative literacy learning process of fourth-grade students at UPT SD Negeri Panyuran 2, Palang District, across five learning sessions using interactive animated multimedia integrated into the PjBL syntax. The scope included observing the story, identifying plot structure, discussing cause-and-effect relationships, designing the project, developing drafts, revising, and presenting the final work. The study was not intended to generalize statistical outcomes to a wider population.

The participants consisted of 15 fourth-grade students who completed the entire learning sequence. In the thesis research, all 15 students were quantitative subjects, whereas three key informants were purposively selected for qualitative exploration based on variations in story-plot comprehension: R-1 (high), R-2 (moderate), and R-3 (low), together with one fourth-grade classroom teacher as a supporting informant. The ability categories followed the

research rubric: 76–100 = high, 56–75 = moderate, and ≤ 55 = low. The three informants were retained under the codes R-1, R-2, and R-3 to maintain analytical traceability without revealing student identities. The selection was intended to capture variations in learning experiences, particularly in understanding conflict, reconstructing plots, and developing stories.

Data were collected through three main techniques: participatory observation, semi-structured interviews, and documentation. Participatory observation was conducted throughout the learning sequence to obtain data on students' activities during learning with interactive animated multimedia. Observation indicators included: (1) students' attention and engagement while observing the interactive animated multimedia; (2) active participation in expressing ideas and discussing within groups; (3) ability to develop ideas into narrative projects; (4) creativity in organizing and developing project content; (5) ability to collaborate during project development; and (6) ability to present the completed work. Observation covered the initial learning stage, core activities, narrative project development, and presentation of results. The instruments consisted of an observation sheet and field notes developed from indicators of learning activities and student creativity.

Semi-structured interviews were conducted with the teacher and students after the learning activities to obtain deeper information about experiences, perceptions, responses, and thought processes that could not be directly observed. The interview guide addressed experiences with interactive animated multimedia, ease and difficulty in understanding the material, experiences in discussing and developing ideas, the narrative project development process, and perceptions of the learning activities and resulting works. Interviews were conducted flexibly while referring to prepared core questions, allowing the researcher to develop follow-up questions

according to informants' responses. The interview instrument was a semi-structured interview guide.

Documentation was used as supporting data to strengthen observation and interview findings. Documentation included photographs of learning activities, field notes, and students' narrative projects. Documentation was collected during learning, particularly during multimedia observation, group discussion, project development, and presentation. Narrative projects served as physical evidence for examining the creative process and products produced by students.

Data collection was conducted during the learning implementation, while interviews were carried out after learning so that teachers and students could reflect on their learning experiences. Before use, the observation sheet and interview guide were reviewed to ensure alignment between indicators, research objectives, and the aspects to be explored. Instrument feasibility was obtained through expert validation by experts with competence in education and/or research methodology. Validation feedback was used to improve language clarity, indicator suitability, question relevance, and representation of the measured aspects before the instruments were used.

The collected observation, interview, and documentation data were processed before further analysis. Observation data were organized according to predetermined indicators, while interview results were transcribed in full from recordings or interview notes. Documentation was inventoried and grouped according to stages of learning activities. All data were then checked for completeness, coded according to source and data type, and grouped according to research themes or focus. This initial processing facilitated systematic reduction, organization, and analysis and enabled triangulation across observation, interview, and documentation data.

Data analysis followed the interactive model of Miles et al. (2014) consisting of interconnected

stages of data condensation, data display, and conclusion drawing and verification. Analysis began by repeatedly reading and reviewing all observation, interview, and documentation data to gain an overall understanding. Coding was then conducted by assigning codes to portions of data indicating student activities, experiences, responses, or thought processes relevant to the research focus. Codes with similar meanings were grouped into broader categories. For example, data concerning students' attention to animation, identification of characters, recognition of event sequences, and connection between events were categorized as story-plot comprehension. Data concerning the emergence of ideas, story development, use of imagination, and independent story construction were categorized as students' creative processes. Categories were then compared and connected to identify themes representing the main patterns in the data.

After coding, categorization, and theme development, the data were presented in narrative descriptions and thematic matrices linking themes to research evidence. This presentation was used to examine relationships among observed activities, informants' experiences, and physical evidence produced during learning. Conclusions were then drawn by identifying patterns, relationships, and tendencies within each theme. Conclusions were not established from a single data source but were continuously verified by comparing findings across sources and data collection techniques until consistent and defensible findings were obtained.

Data trustworthiness was examined through technique triangulation and source triangulation. Technique triangulation compared information obtained through observation, interviews, and documentation regarding the same phenomenon. For example, observation indicated that students began to identify event sequences after observing the interactive animated multimedia. This finding was confirmed through student interviews

indicating that animation helped them understand events sequentially and determine the beginning, middle, and end of the story. The finding was further supported by documentation of narrative projects showing more orderly event sequences. Thus, consistency among observed behavior, students' explanations, and evidence from their work strengthened the finding that interactive animated multimedia supported the story-plot comprehension process.

Source triangulation compared information obtained from students and teachers regarding the same phenomenon. When observation indicated that students actively developed ideas while preparing narrative projects, this information was compared with students' descriptions of how they found and developed story ideas and teachers' descriptions of changes in student engagement and creativity. When the three sources showed consistent tendencies, the data were considered to have stronger consistency. When differences were found, the researcher reviewed observation notes, interview results, and documentation to understand the context before establishing the final interpretation. This triangulation ensured that findings were not based on a single type of data or informant but were strengthened through interconnected evidence.

Overall, the findings were obtained through systematic stages, beginning with identifying relevant data, assigning codes, grouping codes into categories, determining themes, presenting data, and drawing and verifying conclusions. In this way, the conclusions represent interpretations supported by empirical evidence from observation, interviews, and documentation and checked for consistency through technique and source triangulation. Pretest and posttest data on story-plot comprehension and narrative creativity were not reanalyzed in this article; they were used only as supporting context by referring to the results reported in detail in the accompanying quantitative study (Alfiyanti et al., 2026).

RESULTS AND DISCUSSION

RESULTS

Learning Context

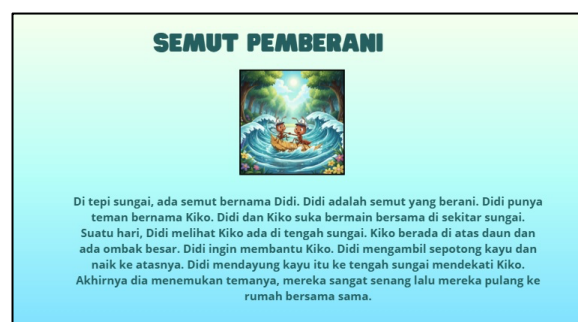
Before the implementation of learning, initial observation showed that students' abilities to understand story plots and develop narratives varied. Some students were able to identify characters and major events but were not yet able to explain cause-and-effect relationships in the story. Students tended to mention events separately without explaining how one event influenced the next. This condition was visible in initial observation notes; when students were asked to retell the story, some could only describe the sequence generally and could not answer questions about why an event occurred. In writing activities, most initial works were still descriptive, focusing on characters or events without clearly constructing a chain of cause-and-effect relationships.

Differences in initial ability were also visible in students' responses when asked to explain the story. Students with stronger comprehension tended to connect several events, whereas students with lower comprehension still needed guiding questions to identify cause-and-effect relationships. Interviews with students with higher ability indicated that plot comprehension involved identifying event sequences as well as cause-and-effect relationships among events. The student stated that animation made the plot easier to understand because each character's action and its consequence could be observed directly. This understanding was then used to construct a narrative project in which events were connected and formed a coherent story. Conversely, an interview with a student with lower initial ability showed difficulty in understanding cause-and-effect relationships. The student could mention several characters and events but had difficulty determining which event occurred first and explaining why one event caused the next. The student also reported that the story became easier to understand after repeatedly watching

the animation and receiving guiding questions from the teacher or discussing with peers. These different responses indicate that difficulties in understanding plot were not uniform but were related to students' ability to identify causal relationships in stories.

The initial condition was also confirmed by the teacher. The teacher explained that some students initially had difficulty understanding cause-and-effect relationships and developing events into a coherent plot. According to the teacher, students were generally able to mention characters and events in the story but were not consistently able to explain causal relationships or develop events into complete narrative writing. The teacher also stated that some students still needed guiding questions and direction when determining event sequences and developing story ideas. This statement was consistent with observations showing that students still needed assistance in developing events into coherent stories. Thus, observation and interviews provided complementary descriptions of the students' initial condition.

Figure 1. Initial Student Work



Note. Original text is in Indonesian; translated by the researchers.

Title: "The Brave Ant." Story: "By the riverside, there was an ant named Didi. Didi was a brave ant. Didi had a friend named Kiko. Didi and Kiko liked to play together near the river. One day, Didi saw Kiko in the middle of the river. Kiko was on a leaf, and there were big waves. Didi wanted to help Kiko. Didi picked up a piece of wood and got on it. Didi paddled the wood to the middle of the river to get closer to Kiko. Finally, he found his friend, and they happily went home together."

Figure 1 shows that students' work was still dominated by descriptions of characters and

events, while cause-and-effect relationships and conflict development were not yet clearly visible.

This initial condition, which was quantitatively described in greater detail in the accompanying study (Alfiyanti et al., 2026), served as a basis for tracing the learning process and changes occurring during implementation. The focus of this study was not to repeat the quantitative analysis but to explain how students experienced the process of understanding story plots and developing narrative creativity through project-based learning supported by interactive animated multimedia.

Learning was conducted in five sessions following the stages of Project-Based Learning (PjBL): formulating a driving question, designing the project, preparing a work schedule, monitoring project progress, assessing the results, and reflecting on the learning experience. Interactive animated multimedia was consistently used at each stage as a visual and narrative stimulus that helped students observe characters, settings, event sequences, conflicts, and story resolutions. Multimedia was not merely positioned as a means of delivering material but became part of students' processes of observing, discussing, interpreting, and developing story ideas.

Observation results showed that the use of animation at the beginning of learning helped students understand important elements of the story. After observing the animation, students began to identify characters, problems, and event sequences. This response indicates that visual stimuli provided a common reference point before students entered discussion and project-development stages. Student interviews also reinforced this finding, with students stating that animation helped them understand the story content and plot more easily.

At the project planning and development stage, differences in student ability became more visible. Students with stronger story comprehension tended to develop ideas more

quickly and connect several events into a complete plot. Students who initially experienced difficulties required guiding questions and group discussion to develop ideas. Observation notes showed differences in responses and levels of engagement. These findings were also supported by interviews with students of different ability levels. Students with stronger abilities demonstrated clearer understanding when explaining the material, whereas students who still experienced difficulties tended to need assistance and guidance in understanding and expressing their thoughts. These differences show that the creative process did not develop identically among all students but emerged through interaction among story comprehension, discussion, animation stimuli, and guidance during project work.

Development of the learning process was also visible in students' work. Initial work showed event sequences that were not yet coherent and relatively simple idea development. In the final projects, students demonstrated better development, characterized by the ability to organize events chronologically, present conflicts and resolutions, and develop story ideas more creatively and originally. This change indicates that the project output was not merely the final product of learning but also evidence of students' development in organizing ideas and constructing cause-and-effect relationships.

Thus, the initial learning context showed a need to help students move from general story understanding toward more structured plot comprehension and from descriptive writing toward narratives with clear causal relationships. Across five sessions, this process was traced through students' activities in observing animation, group discussion, idea development, project construction, and presentation. Evidence from observation, interviews with students of different abilities, teacher interviews, and documentation of student work was used together to explain how the learning process

occurred and how changes in plot comprehension and narrative creativity emerged during implementation.

The Process of Understanding Fictional Story Plots

Analysis of observations and interviews identified four stages in students' understanding of fictional story plots, as presented in Table 1.

Table 1. Stages in Students' Fictional Story-Plot Comprehension Process

Stage	Activity Description	Main Finding
Observing Story Visualization	Students observe interactive animated multimedia presenting the complete fictional story through text, moving images, character illustrations, and audio narration.	Observation showed that 14 of 15 students (93.33%) followed the animation until the end and showed attention to the story visualization. This activity helped students obtain a more concrete picture of characters, event sequences, conflicts, and resolutions.
Identifying Plot Structure	Students recognize parts of the story plot: orientation, conflict, climax, resolution, and moral message.	Animation visualization made it easier for students to recognize conflicts and resolutions that had previously been difficult to understand from text alone.
Analyzing Cause-and-Effect Relationships	Students explain connections among events and reasons for conflicts in the story	Most students were able to explain the reasons for conflicts and their resolutions logically and coherently.
Reconstructing the Story Plot	Students retell the story using	Students were able to reconstruct the plot coherently,

their own language.

from characters and conflict to climax and moral message.

One student in the high-ability category described her experience in an interview as follows.

"When there is animation it is easier to understand the story, so I know which part is the problem and what the ending is like."

This statement illustrates that animated visualization helped students make concrete the abstract concept of story structure, particularly in recognizing conflict and its resolution. The classroom teacher likewise confirmed that the visualization presented through animated multimedia helped students understand the sequence of events more concretely, so that material previously considered difficult became easier to grasp, and that it improved students' ability to identify the orientation, conflict, climax, and resolution of a story.

The Creative Process in Project-Based Learning

Beyond helping students understand story plots, project-based learning also shaped five stages of the students' creative process in producing narrative works, as shown in Table 2.

Table 2. Stages of Students' Creative Process in Developing Narrative Projects

Session	PjBL Stage	Student Activity	Type of Multimedia Used	Data Collected
Session 1	Determining the Driving Question & Project Design (Searching for Story Ideas)	Students observe an animated story on the theme of adventure/fable. Groups discuss and determine the theme, characters, and setting of the story based on inspiration	Interactive Animated Multimedia (interactive animated video as an idea trigger & character simulation)	Story Idea Discussion Worksheet; Observation Notes on Student Interest & Engagement

		from the animation.		
Sessio n 2	Arranging a Schedule & Designing Project Planning (Constructing the Story Outline)	In groups or individually, students construct the story structure (title, characters, onset of conflict, climax, resolution, moral message).	Visual Guidance Multimedia & Outline Diagram (digital template/interactive slides for the narrative plot outline)	Draft of Students' Story Outlines; Observation Notes on Group Discussion
Sessio n 3	Monitoring Project Progress (Developing the Story Draft)	Students develop the story outline into a complete narrative. Students give one another input (peer review) to clarify the causal plot and the development of conflict.	Interactive Learning Multimedia (electronic module / media / examples of narrative conflict construction)	Initial Draft Manuscript of the Narrative Story; Peer-Review Notes / Peer Feedback
Sessio n 4	Testing Results & Assembling the Project Product (Refining the Project Product)	Students revise and improve the story text based on teacher feedback (plot coherence, cause-and-effect relationships, grammar, and moral message).	Visual Workboard / Interactive Digital Module (visual media guiding self-editing/manuscript revision)	Story Text Revision Assessment Sheet (Narrative Rubric); Final Story Work (Project Product)
Sessio n 5	Evaluating the Experience & Presenting the Project (Presenting Project Results)	Students present their narrative work before the class. Students answer questions from the teacher and classmates and reflect on their learning.	Interactive Presentation Multimedia (digital slides / visuals supporting students' work)	Performance Assessment Sheet (Presentation & Self-Confidence); Student Reflection Questionnaire / Presentation Documentation

The classroom teacher reported that, with respect to narrative creativity, students were able to develop story ideas more independently and produce work that was more coherent and complete, and that the PjBL model provided meaningful learning experiences through collaborative activities that improved students' cooperation skills and sense of responsibility in completing projects. Even so, the teacher also noted constraints in the form of limited instructional time and variation in students' initial ability, which were addressed through more intensive guidance and more effective management of learning groups.

Interactive Animated Multimedia as Cognitive Scaffolding

The findings of this study show that interactive animated multimedia does not merely function as a medium of visualization, but as cognitive scaffolding a temporary supporting structure that guides students' thinking as they construct abstract concepts of narrative structure until they attain learning independence. Under conventional instructional conditions, students often encounter obstacles because they are required to imagine the sequence of events, causal reasoning, the dynamics of conflict, and the climax and resolution of a story solely through reading text. This limitation in visualization results in a fairly high level of mental difficulty in absorbing and assembling the story plot.

To overcome this obstacle, interactive animated multimedia in the form of an e-module based on an interactive application was integrated into the instruction. The media was designed with a precisely limited duration (approximately 5–7 minutes per trigger clip) in order to maintain students' focus and attention retention. Technically, the media was equipped with several mutually supporting key features:

- Interactive features: control buttons (play, pause, replay) and interactive quiz features with branching plot lines that give students

the opportunity to choose the course of the story.

- b. Visual and text elements: dynamically moving 2D/3D character animation combined with dialogue text in speech balloons using a legible typeface.
- c. Audio elements: clear voice narration combined with contextual sound effects to reinforce the atmosphere and emotion of the story.

In classroom implementation, the media was used flexibly: beginning with whole-class playback by the teacher as a stimulus, followed by independent exploration in pairs or groups using digital devices.

The integration of this media blended harmoniously into the Project-Based Learning (PjBL) syntax, in which multimedia and PjBL activities divided their roles proportionally and complementarily:

1. Specific contribution of interactive animated multimedia: focused mainly on the conceptualization and visual comprehension stage. The media presents a concrete realization of abstract concepts such as how a triggering problem develops into a main conflict and finds its solution through the synthesis of text, image, and sound. This process provides an initial foothold (visual scaffolding) that makes it easier for students to grasp narrative structure before they begin to express their own ideas.
2. Specific contribution of PjBL activities and collaboration: focused mainly on the stage of deep idea processing, reasoning, and articulation of work. Upon entering the PjBL syntax group discussion, story outline construction, peer review, and independent revision students are invited to engage in active critical thinking. These social activities facilitate students in constructing cause-and-effect relationships in depth within their written drafts, improving linguistic structure, and building the confidence to present their work before the class.

Through this mutually reinforcing division of roles, interactive animated multimedia acts as visual support at the outset (cognitive scaffolding), while the collaborative process within PjBL becomes the actual space in which students process ideas, reflect, and produce complete and authentic narrative products.

The Relationship of Multimodality to Narrative Literacy

Another finding indicates a connection between multimodal presentation (visual, verbal, and audio) and the development of students' narrative literacy, which in this study is understood not only as the ability to comprehend the content of a story but also as the ability to develop ideas, compose narratives coherently, and communicate ideas through writing. An interesting finding from observation and interviews is that the story visualization presented did not lead students merely to imitate the story shown; rather, the multimedia stimulated students' imagination to develop their own story ideas different from the examples provided by the teacher, in line with students' increasing confidence in presenting their work.

DISCUSSION

The finding regarding the function of interactive animated multimedia as cognitive scaffolding offers a deeper explanation of how media helps students comprehend story plots. In this study, animation did not merely serve as an aid for attracting attention, but also provided cognitive support through the visual, gradual, structured, and contextual presentation of information. This support helped students organize story information that was initially abstract into more concrete representations, particularly when students had to identify characters, conflict, sequence of events, causal relationships, and resolution. Scaffolding within multimedia can therefore be understood as temporary assistance that guides students in

processing complex information until they are able to construct understanding more independently.

This finding reinforces the perspective of Cognitive Load Theory, which explains that human working memory capacity is limited. When students receive story information only through text or verbal explanation, they must carry out various mental processes simultaneously, such as retaining information, connecting events, imagining story situations, and determining cause-and-effect relationships. Such conditions can generate processing obstacles unrelated to the instructional objectives. Structured animated presentation is indicated to function as cognitive support because important information about events, characters, conflict, and resolution is displayed through visual representations that are easier to follow (Juliani & Ibrahim, 2023; Kusumajanti, 2023). Animation thus demonstrates cognitive support that allows the cognitive capacity students previously used to build a basic mental image to be redirected toward more meaningful processing, such as interpreting the relationships among events and understanding the development of the story's conflict (Fitriana et al., 2021).

This relationship is further reinforced by the Cognitive Theory of Multimedia Learning, which states that learning can proceed more effectively when information is presented through verbal and visual channels in an integrated manner rather than through words alone (Mayer, 2024). In the context of this study, moving images, character expressions, scene changes, and visual sequencing provided cues that helped students connect visual information with verbal explanation. This process enabled students to build a more complete mental representation of the story. It can explain the finding that students more readily identified conflict and resolution after observing the animated visualization. In other words, the effectiveness of multimedia is not due simply to movement or visual appeal, but to

the fact that such visualization helps students select relevant information, organize it, and then integrate it with prior knowledge.

Related to constructivist theory, this scaffolding function shows that multimedia does not directly "transfer" knowledge from the media to the student. Rather, the media provides experiences and representations that allow students to build their own understanding through the processes of observing, connecting, interpreting, discussing, and producing stories. The teacher's position in this process is not that of the sole source of information, but that of a facilitator who provides assistance when students encounter difficulty and gradually reduces that assistance as students' ability increases. There is thus a complementary relationship between constructivism and scaffolding: multimedia provides the learning environment and representations, while teacher interaction and student activity determine how those representations are constructed into knowledge.

This finding also offers the important perspective that interactive multimedia does not always produce better learning simply because it employs many visual elements. The principles of Cognitive Load Theory in fact show that excessive animation, irrelevant decoration, overly dense text, or movement unrelated to story content can increase cognitive load and disrupt the learning process. The results of this study are therefore more appropriately understood as evidence that multimedia functions as cognitive scaffolding when its visual design is relevant to the learning objectives and helps students understand the structure of the information. In this study, animation that displayed the sequence of story events in a structured manner provided support that matched students' need to understand chronological and causal relationships within the story.

The intersection of these three perspectives points to a continuous learning mechanism. Interactive multimedia provides structured visual

and verbal representations; those representations are indicated to serve as cognitive support that helps students manage the limitations of working memory. The presence of animation and interactive media demonstrates cognitive support that enables students to focus attention on relevant information. Subsequently, through a constructivist process, students connect new information with prior knowledge and build an understanding of story structure. That understanding then becomes the basis for students to produce new narratives in a more purposeful way.

Accordingly, the improvement in story-plot comprehension and narrative creativity in this study cannot be explained by the presence of animated media alone, but by the interaction among multimedia design, cognitive support, students' constructive activity, and the application of Project-Based Learning (PjBL).

From the PjBL perspective, this process is strengthened further because students do not stop at receiving and comprehending stories but are directed to use their understanding as a basis for producing a narrative product or work. When students identify story elements, reconstruct the sequence of events, determine conflict and resolution, and then develop story ideas into a product, a shift occurs from the process of comprehending to the process of creating. The cognitive scaffolding provided by multimedia in the early stage thus functions as a bridge toward independent thinking in the subsequent stage. The visual assistance that initially made it easier for students to comprehend the story can be gradually reduced once students begin to be able to determine structure and develop stories on the basis of their own understanding.

On the creativity dimension, the stages of the creative process identified in this study from searching for ideas to presenting project results reflect the constructivist principle that knowledge and creativity are actively built by students through meaningful learning experiences

(Setiawan et al., 2021). This process gives students latitude to explore various possible story resolutions, consistent with the findings of Emira Hayatina Ramadhan and Hindun (2023) which show that project-based learning models encourage students to think more creatively when faced with open-ended tasks, and with the finding that visually supported interactive media fosters children's creative thinking ability in composing stories (Sulhaliza et al., 2024).

The process findings of this study extend the scope of previous research, which has generally focused on media feasibility, levels of student engagement, or general improvement in learning outcomes through the use of interactive multimedia and Project-Based Learning (PjBL). Earlier studies have shown that project-based multimedia can support the continuity of thematic learning (Darma et al., 2024), as well as the effectiveness of interactive multimedia based on Problem-Based Learning in the context of Indonesian language learning (Eka Yulianti et al., 2024). In contrast to those studies, the present research does not merely measure the effectiveness of an intervention, but describes comprehensively the process mechanism explaining the complementary interaction between animation-based interactive multimedia and PjBL in the teaching of fictional narrative texts. Within that mechanism, interactive animated multimedia is indicated to serve as cognitive support that facilitates students in visualizing characters, plot, sequence of events, conflict, and story resolution in a more structured way. This solid visual understanding then becomes the fundamental basis for students to participate optimally in every stage of PjBL, from idea generation and the construction of narrative work to revision and presentation. Theoretically, these findings reveal a learning pathway of visualization and plot comprehension, idea development, work construction, revision, presentation, and reflection. Multimedia functions primarily at the stage of building mental representations and

understanding story structure, while PjBL provides space for students to transform that understanding into narrative work through processes of creation and improvement. This mechanism shows that plot comprehension and narrative creativity do not develop separately but are mutually related: understanding story structure becomes the basis for producing work, while the process of composing and revising work in turn strengthens students' understanding of plot.

Overall, these findings confirm that the success of PjBL-based interactive animated multimedia, as statistically demonstrated in the companion study (Alfiyanti et al., 2026), does not occur instantaneously, but through a series of structured cognitive and creative processes that can be identified stage by stage, thereby providing a more complete understanding of how technology-based narrative literacy instruction can be designed effectively in elementary schools.

CONCLUSION AND SUGGESTIONS

This study concludes that the improvement of fourth-grade elementary students' story-plot comprehension and narrative creativity through Project-Based Learning (PjBL)-based interactive animated multimedia takes place through a process that can be identified stage by stage. The process of comprehending story plot comprises four stages: observing the story visualization, identifying plot structure, analyzing cause-and-effect relationships, and reconstructing the story plot. Meanwhile, the creative process in constructing narrative projects proceeds through five stages: searching for story ideas, constructing the story outline, developing the draft, refining the product, and presenting the project results. Within this process, interactive animated multimedia demonstrates cognitive support through visual and structured presentation that helps students understand story elements and causal relationships, while PjBL provides a constructive learning space for students to

develop, revise, and communicate narrative work actively. These findings enrich the evidence of effectiveness previously reported statistically in the companion study by explaining the process mechanism underlying the development of story-plot comprehension and narrative creativity.

Based on these findings, fourth-grade elementary teachers are advised to attend to the stages of students' plot comprehension and creative processes as a basis for designing instruction using interactive animated multimedia and PjBL. The use of multimedia should not be limited to screening animations, but should be directed toward helping students observe, identify, and connect the elements of story plot before entering project activities. Furthermore, the stages of PjBL need to be facilitated systematically through idea development, outline construction, draft writing, revision, and presentation, so that students have the opportunity to build and develop narrative work gradually. Schools are advised to support teachers in group management, the provision of multimedia facilities, and the allocation of instructional time so that every stage of learning can proceed optimally. Future research may examine similar processes with different text types, subject matter, or grade levels, and explore the factors producing variation in learning processes among individual students, so that understanding of the mechanisms of technology-based narrative literacy instruction in elementary schools can be developed more comprehensively.

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