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DEVELOPING AND EVALUATING AN AUGMENTED REALITY (AR) DIGITAL STORYTELLING VIDEO TO FOSTER MULTIMODAL LITERACY AND NARRATIVE COMPREHENSION

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Abstract

This study proposes the development of an augmented reality (AR)-based digital storytelling video, grounded in the systemic functional linguistics genre-based approach (SFL-GBA), to enhance Indonesian students' reading comprehension of narrative texts. Leveraging the multimodal affordances of augmented reality (AR) and the pedagogical strengths of digital storytelling, this project meticulously integrates text-image relations to create a deeply engaging learning experience of reading Indonesian narrative. The video was developed using analysis, design, development, implementation, and evaluation (ADDIE) instructional design model. The results demonstrated a significant 60% improvement in students' reading comprehension of Indonesian narrative texts, particularly in identifying intrinsic story elements, analysing the meaning of the story, and formulating thoughtful responses. Students also reported positive learning experiences with the AR digital storytelling video, highlighting the value of explicit instruction on genre features, scaffolding, and targeted teacher feedback. In conclusion, while AR digital storytelling videos present powerful learning tools, their effectiveness is highly dependent on sound pedagogical strategies and skilled teaching practices.

Keywords: Augmented reality, Digital storytelling, Multimodal affordances, Reading comprehension, SFL-GBA.

1. Introduction

Digital Storytelling (DST), which blends text, images, and audio, has proven effective in enhancing narrative understanding [1, 2]. Reading comprehension, especially in narrative texts, is essential in education, yet Indonesian students face significant challenges in this area [3-5]. Narrative texts not only entertain but also convey cultural and moral values, making their comprehension critical for holistic education [7-9]. When combined with Augmented Reality (AR), DST becomes even more immersive, engaging in multiple senses and improving student motivation [10, 11]. Previous studies regarding AR have been well-documented, and several reports are shown in Table 1 [12-15]. However, there is limited research on integrating DST with AR in teaching Bahasa Indonesia narrative texts, especially within a structured pedagogical framework.

This study aims to develop and evaluate an AR-based DST video to improve Indonesian students' narrative reading comprehension. The research follows the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model and is grounded in the Systemic Functional Linguistics Genre-Based Approach (SFL-GBA) to ensure effective teaching of genre features. The novelty of this research lies in: (i) Integrating AR with DST for Indonesian narrative texts, (ii) Applying SFL-GBA for structured genre-based learning, and (iii) Enhancing multimodal literacy through image-text relations.

Table 1. Previous studies on AR for digital storytelling.

No.	Findings	Ref.
1	AR can contribute to making stories more immersive and engaging for audiences.	[16]
2	the benefits of AR in storytelling are not limited to a single field and can be adapted for various learning contexts within education	[17]
3	AR in digital storytelling can empower learners to engage more directly with the material, potentially leading to deeper understanding and retention.	[18]
4	the importance of thoughtful design and technological implementation to maximize the benefits of AR in educational digital storytelling	[19]
5	Remedial students in a government school exhibited engagement and focus issues during learning sessions, suggesting a need for more engaging educational approaches like digital storytelling (DS)	[20]
6	AR technology significantly improved fifth-graders' narrative skills, story length, and creativity, which were also positively correlated.	[21]
7	The immersion created by digital storytelling advertisements, particularly when enhanced with augmented reality (AR), leads to increased audience interaction and response.	[11]
8	Scripted collaborative digital storytelling significantly improved EFL college students' vocabulary acquisition	[22]

2. Literature Review

2.1. Reading comprehension

Reading comprehension, the cornerstone of literacy, transcends mere word decoding to encompass the intricate process of understanding and interpreting written text [23]. Initial perspectives leaned towards bottom-up processing,

emphasizing sequential decoding [24]. However, contemporary models advocate for an interactive approach, where text-driven and reader-driven processes synergistically construct meaning [25]. Schema theory further illuminates the pivotal role of prior knowledge, suggesting comprehension hinges on connecting new information to existing cognitive frameworks [26]. These foundational theories underscore the active and constructive nature of reading comprehension.

Effective instructional strategies are crucial for fostering reading comprehension. Explicit strategy instruction, reciprocal teaching, collaborative strategic reading, text structure instruction, and targeted vocabulary instruction have all demonstrated positive impacts [27-32]. Furthermore, cultivating motivation and engagement is paramount [33]. Contemporary research explores comprehension in digital environments, multilingual contexts, and the role of affect and reader identity, indicating an evolving understanding of this complex skill [34-36].

Figure 1 illustrates that Reading comprehension is a dynamic cognitive process reliant on the interplay of foundational skills and active strategies. Effective decoding provides the initial access to the text, while vocabulary knowledge enables semantic understanding of individual words. Prior world knowledge furnishes the necessary contextual framework for interpretation and inference. Readers actively employ comprehension strategies to construct meaning and engage with the text. Crucially, monitoring functions as a metacognitive control mechanism, allowing readers to assess their understanding and adjust strategies as needed. This integrated model posits that proficient reading comprehension emerges from the synergistic application of these interconnected components.

Fig. 1. Reading comprehension concept.

2.2. The elements and types of digital storytelling (DST)

This part elaborates on the elements and types of Digital Storytelling. Digital Storytelling (DST) is claimed as a blend of personal narratives consisting of visual elements and audio that carry the reflection, emotion, and personal meanings [37]. Peculiarly, the framework as outlined by the Centre for Digital Storytelling comprises seven key components: point of view, a dramatic question, emotional content, the gift of voice, the power of soundtrack, economy, and pacing. Point of view refers to the author's perspective as represented in the narrative. A dramatic question is a central narrative element that creates tension and is resolved by the story's conclusion. Emotional content encompasses the issues and conflicts that drive the narrative and resonate with the audience. The gift of voice denotes the

way the narrator contextualizes the story, facilitating audience understanding. The soundtrack, including music and sound effects, enhances the story's impact and emotional depth. Economy emphasizes the efficiency of storytelling through concise language and avoidance of extraneous elements. Finally, pacing refers to the tempo and rhythm of the narrative. More than that, in Digital Storytelling, the story should cover particular experiences, events, and a moment of change which can be connected to the personal life circumstances [38].

In the context of teaching digital storytelling, there are six key elements: acquisition, practice, production, discussion, and collaboration [39]. Acquisition involves students gaining the knowledge and skills necessary to create DST, including familiarity with software applications such as Microsoft PowerPoint and Microsoft Photo Story, as well as language skills. Practice entails the development of students' literacy and technical skills in DST, such as voice recording techniques, volume control, pacing, and sentence stress. Production involves students creating digital stories, including the integration of images, text, and audio elements. Discussion provides a platform for students to consult with instructors and peers regarding their creative process. Collaboration involves students working together in the creation of digital stories, often dividing roles such as producer, actor, and editor. Teachers, therefore, should consider both the core elements of digital storytelling and the pedagogical strategies that facilitate its effective implementation in the classroom.

Building upon the aforementioned core elements of digital storytelling, DST is categorised into five primary formats: video, swipeable slide presentations, web stories, visual stories, and listicles [40]. Video has become a dominant format in digital storytelling. The surge in demand for video content has established it as a potent medium for audience engagement, particularly among social media and mobile users. Video's effectiveness stems from its capacity to deliver information in a visual, concise, and highly shareable manner. This is particularly evident in videos that present compelling narratives. The incorporation of sound and subtitles further enhances audience engagement and accessibility. Video stories are frequently employed to convey news, inspirational narratives, and to elucidate concepts in educational contexts [41].

Furthermore, contemporary students, who primarily consume information via smartphones, are accustomed to rapid information access. Swipeable slide presentations, often referred to as horizontal stories, offer an effective DST format in this regard. These presentations consist of succinct text and engaging visuals or videos, optimized for full-screen viewing on mobile devices. The swipeable format enhances audience engagement by creating anticipation for subsequent content, thereby sustaining attention [42].

Web stories, initially developed by Google, represent another innovative narrative format. These visually rich stories are designed for optimal viewing on mobile devices and leverage Accelerated Mobile Pages (AMP) technology to ensure swift loading speeds [43]. While bearing some resemblance to story formats on platforms like Snapchat and Instagram, web stories offer the distinct advantage of search engine visibility. This format facilitates immersive experiences, effectively captures audience attention, and demonstrates strong performance in user engagement metrics. Web stories are versatile and can be adapted to various content types, including news, informational content, and personal narratives [44].

Visual stories, created using tools such as the Web Story Builder, provide a platform for developing web stories with a high degree of visual sophistication. These user-friendly tools offer extensive customization options, empowering a diverse range of creators, from bloggers to content marketers, to efficiently produce visually compelling stories [45]. Visual stories enable writers to showcase their writing through visual blogging, allow content marketers to present content in a contemporary style, and enable businesses to seamlessly integrate web stories into their websites, thereby enhancing brand value through creative promotion. Listicles represent another notable format within digital storytelling. This format utilizes lists with captivating and concise headings to attract readership and encourage social sharing. Effective listicles feature engaging, high-quality content within each point, often incorporating visuals, to motivate readers to progress through the entire list. The inherent shareability of listicles on social media platforms contributes to their potential for generating high levels of traffic and audience engagement.

2.3. Augmented reality

Augmented reality (AR) fundamentally merges the tangible real world with digitally created virtual elements through computational processing, thereby enriching the user's visual experience and enhancing the overall quality of communication. This fusion of realities opens up a novel perspective, acting as an augmented lens through which individuals can perceive and interact with their surroundings in a significantly more informative and visually enriched manner.

Figure 2 illustrates the hardware components that underpin AR technology systems. At its core is a computer or desktop, serving as the primary device for executing AR applications. User input and interaction are facilitated through a keyboard and mouse, while a monitor or display provides real-time visualization of AR guidance and the resulting collages. Crucially, cameras function to capture images or videos of plastic waste, which are subsequently processed, identified, and organized through the capabilities of the AR technology.

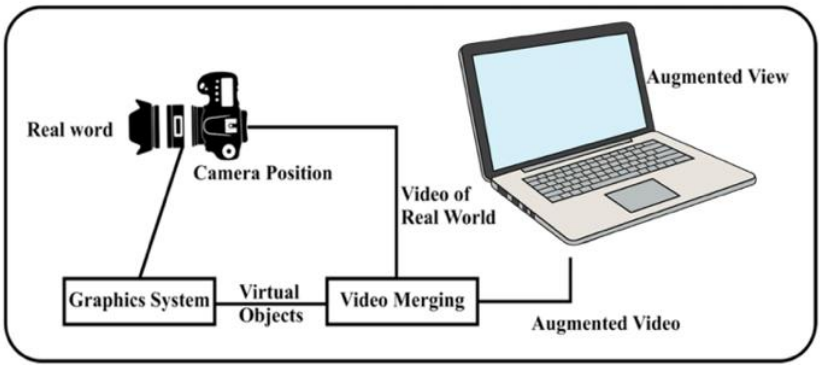


Fig. 2. AR system supporting devices.

Presently, research and development efforts are focused on two primary methodologies within Augmented Reality: marker-based tracking and markerless AR. Marker tracking relies on the utilization of two-dimensional visual markers, characterized by specific patterns, which are captured and interpreted by a

computational system via an attached webcam or camera. These markers typically consist of square-shaped black-and-white designs featuring prominent black borders on a white background. In contrast, the markerless AR approach eliminates the necessity for users to employ physical printed markers to overlay digital content. Instead, this method leverages inherent environmental cues, such as device orientation, directional data, or geographical location, as the recognized anchors for the augmentation.

Figure 3 illustrates the fundamental principle of marker-based AR implementation on a smartphone. This process initiates with the device's camera scanning a designated marker, which subsequently triggers the rendering and display of a virtual object directly on the user's smartphone screen. Advancements in AR technology have broadened its applicability across numerous domains, with education recognized as a sector where its integration holds significant potential to enhance learning experiences.

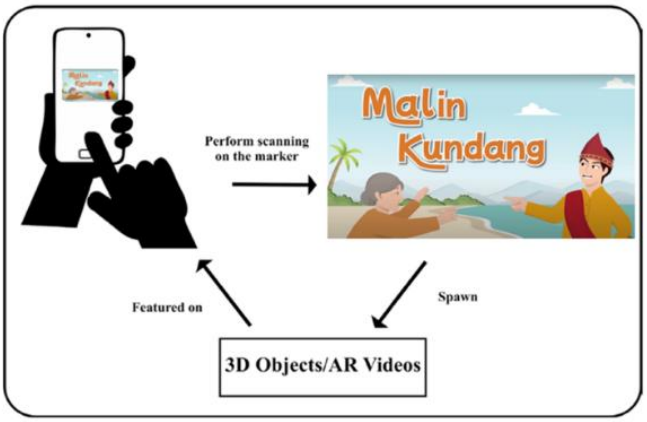


Fig. 3. The principle of using AR on a marker model smartphone.

Figure 4 elucidates the reality-virtuality continuum, a schematic representation that conceptually maps AR's position within the spectrum of reality extension into digital information, particularly as it is effectively applied in learning art practices. This schematic distinguishes four key environments: (i) the real environment (RE), which constitutes our physical world governed by natural laws; (ii) augmented reality (AR), characterized by a physical reality where users simultaneously perceive virtual augmentations overlaid onto their real surroundings; (iii) augmented virtuality (AV), conversely defined as a predominantly virtual environment incorporating real-world elements integrated within it; and (iv) virtual reality (VR), representing a fully synthetic digital world that provides the user with a complete sense of immersion.

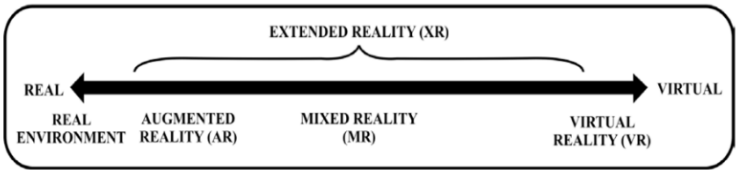


Fig. 4. Reality-virtuality continuum schematic.

AR is a technology that combines two-dimensional or three-dimensional virtual objects to see the real world while projecting certain objects virtually simultaneously. AR combines the physical world with virtual elements, creating an environment that allows the relationship between the factual world and digital information. AR technology with this content can offer the potential to change the traditional learning paradigm into a more interactive and interesting experience with AR as a learning medium that has an impact on student learning activity by presenting information visually but also creating an immersive and dynamic experience for students. However, in the utilization of AR, there are still challenges that need to be overcome. Technological limitations, infrastructure readiness, and lack of training for educators. On the contrary, along with these challenges, there are opportunities to realize a more mutually active and engaging learning experience as software technology develops as a provider that is easy and flexible to use. Currently, AR is widely used in gaming, medicine, and image processing, but it is still rarely used in education [46]. In Fig. 5, the AR concept explains combining virtual objects into information that can be utilised interactively in real time.

By merging the physical environment with digital elements, AR establishes a context where the interplay between factual reality and digital information becomes apparent. This capability positions AR technology as a potential catalyst for transforming traditional learning paradigms into more interactive and engaging experiences. As a learning medium, AR can positively influence student learning activity by presenting information visually and by fostering an immersive and dynamic environment. However, the widespread adoption of AR in education still faces challenges, including technological limitations, the necessity for adequate infrastructure, and the need for comprehensive educator training. Conversely, advancements in user-friendly and flexible software development present significant opportunities to realize more mutually active and engaging learning experiences. While AR has found considerable application in fields such as gaming, medicine, and image processing, its integration within educational settings remains relatively limited [47]. Figure 5 conceptually illustrates AR as the process of integrating virtual objects with information in a manner that allows for real-time interactive utilization.

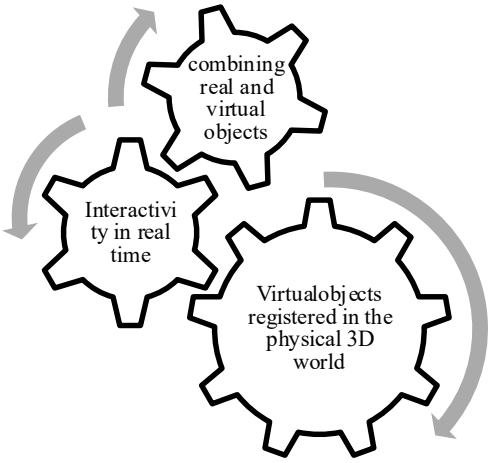


Fig. 5. Concept of AR.

Contemporary millennial learners exhibit a strong inclination towards the pervasive integration of digital media and technologies within their daily routines, particularly within the educational sphere [48]. Consequently, pedagogical approaches should strive to establish a congruent connection between learning content and engaging classroom experiences facilitated by such digital tools. Augmented Reality (AR) has emerged as a rapidly expanding technological domain in recent years, enabling users to perceive and interact with their physical surroundings in novel, more immersive, and interactive ways through their smart devices.

AR possesses the capacity to foster environmentally conscious behaviour through several mechanisms [49]. Firstly, AR can generate highly captivating and interactive experiences that imbue environmental issues with a heightened sense of immediacy and tangibility. Secondly, AR can incentivize the adoption of more sustainable practices by incorporating gamified elements and providing real-time feedback on user actions. For instance, AR applications can offer virtual rewards for engaging in recycling initiatives or conserving energy, thereby rendering eco-friendly behaviours more appealing and gratifying. Thirdly, AR can overlay environmental data directly onto the user's real-world view, facilitating a more intuitive understanding and interaction with information about their immediate surroundings. Finally, certain AR applications are specifically designed to enhance awareness of ambient environmental conditions, such as air quality and temperature, which can inform more responsible decisions regarding energy consumption and environmental comfort. Therefore, the increasing integration of AR across diverse sectors underscores its potential not only to educate and inform but also to directly influence and encourage the cultivation of sustainable behavioural patterns.

2.4. Systemic functional linguistics - genre-based approach (SFL-GBA)

The Systemic Functional Linguistics (SFL) Genre-Based Approach, designed to facilitate language learning, particularly in writing, is structured around four key stages: Building Knowledge of Field (BKoF), Modelling of the Text (MoT), Joint Construction of the Text (JCoT), and Independent Construction of the Text (ICoT).

BKoF is the initial stage that focuses on developing students' understanding of the writing topic [50]. Teachers guide students to become familiar with the theme through activities such as reading, listening, and speaking, with an emphasis on building relevant vocabulary. BKoF activities include analysing model texts, discussing unfamiliar expressions, and exploring related cultural contexts and experiences. This stage establishes the necessary foundation for comprehending the subject matter of their writing. In the MoT stage, students are introduced to exemplary texts to familiarize them with the target genre's structure and linguistic features [50]. Teachers direct students to analyse these texts, answer comprehension questions, identify structural elements, and recognize linguistic patterns. MoT enables students to grasp the essential characteristics of the specific text type they are learning to produce.

Moreover, JCoT is the stage involving collaborative writing practice, where students engage in text creation either as a whole class (scribing) or in small groups [51, 52]. Teachers play a crucial role by providing explicit instruction, offering

feedback, and monitoring the collaborative writing process [53]. JCoT emphasizes guided practice and peer interaction to support students in developing their writing skills. In ICoT, the final stage requires students to produce a text independently, drawing upon the knowledge and skills acquired in the preceding stages [54]. Teachers continue to provide guidance and monitor student progress as they engage in activities such as idea generation, text organization, drafting, and revision, culminating in the completion of a final written product. ICoT aims to foster students' autonomy and proficiency in writing.

Figure 6 shows the cyclical pedagogical framework encompassing Building Knowledge of the Field (BKoF), Modelling of Text (MoT), Joint Construction of Text (JCoT), and Independent Construction of Text (ICoT) provides a structured and scaffolded approach to writing instruction. BKoF establishes foundational understanding, MoT familiarizes students with genre conventions, JCoT fosters collaborative skill development through guided practice, and ICoT cultivates independent writing proficiency. This progression, supported by explicit teaching and feedback, aims to empower students to become autonomous and competent writers within specific text types.

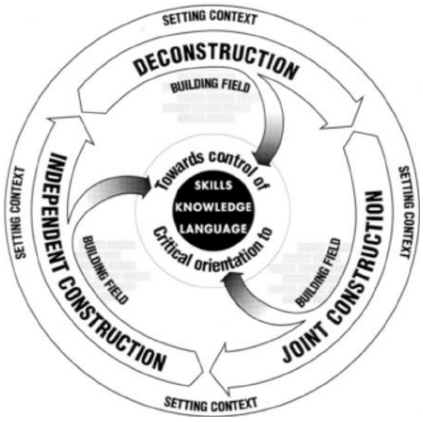


Fig. 6. The teaching-learning cycle of GBA.

2.5. The concept of how image-text relation in digital storytelling is taught

This part elaborates on the materials taught by the teacher to the students about narrative texts. Below are the aspects focused on by the teachers for students who are assumed to be new. The framework used here is Systemic Functional Multimodal Discourse Analysis (SF-MDA) covering orientation, representation, and presentation [55].

For novice learners of narrative texts, teachers focus on foundational elements through the lens of SF-MDA, covering orientation, representation, and presentation [56]. Orientation describes how viewers or readers are positioned through meaning-making elements within an image, encompassing involvement, contact (positive direct gaze vs. negative absent gaze), affect (emotional expression), social distance, and power. Notably, a key aspect of contact is its categorization into positive (direct gaze engaging the viewer) and negative (absent gaze positioning the viewer as a passive observer), indicating "demand" versus "offer." Affect, aligning with Kress and van Leeuwen's concept of "address," examines emotional conveyance via

visual cues, with gaze being a significant indicator of the level of interaction established in images [57]. A more detailed explanation of gaze as a representation of "demand" is provided in the subsequent Table 2.

Table 2. Facial expression.

No.	Type of expression	Meanings
1	Smiling	Asking viewers to enter the social relation
2	Cold Staring	Demanding readers to consider the participants inferior
3	Seductive pouting	Asking the viewers to desire the participants
4	Looking up leading	Demanding readers to have empathy
5	Finger pointed at view	Inviting viewers to come closer
6	Defensive Gesture	Asking readers/ audiences to be far

Involvement**,** as a component of visual contact, pertains to the extent to which viewers are positioned as participants in the image (Table 3). It is primarily determined by the angle of representation**,** which is classified into inclusion and exclusion**.** Inclusion is typically conveyed through a frontal angle**,** suggesting viewer engagement, while exclusion is expressed through an oblique angle**,** indicating viewer detachment. According to Kress and van Leeuwen [58], an oblique angle, where the vanishing point lies outside the vertical frame, signals that viewers are not included in the represented reality. Conversely, a frontal angle where the vanishing point lies within the image invites viewers into the visual narrative. Furthermore, visual angles are categorized into vertical and horizontal dimensions. A vertical frontal angle positions the viewer above the represented participants, implying a power dynamic in favour of the viewer. In contrast, a horizontal angle reflects equality between the viewer and the image participants, indicating a shared or balanced social relation [59]. The subsequent aspect to consider is social distance**,** which is determined by the type of image shot employed. This visual element reflects the perceived proximity or remoteness between the represented participants and the viewers, as indicated by the framing size within the image.

Table 3. Size of frame and social distance.

Frame Size	Characteristics	Social Relation
very close up	less than head and shoulders of subject	intimate
close shot	head and shoulders of subject	friendly or personal
medium close	cuts off subject approximately at waist	social or ' one of us'
medium shot	cuts off subject approximately at knee level	'familiar' social
medium long	shows full figure	general social
long shot	human figure fills half image height	public, largely imperso
very long shot	anything beyond (wider) than half height	little or no social connec

The final aspect to be addressed is power**,** which is represented through the use of various visual angles, including horizontal**,** high**,** and low angles. A horizontal

angle suggests an equal relationship between the viewer and the represented participants. In contrast, a high angle positions the viewer above the subject, implying viewer dominance, while a low angle places the viewer below the subject, indicating subordination. The following images illustrate these different power dynamics.

Additionally, representation in visual images refers to the depiction of experiences as constructed within the visual context, encompassing the actions performed by participants, the relationships among them, and the surrounding circumstances or environment [60]. The representational process is typically categorized into narrative and conceptual structures. Narrative representation is commonly conveyed through the use of vectors-visual connectors between participants-and can be classified into five types: action processes**,** reactional processes, mental processes**,** conversion processes, and geometrical symbolism [61].

Figure 7 shows the visual representation. Action processes are depicted as physical activities involving participants, which include the actor (the doer), the goal (the recipient), and the range [62]. These processes may be transactional (involving two participants, the actor and the goal) or non-transactional (involving only one participant, the actor, with no goal). Reactional processes, which resemble mental processes, represent activities as perceived by participants and are identified through a vector formed by the eyeline**.** This process involves a reactor (the perceiver) and a phenomenon (the object of perception), and it may also be either transactional or non-transactional.

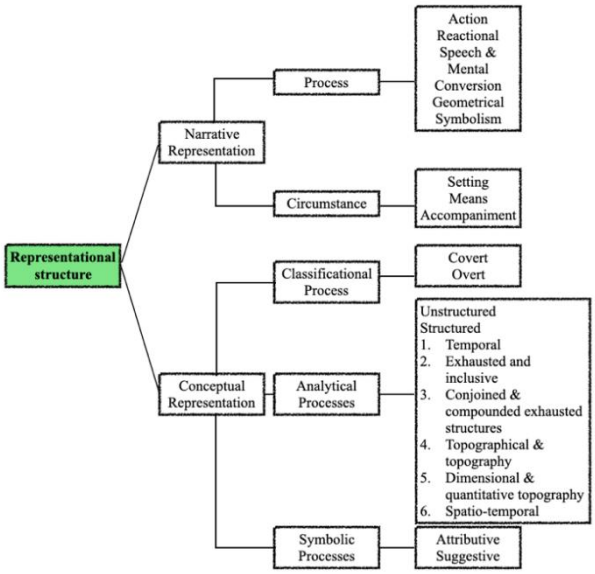


Fig. 7. Representational visual structure.

The speech/verbal process represents communicative actions such as speaking or questioning, where a vector links the sayer to the content of the speech. The conversion process depicts natural events or human interactions, often represented through diagrams or charts, such as the water cycle. Conceptual processes**,** which parallel existential or relational processes in language, encompass classificational, analytical, and symbolic processes, all of which define participants based on their

attributes or symbolic meaning. A symbolic process emphasizes mood or atmosphere, with participants typically portrayed through symbolic attributes. In narrative analysis, examples such as a mother feeding camels or an individual enjoying a sunset demonstrate these processes in action, illustrating the interaction between participants, their environment, or perception. Ultimately, representation operates as a transitivity system, focusing on the interactions, relationships, and contextual factors within visual representations.

In the context of language, as portrayed by Fig. 8, presentation in images pertains to the textual meta function, which involves the organization and arrangement of ideas within an image. This analysis examines how visual elements are structured through three primary systems: salience, information value, and framing. In this study, the focus is on the aspect of information value, which refers to the compositional structure or arrangement of ideas. This category is further divided into Given-New**,** Ideal-Real**,** and Centre, as illustrated in the following section.

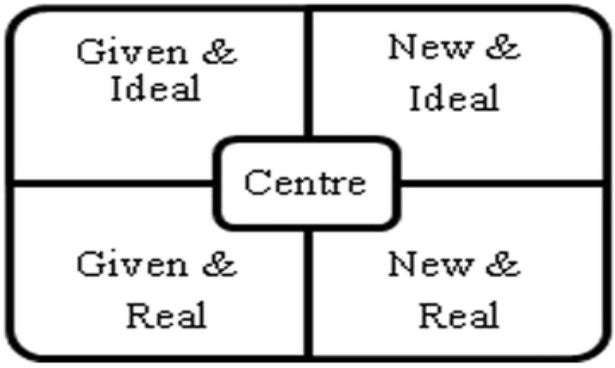


Fig. 8. The compositional structure.

The digital storytelling (DST) project centres on the narrative text of "Malin Kundang," a well-known legend from West Sumatra. This narrative conveys a moral lesson concerning a son's behaviour towards his mother. Specifically, the story recounts how the mother, deeply hurt by her son's denial of their relationship, curses him, resulting in his transformation into stone.

2.6. Indonesian narrative texts

Narrative texts, both in English and Indonesian, serve a primary function of entertaining readers [63]. However, their significance extends beyond mere amusement. In the Indonesian context, narrative texts play a crucial role in conveying and promoting cultural values and norms inherent to a specific social setting. These stories often function as a vehicle for transmitting societal beliefs, historical events, and ethical principles across generations, contributing to the preservation and understanding of cultural heritage [64].

The structure of Indonesian narrative texts typically comprises several key stages. The initial stage, orientation, introduces the main characters and establishes the setting, providing essential background information. This stage clarifies the characters' identities, roles, and relationships, as well as the time and place in which

the narrative unfolds. Orientation serves to contextualize the story and engage the audience by providing a framework for understanding the subsequent events [65].

Following the orientation, the complication stage introduces the central conflict or problem that drives the narrative forward. This is the phase where tension arises, and the characters face challenges or obstacles. The complication is crucial for generating interest and suspense, as it disrupts the initial equilibrium and sets the stage for the characters' actions and interactions [66]. The way the characters respond to and navigate this conflict forms the core of the narrative [67].

The resolution stage provides the outcome of the conflict, illustrating how the problem is solved or resolved. This stage may depict the characters' success, failure, or a compromise, offering a sense of closure to the narrative. The resolution is a critical element, as it provides a sense of completion and allows the audience to reflect on the consequences of the characters' actions and the themes explored in the story [68].

Finally, some narratives may include a coda, an optional concluding element that encapsulates the moral message or lesson of the story. While not present in all narratives, the coda serves to explicitly articulate the underlying values or principles that the narrative conveys. The coda often provides a direct statement about the ethical implications of the events and encourages the audience to reflect on the broader significance of the story [69].

3. Research Methods

Concurrently, the development of multimodal teaching media was made under the ADDIE model since this modified a video as an authentic material implemented in teaching reading Bahasa Indonesia. Detailed information for this method is explained elsewhere [70-72].

Figure 9 process commences with a thorough analysis of students' problems in comprehending Indonesian narrative reading text. Subsequently, the study concentrates on the crucial pre-production phase, encompassing the detailed design of an instructional video script that meticulously maps out the material through a structured sequence of scenes, locations, settings, and dialogue to serve as the primary guide for production. This stage also involves the creation of an interface storyboard and the arrangement of a flowchart to visualize the media's structure and user interaction. Following this detailed planning, the actual development of the learning media takes place, leading to its implementation within the intended educational context. The final stage of the process involves a comprehensive evaluation to determine the media's effectiveness and impact on learning outcomes.

In the area of evaluation, the student responses were elicited via semi-structured interviews conducted with a purposefully selected focus group of nine students from the same cohort and were analysed using thematic analysis to provide rich insights into their perceptions and experiences with the integrated learning approach. Furthermore, to elucidate the specific nature and extent of improvements in reading comprehension, a qualitative Systemic Functional Linguistics (SFL) analysis, focusing on the metafunctional dimensions of Field, Tenor, and Mode, was conducted on the multimodal texts employed within the Digital Storytelling interventions.

Further, pre-and post-test assessments were administered to all seventy participating tenth-grade students from one senior high school situated in West

Java, Indonesia, who were subjected to paired-samples t-tests in true-experimental design to ascertain the statistical significance of any observed gains in reading comprehension following the intervention. Detailed information for statistical analysis is explained elsewhere [73-75].

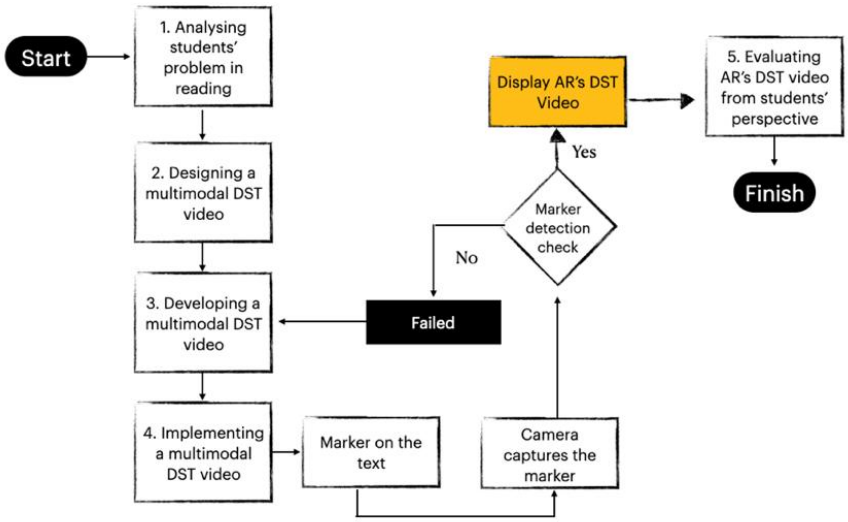


Fig. 9. Flowchart of developing AR digital storytelling (DST) video.

The selection of this school and student cohort was predicated on three key factors. Firstly, these students possessed prior experience with Digital Storytelling as a learning tool for approximately one academic year, providing a foundational understanding of the medium. Secondly, the school's categorization as a suburban institution that has introduced technology but still faces certain resource limitations offered a relevant context for investigating the practical application of readily available digital tools. Building upon this school profile, the most pragmatic and immediately applicable approach to address the identified reading comprehension challenges within this setting is to strategically leverage the affordances of readily available Digital Storytelling resources rather than focusing on the development of novel platforms or complex technological integrations that may strain existing resources and infrastructure. Based on these considerations, the selected participants and research site were deemed appropriate for addressing the objectives of this present study, particularly in understanding the pedagogical affordances of DST within a context of technological integration and existing infrastructure.

4. Results and Discussion

The findings of this research are presented through the lens of the ADDIE model, a systematic instructional design framework. This approach structures the study's progression across five distinct phases: a thorough analysis of the needs and context, the strategic design of the intervention or solution, the practical development of materials and activities, the careful implementation of the designed solution, and finally, a comprehensive evaluation of its effectiveness. By adhering

to this structured process, the study ensures a clear and logical presentation of its journey from initial understanding to final assessment.

4.1. Analysis

Figure 10 displays the analysis of students' problems in comprehending Indonesian narrative text, showing that the initial assessment of students' reading comprehension, utilizing a rubric encompassing the identification of intrinsic story elements, analysis of the story's message, and response to the story, revealed a heterogeneous distribution of proficiency levels. Quantitatively, the highest mean performance was observed in message analysis (51%), suggesting a relative, albeit potentially superficial, strength in interpreting underlying narrative themes. Conversely, the identification of intrinsic story elements demonstrated a lower mean proficiency (38%), indicating a limited capacity to recognize and articulate fundamental narrative components. The lowest mean proficiency was evident in the ability to respond logically to the story's content (29%), highlighting a significant challenge in engaging with the narrative in a reasoned and coherent manner.

Fig. 10. Analysis result of students' problems in reading based on students' reading comprehension quality (Pre-test).

Aggregating these individual criterion scores, the overall mean reading comprehension proficiency for the cohort was calculated at 39.33%. This baseline data underscores the need for targeted pedagogical interventions to enhance specific aspects of reading comprehension, particularly in the areas of identifying intrinsic story elements and formulating logical responses to narrative content, to elevate the overall comprehension abilities of the students.

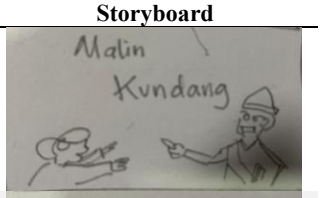
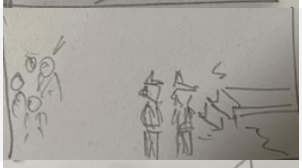
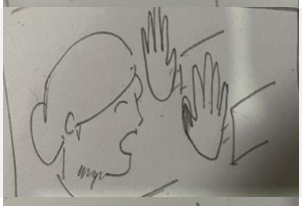
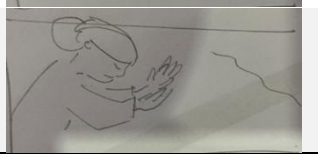
4.2. Design

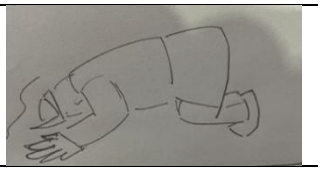
a. Creating a scenario and a storyboard

Drawing upon a multimodal perspective, the development of this scenario and storyboard involved a deliberate effort to integrate the meaning-making capabilities of both textual and visual elements (Table 4). The resulting design comprises nine distinct scenarios, each specifically crafted to underscore the

three fundamental generic structures inherent in narrative texts: orientation, complication, and resolution.

Table 4. Scenario and storyboard.

No.	Scenario	Storyboard
1	The intro of the video covers the title "Malin Kundang" and the main figure. Backsound Background colour: sky blue Setting: beach	
2	Malin, when he was a child, cared for his mother by helping sell fish (orientation) Backsound Background colour: brown Setting: traditional market	
3	Malin asks permission from his mother to seek his fortune. His mother is sad and prays for him. Backsound Background colour: brown Setting: house	
4	Malin and his friends have returned with good clothes. Backsound Background colour: sky blue Setting: beach	
5	Malin is angry at her mother and does not accept her (complication). His face shows anger, and his hand points at his mother. Backsound Background colour: sky blue Setting: beach	
6	Malin is pushing her mother away. His hands are big and strong, pushing his mother down. His mother is shouting and crying. Backsound Background colour: cream Setting: unknown	
7	Malin is leaving his mother. His face has a strong expression. His mother lay down and was sad. Backsound Background colour: sky blue Setting: Beach	
8	His mother curses his son, Malin Kundang, to become a stone (resolution) Backsound Background colour: sky blue Setting: Beach	

9	Malin becomes a stone Backsound Background colour: sky blue Setting: Beach	

b. Flowchart

The flowchart in Fig. 11 outlines the scenario, commencing with the visual creation for the video's central frame, showcasing the title and introducing the primary characters. Subsequently, it transitions to the orientation phase, which visually establishes the initially warm and supportive relationship between the mother and her son. This is specifically portrayed through scenes of Malin conscientiously assisting his mother with her daily tasks, highlighting their close bond. The narrative then advances to the pivotal moment where Malin seeks his mother's blessing to depart their home and journey abroad, driven by the aspiration of achieving a more prosperous life. Following this, the flowchart depicts scenes illustrating Malin's eventual success and his return to his native village, now a man of means. However, the narrative takes a tragic turn as it portrays Malin's painful denial of his mother upon his successful return, unwilling to acknowledge their past connection in his newfound status. This rejection is directly followed by scenes of Malin callously abandoning his heartbroken mother. Consequently, the flowchart illustrates the mother's profound anguish and her subsequent act of cursing Malin, condemning him to a petrified existence. The scenario culminates in the dramatic scene of Malin abruptly undergoing a physical transformation into stone, fulfilling his mother's curse.

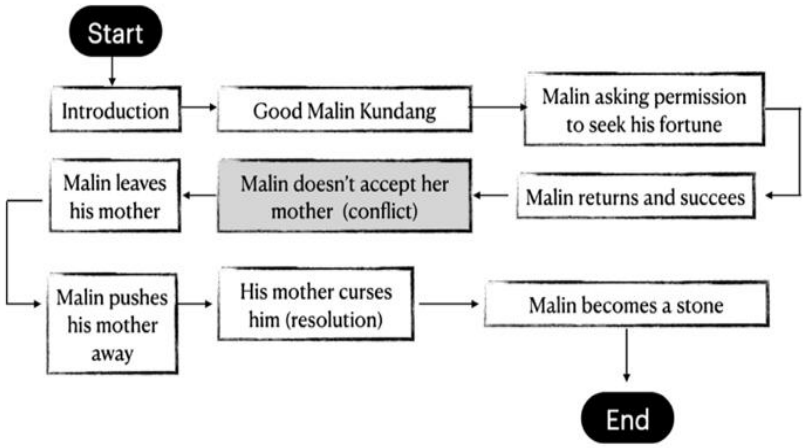


Fig. 11. The flowchart of the scenario and storyboard.

4.3. Development

At this stage, the process of developing the learning media using Animaker.com was carried out. The production phase was guided by a predetermined instructional video script that had been designed in the earlier stages. The development began with selecting animated cartoon characters that aligned with the roles and

characteristics of the figures depicted in the storyline. These characters were selected from the available character library in Animaker.

Figure 12 subsequently shows that appropriate properties and background settings were chosen to match the subject matter being delivered. After selecting the characters, props, and backgrounds, the next step involved animating these visual elements according to the instructional script and learning objectives. The resulting animation clips were then compiled and integrated with relevant educational content, as well as engaging background music, to enhance viewer interest and understanding.

During this stage, editing and revisions were also conducted. This included the addition of voice-over narration to support the explanation of the material, ensuring that the final animated video was coherent, engaging, and aligned with the intended instructional content. The overview of the development of this instructional video media is in Fig. 12.

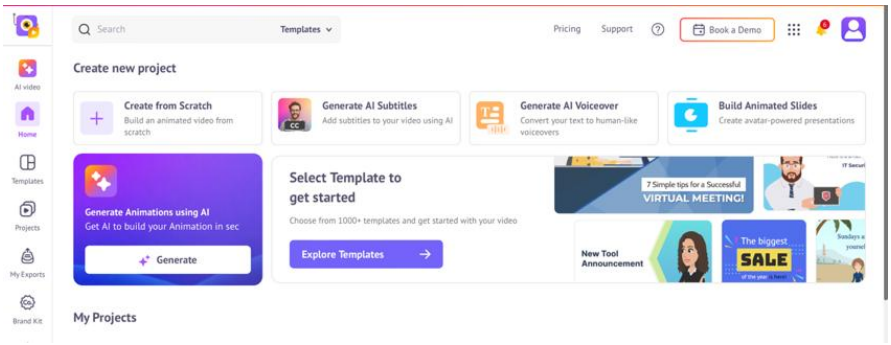


Fig. 12. Workspace interface of Animaker.com.

After logging into Animaker, in Fig. 13, users are immediately directed to the workspace, commonly referred to as the dashboard. On this page, users can click the "Create" button to start a new video project. Animaker offers a wide range of pre-designed templates that can be selected based on the type of video you wish to create, such as explainer videos, educational content, or business presentations. These templates are available directly on the dashboard for easy access. To view previously created videos, users can navigate to the "My Projects" section located at the top-right corner of the page.

Fig. 13. Studio interface of making video.

Figure 14 shows the steps for developing instructional videos using a variety of available tools. The bottom centre of the interface contains the timeline panel, where users can edit and synchronize voiceovers, images, animations, and background music. On the left side, there are options to add, duplicate, or delete scenes, allowing for efficient scene management throughout the video. Meanwhile, the right side features the asset library, where users can search for and insert various elements such as images, shapes, text, backgrounds, characters, props, and music to enhance the visual and auditory quality of the video.

Fig. 14. The scenes in the video are adjusted to align with the narrative stages of the text.

Animaker video production begins with meticulous planning and scriptwriting, establishing the narrative's orientation through descriptive language and initial dialogue. Next, users design scenes and characters that embody the story's central conflict, utilizing dialogue and action verbs to showcase their responses. Animation then brings the narrative to life, progressing through rising action to the climax, synchronized with voiceovers and sound effects via action verbs and transitions. The falling action and resolution are conveyed through voiceovers (or text-to-speech) and background music, incorporating evaluative language and summarizing expressions. Finally, the video undergoes thorough editing and review to ensure seamless flow and accurate representation of the narrative's linguistic elements, including speech, descriptions, and tenses.

Figure 15 showcases the resulting output of an Augmented Reality (AR) Digital Storytelling video. This likely illustrates how digital elements are integrated with a real-world video to enhance or convey a narrative. Viewers would see a blend of the physical environment captured by the video and superimposed virtual content, such as characters, objects, or interactive elements, that contribute to the storytelling experience. The figure probably highlights how AR technology can be used to create more engaging and immersive narratives by overlaying digital information and interactive features onto the viewer's perception of reality, potentially enriching the story with visual enhancements and interactive possibilities.

Fig. 15. The product of AR DST video.

4.4. Implementation

We also did the implementation stage (the figure was not displayed). It is the evaluation phase centring on determining the effectiveness of the digital storytelling video through a dual approach: expert validation and the measurement of students' reading comprehension. Expert validation involves assessment by professionals in relevant fields to gauge the video's quality, accuracy, and pedagogical soundness. The study also examines students' reading comprehension performance after engaging with the video, providing empirical data on its impact on their understanding of the presented content. This two-pronged evaluation provided a comprehensive understanding of the digital storytelling video's overall quality and its efficacy as a learning tool.

4.4.1. Expert validation

The expert validation test for learning media is an evaluation process conducted by media experts, reading material experts, and language experts to ensure its feasibility, suitability, and quality (Table 5). This process is carried out to obtain feedback from the experts and ensure that standard learning media.

Table 5. Expert validation results.

No.	Validator	Validation Result
1	The expert validation test for the learning media	It indicated a high or very good rating for: (i) visual quality, which includes the quality of images, videos, animations, and other visual elements within the video, including resolution, lighting, and composition. A high score was also given to (ii) audio usage, which includes: the narrator's voice, background music, and sound effects, as well as their suitability to the narration. (iii) The interactivity of the digital storytelling video was rated as good in terms of interactive elements, such as links, quizzes, or other features that allow users to interact with the video. (iv) The format and structure of this video were also rated as good, considering the video format, which includes duration, editing style, and

		sequence of scenes, as well as its suitability to the objectives and audience [76, 77].
2	The expert validation test for reading material learning	The material experts gave a very good rating for: (i) relevance, which includes the suitability of the material to the objectives, theme, adequacy, and accuracy of the material presented in the video. (ii) Clarity, which includes the clarity and readability of the information conveyed in the video. (iii) Alignment with the current Merdeka curriculum.
3	The language expert validation test	The language experts also gave a very good rating for: (i) accuracy of terms, (ii) suitability of the language style to the objectives and audience's level of understanding, (iii) readability of the text or narration in the video, including font type, size, and layout. (iv) Simplicity of the language used. Thus, the message can be easily understood by the audience.

4.4.2. Students' reading comprehension

Figure 16 shows the mechanism of the implementation of AR's DST video by the students. Augmented reality digital storytelling videos leverage a user's device to overlay digital narratives onto their physical environment. The process initiates with the user engaging an AR application on their device, which then utilizes the device's camera to detect and track a marker or environmental features. Specialized software algorithms analyse the visual input to determine the spatial position and orientation of the tracked element. This spatial data serves as an anchor for rendering pre-designed AR objects – the digital storytelling components – which are then composited onto the live camera feed displayed on the device screen. Real-time tracking ensures the AR objects remain spatially registered with the physical world, creating an immersive and interactive narrative experience.

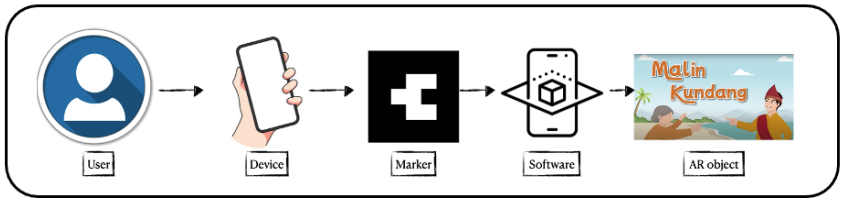


Fig. 16. AR technology implementation concept.

This phase provides insights into the students' reading comprehension proficiency, analysed through the lens of Systemic Functional Linguistics and Genre-Based Approach (SFL-GBA), following exposure to the digital storytelling video. Within the Systemic Functional Linguistics and Genre-Based Approach (SFL-GBA) framework, the digital storytelling video was implemented during the Modelling of the Text (MoT) phase. At this stage, students attend to aspects of the text, including its organization and linguistic features. Through a scaffolding strategy, students carefully and gradually analyse the elements presented in the video. For instance, they examine background information about the characters, such as who, what, when, and where, as shown in the opening scenes of the video. They also attend to the conflict

elements of the text, which are represented through the characters' actions, expressions of anger, and emotional displays. In addition, students observe the socio-cultural aspects embedded in the text by analysing visual attributes present in the video. This approach aligns with the principles of SF-MDA, which posits that reading comprehension involves not only verbal textual elements but also non-verbal semiotic resources, such as images conveyed through video. Those aspects are strengthened by the image-text relations in a multimodal perspective.

Figure 17 shows that the intervention demonstrated statistically significant positive effects on students' reading comprehension across all assessed criteria. The post-intervention mean proficiency in reading comprehension reached 78.67%, representing a substantial 39.34 percentage point increase from the pre-intervention mean of 39.33%. This overall improvement underscores the intervention's effectiveness in enhancing students' general reading comprehension abilities.

A detailed analysis of the individual criteria reveals varying degrees of improvement. The most pronounced gain was observed in the identification of intrinsic story elements, with a 41% increase from 38% to 79%. While the highest absolute post-intervention proficiency was in analysing the story's message (88%), this still constituted a significant 37% improvement from the pre-intervention level of 51%. Similarly, the ability to respond logically to the story's content showed a noteworthy 40% increase, rising from 29% to 69%. These quantitative findings provide compelling evidence for the intervention's success in bolstering specific facets of reading comprehension, contributing to the significant overall enhancement in student performance. The SFL analysis of reading comprehension, focusing on text purpose, textual structure, and linguistic features, indicates that students generally developed their multimodal reading comprehension abilities.

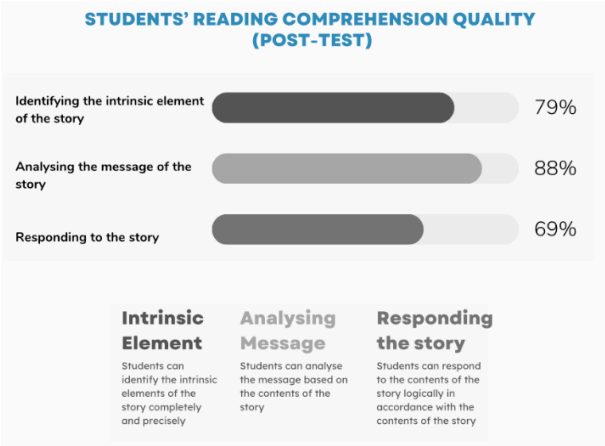


Fig. 17. Students' reading comprehension quality influenced by AR DST video. This is based on students' reading comprehension quality (post-test)

The findings indicate that the integration of the Systemic Functional Linguistics Genre-Based Approach (SFL-GBA) with Digital Storytelling (DST) video, which is exemplified with AR, can significantly enhance students' reading comprehension of narrative texts. This is supported by the adaptation of Genre-Based Pedagogy to a multimodal framework, drawing on Systemic Functional Linguistics as a

theoretical foundation [76, 77]. This pedagogical model emphasizes the three metafunctions of language: experiential, interpersonal, and textual meanings. Furthermore, prior studies have affirmed that DST should be utilized not merely as a medium of instruction but as a meaningful resource in the process of meaning-making [78]. In line with this, DST can enhance student engagement by involving them actively in interpreting digital narratives [53]. Furthermore, the findings of this study offer insight into how Digital Storytelling, when implemented within the SFL-GBA framework, can effectively develop students' reading skills in Indonesian narrative texts. This is corroborated by a previous study that reviewed trends in DST research over the past decade [79]. The review revealed that while most research focused on the general use of DST in educational contexts, there remains a lack of studies examining its application in the teaching of specific skills and genres.

Even in the Indonesian context, studies on DST in English narrative instruction have primarily explored teachers' and students' perceptions and the impact of DST on general language skills and soft skills such as creativity and critical thinking [80-85]. In contrast, the application of DST in the teaching of Bahasa Indonesia remains underexplored. For instance, a study focused solely on the process of creating DST and its influence on student creativity and engagement, without examining how DST facilitates comprehension of the text itself [86]. Additionally, the study emphasized the need for further research on effective pedagogical approaches for implementing DST in the instruction of Indonesian texts [87]. In conclusion, this study contributes a novel perspective on teaching Indonesian texts, particularly narrative texts, through the integration of DST and SFL- genre-based pedagogical approach. It highlights the importance of not only fostering technological literacy but also enhancing students' genre literacy, which is essential for comprehending various Indonesian text types.

Several points are in the following:

(i) First, regarding text purpose, students demonstrated an improved understanding that narrative texts aim to entertain readers/audiences, a distinction that was less apparent in their pre-test responses. For instance, Student 1 stated, *'Digital Storytelling presents narrative text to entertain us through the created story.*' This was corroborated by Student 6, who noted that *'this DST is made to entertain audiences through a story with high moral value*.' These responses suggest that students recognize narrative texts as vehicles for conveying moral messages and reflecting cultural norms. The improvement in students' understanding of text purpose can be attributed to the Building Knowledge of Field (BKoF) stage of the SFL-GBA approach. During BKoF, the teacher facilitated the activation of students' prior knowledge by posing questions such as, *'Have you ever heard the legend of Situ Bagendit?*' and *'What aspects of that story did you find entertaining?*' Furthermore, the teacher introduced and discussed other legends, consistently prompting students to identify the messages conveyed within those narratives. This pedagogical strategy prioritized the implicit understanding of messages within Digital Storytelling, rather than explicitly stating the aim of Digital Storytelling at the outset."

(ii) Second, the analysis revealed a notable improvement in students' understanding of narrative text organization. One of them is that students

demonstrated a clear understanding that narrative texts typically begin with an orientation, establishing the background of the story. For instance, Student 4 indicated that the initial stage of creating Digital Storytelling (DST) involves presenting the background of the main character, in this case, Malin Kundang, and his mother. Furthermore, the student emphasized that this orientation includes details about the characters' identities, origins, and setting, conveyed through visual elements such as colours and contextual features like the house, environment, and overall scenery. This understanding represents a significant shift from the pre-test results, where Student 4 omitted the orientation and incorrectly identified the conflict as the starting point of the narrative. Another improvement is seen from a greater awareness of the importance of conflict in narrative texts. While they acknowledged its presence in the pre-test, their understanding deepened, particularly regarding how conflict can be portrayed. Previously, students primarily focused on physical conflict (e.g., physical bullying), but they now recognized the potential for other forms of conflict, such as psychological tension between characters. Third, students consistently recognized the necessity of a resolution in narrative endings. All students articulated that the resolution, demonstrating how the central problem is resolved, should be explicitly presented in the DST.

(iii) Third, in terms of language features, students demonstrated notable improvement in their understanding of both linguistic and visual elements characteristic of the narrative genre. This multimodal awareness was evident in the way students recognized the interplay between textual and visual components in digital storytelling (DST), where each mode contributes to the construction of meaning. For instance, students understood that material processes—such as actions and physical events—should be prominently represented not only in the written narrative but also visually on the screen. Actions like "falling," "crying," or "lying face down" were expected to be depicted through both verbal and visual cues. One student (S5) expressed this by stating, *"We have to show what happens through both visual and verbal cues; for example, when Malin Kundang's* mother begs God in her sorrow, and Malin Kundang's anger is shown through his pointed finger." This dual representation, according to the student, enhances the effectiveness of the storytelling by reinforcing meaning.

A participant similarly emphasized the importance of visual expression, stating, 'The characters' emotions—such as sadness, happiness, and regret—need to be depicted in the images to enhance comprehension of the story's progression.' Students also acknowledged the role of auditory elements, such as variations in tone and pitch, in conveying narrative flow. These observations indicate that students are developing a more integrated understanding of narrative construction through the interplay of verbal, visual, and auditory modes in digital storytelling. Regarding temporal conjunctions and specific participants, students demonstrated understanding in the pre-test; however, they became more aware of the importance of non-verbal modes (i.e., images) in conveying the sequence of the story's plot. Furthermore, student comprehension of adjectives and expressions showed substantial improvement. Students increasingly recognized the significance of facial expressions in digital storytelling for contributing to the text's meaning. For example, Student 8 stated, '*Facial expressions (e.g. sadness, happiness) should be*

explicitly conveyed through eye contact, mime, or gesture to prevent misunderstanding of the story and to enhance its entertainment value.'

Finally, students recognized the importance of direct and indirect speech. They understood that dialogue is crucial for enlivening the narrative; consequently, a monologue by a narrator alone is insufficient to make digital storytelling engaging and entertaining. Moreover, students gained a clearer understanding of how direct and indirect speech function within the narrative genre. In summary, students demonstrated improved genre awareness and a greater understanding of multimodal affordances, particularly concerning the relationship between text and image in constructing Indonesian narrative texts."

Regarding the data, students exhibited a comprehensive improvement in their understanding of the key structural elements of narrative texts as presented in Digital Storytelling (DST). These findings align with the pedagogical strategies employed during the Modelling of the Text (MoT) stage. During this stage, the teacher provided explicit instruction on the generic structure of narrative texts, utilizing the DST examples as models. Specifically, the teacher paused at critical points within the DST to facilitate analysis of the text structure. For instance, the teacher posed questions such as, 'Please observe this image. What are the professions of Malin Kundang and his mother? What visual cues support your answer? What contextual features do you observe here?' The teacher also emphasized the portrayal of conflict and resolution through the characters' gestures, movements, and expressions. This approach effectively employed scaffolding to facilitate students' comprehension of the narrative genre through the DST medium, aligning with established principles of genre-based pedagogy. Furthermore, the improvement in students' understanding of linguistic features can also be attributed to the MoT stage, where the teacher highlighted these features through an analysis of the image-text relationship within the DST. For example, the teacher prompted students with questions such as, 'Please observe this image; what emotion is the mother experiencing? How can you infer that emotion? What is Malin Kundang's dialogue? What messages can you infer from the mother's gaze?' This pedagogical approach demonstrates an exploration of multimodal resources to construct meaning, consistent with the principles of Systemic Functional Linguistics, which underscores the importance of analysing how meaning is conveyed through the interplay of various semiotic modes."

The first significant improvement observed in this study pertains to students' understanding of the purpose of a text. As demonstrated in the findings, Digital Storytelling (DST) effectively supports students' literacy skills, particularly in identifying the main idea of narrative texts. These results corroborate the findings of previous research, which reported that DST can enhance students' competencies in both reading and writing [88]. The observed progress is further supported by the integration of Systemic Functional Linguistics (SFL)-based Genre Pedagogy. This pedagogical approach has been explicitly recognized and empirically validated as effective in improving students' reading comprehension skills [89-92]. The synergy between DST and genre-based instruction appears to contribute significantly to students' deeper engagement with the text, enabling them to identify not only the structure but also the communicative purpose of narrative genres.

Second, this study also addresses students' understanding of the text organization within Indonesian narrative texts, which typically consist of

orientation, complication, resolution, and an optional coda. Interestingly, the data revealed that students were not only able to recognize these structural elements through the verbal or linguistic aspects of the text, but also through visual elements such as images. This finding underscores the role of the Systemic Functional Linguistics Genre-Based Approach (SFL-GBA) in fostering students' multimodal literacy, specifically, their ability to interpret and integrate meaning from both visual and verbal modes. Such integration is essential in Digital Storytelling (DST), where the interplay between images and text contributes to a more coherent and meaningful narrative. As a result, students were not only aware of the fundamental components of DST and how to construct them, but they also began to pay greater attention to how images and written language work together to reinforce the message and convey the essence of a narrative story. These findings are in line with previous research that emphasizes the importance of multimodal literacy in narrative construction [50, 80].

Third, the findings also highlight students' improvement in reading skills, particularly regarding the identification and interpretation of the linguistic features commonly found in narrative texts. These features include action processes, adjectives, conjunctions, specific participants, and the use of both direct and indirect speech. The data revealed that students became increasingly aware that these linguistic components are essential to constructing a coherent narrative. More importantly, their awareness of these features significantly enhanced their overall comprehension of the text. These results are consistent with prior research, which indicates that mastery of linguistic elements supports students' understanding of narrative structures and meanings [50, 93]. The incorporation of these features into students' reading strategies indicates a developing ability to critically engage with texts, which is a fundamental goal of literacy education.

In addition to linguistic awareness, students also demonstrated a heightened sensitivity to visual elements that support meaning-making in digital narratives. Their understanding of language features appeared to be reflected in their interpretations of visual cues, such as mime, gesture, body positioning, and actions depicted in images. These non-verbal elements significantly broaden the scope of digital literacy competencies students are expected to develop and provide alternative pathways for teaching multimodal literacy [94-96]. Therefore, educators must be equipped not only with the technical skills to implement Digital Storytelling (DST) but also with pedagogical knowledge of genre-based instruction that integrates both linguistic and non-linguistic (visual) features. By adopting such an approach, students can come to understand that images and other multimodal components in DST are not merely decorative but serve as integral contributors to meaning-making and text comprehension.

It is evident from the discussion above that the role of the Systemic Functional Linguistics–Genre-Based Approach (SFL-GBA) is integral and should be thoughtfully considered in the teaching of narrative texts. This approach offers a clear and structured pedagogical framework through its four main stages: Building Knowledge of the Field (BKoF), Modelling of the Text (MoT), Joint Construction of the Text (JCoT), and Independent Construction of the Text (ICoT). Each stage embodies the principles of explicit teaching, corrective feedback, and scaffolding, all of which are essential in helping students grasp the linguistic and structural features of texts comprehensively. As supported by previous studies [76, 97], these

pedagogical elements ensure that students are not only exposed to theoretical concepts but are also guided step-by-step through practical application, which ultimately enhances their literacy skills in a meaningful way.

Moreover, the application of the SFL-GBA framework contributes significantly to pedagogical innovation in the teaching of reading of Bahasa Indonesia, particularly in supporting multimodal and differentiated literacy practices. Despite its theoretical robustness and evidence of its effectiveness, the implementation of this approach in Bahasa Indonesia classrooms, especially at the primary and secondary levels, has remained limited over the past decade [98]. This underutilization signals a critical need for further exploration and wider adoption of SFL-GBA to enrich teaching strategies. By integrating this approach, educators can offer alternative and more effective means of engaging students in understanding and producing texts, thereby fostering both linguistic competence and critical literacy in culturally relevant and contextually appropriate ways [99].

Overall, the findings underscore the effectiveness of integrating the Systemic Functional Linguistics–Genre-Based Approach (SFL-GBA) with Digital Storytelling (DST) in enhancing students' digital literacy as well as their reading comprehension of the narrative genre, particularly in the domain of visual linguistics. This integration allows students not only to engage with technological tools but also to develop a critical awareness of how verbal and visual elements interact to construct meaning within a text. Such an approach ensures that students are not merely passive users of digital platforms but are also active interpreters of multimodal texts, thus expanding their literacy beyond conventional boundaries. This reinforces the idea that visual and textual literacy are interconnected and must be addressed simultaneously in modern language education.

However, the study also reveals a critical challenge in the field. Despite increasing familiarity with digital tools such as DST, many teachers still demonstrate limited multimodal literacy skills. This gap suggests that proficiency in using technology does not automatically translate into pedagogical competence in integrating multimodal elements meaningfully. Therefore, it is essential not only to train teachers in the technical use of DST but also to cultivate their ability to design and implement technology-enhanced instruction that supports multimodal meaning-making. For Bahasa Indonesia teachers, in particular, this calls for a shift in focus, from merely using digital tools to strategically integrating them with linguistic and visual pedagogies. Promoting this pedagogical shift is crucial to preparing students for literacy demands in a media-rich and visually saturated world.

4.5. Evaluation

In this stage of the research, a comprehensive evaluation was conducted by meticulously considering the students' responses to the implementation of the digital storytelling video. This evaluation specifically focused on capturing the nuances of their knowledge acquisition and their overall opinions regarding this pedagogical approach.

a. Students' knowledge

Qualitative analysis of student reflections revealed a notable advancement in their understanding of the synergistic relationship between textual and nonverbal elements in meaning construction. Participants explicitly articulated a shift from a

predominantly linguistic interpretation of reading towards a more integrated, multimodal perspective. A representative quote illustrates this emerging awareness: "*I realise that when we are learning using digital storytelling, we have to consider the meaning of the picture, like the expression of the characters has a strong influence on the meaning of the story*."

This articulation signifies a developing comprehension of visual literacy principles. Students began to recognize that visual cues, such as character expressions within accompanying images, are not peripheral embellishments but actively contribute to the narrative's overall message and its interpretation. This suggests an evolving understanding that meaning is not exclusively encoded within the linguistic text but is also embedded within the visual semiotic landscape [100]. The emergence of this insight within the context of a digital storytelling pedagogical approach highlights the potential of this methodology in fostering an integrated understanding of multimodal communication, where textual and visual components are perceived as essential and mutually reinforcing elements in the construction of narrative meaning. This finding aligns with contemporary research emphasizing the importance of multimodal literacy in comprehending complex communicative acts.

The respondents' reflections further illuminated their enhanced understanding of narrative text comprehension, specifically highlighting the significance of direct speech within the context of digital storytelling. They recognized direct dialogue as a vital element that animates the narrative and effectively captures their engagement with the story. As articulated by Student 8, *"after learning to read through digital storytelling, I feel more confident in reading narrative text by considering the elements of the picture and text that I read."*

This statement underscores a perceived ease in navigating narrative texts, attributed to the integration of both visual and textual cues facilitated by the digital storytelling approach. The student explicitly connects their improved reading comprehension to the consideration of both pictorial and textual elements [101, 102]. This suggests that the digital storytelling method may have fostered a more holistic and accessible approach to narrative comprehension, where visual aids serve to contextualize and enhance the understanding of linguistic elements such as direct speech. The recognition of direct speech as a tool for bringing the text "alive" indicates a developing sensitivity to the nuances of narrative structure and how dialogue contributes to character development, plot progression, and overall reader engagement. This finding supports the notion that multimodal learning environments can positively impact students' ability to comprehend and appreciate the complexities of narrative texts [103, 104].

b. Students' Opinion

Students showed their positive opinions towards the integration of SFL-GBA and DST in their reading activities. First, the collected data indicates a uniformly positive reception among the focused respondents towards the pedagogical strategies and technology employed by the teacher. Specifically, the use of digital storytelling elicited notable enthusiasm. Student 3 stated, "I feel the learning process is new to me, as I usually encountered digital storytelling in previous teaching. However, this time, the teacher gave clearer material, especially in understanding not only the text but also the picture. This

highlights the perceived novelty and clarity of the approach. It suggests that the teacher's implementation of digital storytelling was distinct from prior experiences, effectively presenting material in a way that facilitated understanding of both textual and visual components.

This sentiment is also reinforced by Student 5's statement: "I have come to understand that digital storytelling is not only a medium to gain my interest in learning, but it also supports me in understanding the text concepts from the slides provided in the digital storytelling." This response underscores a dual benefit of digital storytelling: enhanced engagement and improved conceptual understanding [105]. The student explicitly recognizes the technology not merely as a tool for motivation but as a cognitive aid that supports the comprehension of textual concepts presented within the digital storytelling slides. These testimonials collectively suggest that the teacher's integration of digital storytelling was perceived as a novel, clear, and effective pedagogical strategy that fostered both student interest and a deeper understanding of the learning material by leveraging the interplay between text and visuals.

Regarding student engagement, the data indicates a perceived increase in active participation. Student 2 stated, "*The learning of reading through digital storytelling makes me more actively participate in responding to the message of the text. The teacher directs me to explore not only the area of text but also the picture. Furthermore, active feedback given by the teacher is responsively provided.*" This statement highlights several key aspects of enhanced engagement. Firstly, the student explicitly links digital storytelling to a more active role in responding to the text's message. This suggests that the multimodal nature of digital storytelling, incorporating both visual and textual elements, encourages a more dynamic and interactive engagement with the content [106]. Secondly, the teacher's guidance to explore both the textual and pictorial dimensions appears to have broadened the scope of student inquiry and participation. By prompting students to consider the interplay between these elements, the learning process becomes more comprehensive and potentially more stimulating. Finally, the mention of "active feedback given by the teacher" and its responsive nature underscores the importance of timely and relevant instructor input in fostering student engagement. This suggests that the pedagogical approach, facilitated by digital storytelling, created a more interactive and supportive learning environment that encouraged active participation and response [97].

All participating students expressed positive perceptions regarding the use of AR Digital Storytelling (DST) within the framework of the Systemic Functional Linguistics–Genre-Based Approach (SFL-GBA) in their reading practice of narrative texts. The students consistently reported that they felt more engaged and motivated during the learning process compared to their previous experiences. This heightened engagement reflects a significant pedagogical shift, where the integration of AR DST provided a more interactive and student-centred environment [107, 108]. These findings corroborate prior research that underscores the potential of AR DST to enhance students' active participation and involvement in language learning, particularly in reading comprehension of narrative texts [109, 110].

Furthermore, students emphasized that the learning process designed by the teacher contributed meaningfully to their comprehension of multimodality, specifically, how images and text function collaboratively to convey narrative meaning. This

awareness marked a critical development in students' literacy skills, as they began to recognize that reading in the digital era extends beyond decoding verbal texts. Instead, understanding how visual and linguistic modes operate in tandem became central to their interpretation of meaning [111]. Such insights are essential in fostering visual literacy and preparing students to critically engage with multimodal texts, which are increasingly prevalent in digital and media-based communication.

In addition, the tailored approach allowed students to move beyond traditional conceptions of reading as a linear and text-based process. They began to appreciate the interplay of design, layout, image positioning, and linguistic choices, all of which shape the message and emotional tone of a narrative [112]. As a result, students not only improved their comprehension of narrative structures but also developed analytical skills that enabled them to reflect on how meaning is constructed and interpreted through various semiotic resources. This points to the importance of equipping students with a multimodal reading framework as part of literacy instruction in contemporary classrooms.

Ultimately, these positive perceptions highlight the need for a pedagogical paradigm shift that prioritizes engaging, multimodal, and meaning-oriented instruction. While digital tools such as DST are becoming more accessible, their true potential can only be realized when embedded within a pedagogically sound framework like SFL-GBA. For language educators, particularly in the context of Bahasa Indonesia instruction, this study reinforces the urgency to integrate multimodal literacy practices into the curriculum. Doing so not only enhances students' engagement and comprehension but also aligns teaching practices with the evolving nature of texts in the 21st-century digital landscape.

5. Conclusion

In conclusion, this research demonstrates the significant potential of an AR-based digital storytelling video, informed by SFL-GBA principles and developed through the ADDIE model, to substantially improve Indonesian students' comprehension of narrative texts. The observed gains in identifying story elements, analysing meaning, and responding to the narrative, coupled with positive student feedback regarding explicit instruction and support, underscore the value of this innovative approach. However, the study also emphasizes that the successful integration of AR DST video for reading instruction relies critically on the application of effective pedagogical strategies and the expertise of educators in facilitating the learning process.

Based on this research, it is suggested that educators consider integrating AR-based digital storytelling videos, designed with SFL-GBA principles and following a structured development process like ADDIE, into their Indonesian language arts curriculum to enhance students' narrative text comprehension. Professional development should also focus on equipping teachers with the pedagogical strategies and skills necessary to effectively implement such innovative tools and maximize their impact on student learning.

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