Using Digital Game-based Learning to Foster Multimodal Literacy in Left-behind Children of Migrant Workers: Possibilities and Challenges

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Abstract

Digital games offer opportunities for the youth's development of multimodal literacy required in the technology-driven world. However, both digital games and multimodal literacy are undervalued in rural contexts characterized by migrant parents and left-behind children. This qualitative case study conceptualized systematic guidance to foster students' multimodal literacy through digital games and trialled its possibilities and challenges in enhancing left-behind children of migrant workers in a suburban school. Sixteen student participants engaged in critical game analysis and game video design in a 16-session classroom-based program, with the guidance of the researchers and two local teachers. Multiple data-collection methods were applied to capture students' learning progress aligned with the teachers' perceptions. Thematic analysis and multimodal analysis were utilized to process data. The findings indicate that this instructional approach deepened and broadened the students' critical viewing and application of multimodal texts and enhanced their proficiency in leveraging digital tools for multimodal communication. The challenges include students' varied competencies and motivation, time constraints, and limited access to digital devices. We advocate for integrating DGBL in literacy classrooms, thus catering to left-home students' demands and social needs in the digital age. Meanwhile, joint efforts are necessitated to address perennial challenges in this education reform and inequities within the process.

Keywords: *Multimodal Literacy, Digital Game-based Learning, Left-behind Children, Education Equity.*

Introduction

The recent two decades have seen the surging usage of interactive digital media among the youth, especially for watching online videos, playing digital games, and using social media (Rideout et al., 2022). This changing media environment makes multimodal literacy increasingly prominent, which refers to the ability to critically read, interpret, use, and creatively combine multiple semiotic modes in ways that are appropriate to the given context for unique demands (Jewitt & Kress 2003). Since the New London Group's (NLG) landmark manifesto in 1996, the print-based and language-focused literacy instructional approach has been transforming into a multimodal, contextualized, and inclusive one, embracing diverse digital media practices close to the youth's daily lives (Si et al., 2022).

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Currently, multimodal literacy is addressed in national literacy curricula globally (e.g., in the US, Australia, China, and Singapore) to facilitate students' critical engagement with digital media and active participation in technologically advanced societies with increasingly proliferate digital media practices (Lim, Toh, et al., 2022). However, there is still a disparity between the policy and the practice due to perennial challenges, such as the dominant prescribed school curricula and teachers' limited expertise (Yin, 2014), causing multimodal literacy unaddressed in reality. The disparity is particularly pronounced in rural areas of China, characterized by limited access to advanced technologies and educational resources (Yang et al., 2018). Additionally, young people in these regions are more susceptible to inadequate support and supervision in their digital media practice due to the parental absence caused by the significant parental migration, making many of them "left-behind children" (LBC) (Zhao et al., 2018). Consequently, it is urgent to support multimodal literacy learning in school education, especially for marginalized groups like children of migrant workers in rural areas.

Digital games, one of the most pervasive multimodal practices among young people (Toh & Lim, 2022), receive great attention and controversy (Liu et al., 2020). Many scholars recognize multimodal literacy afforded by digital game-based learning (DGBL). Specifically, digital gameplay creates an interactive, multi-sensory, immersive, and collaborative learning environment (Gee, 2007), where students develop the ability to read, comprehend, analyse, utilize, and respond to sophisticated interrelated multiple sign systems in the game and game-related media products (i.e., game paratexts) (Apperley & Walsh, 2012; Consalvo, 2007; Toh & Lim, 2022). Besides, digital gameplay empowers students to become active designers of meaning (Cope & Kalantzis, 2020). Through artifact-making in the game (Marlatt, 2018) or game paratext compositions (e.g., game walkthroughs and game reviews), students form critical stances in "shared and personal meaning-making, multimodal production, appropriation, and critical decision-making" (Burwell & Miller, 2016, p.122).

However, the complexity of DGBL presents challenges for educators. Teachers expressed concerns about the relevance of digital gameplay to learning objectives and lacked confidence in effectively incorporating digital games into the classroom (Dashtestani, 2022), resulting in a reserved attitude towards applying DGBL in the classrooms. Besides, the merits of DGBL are usually overshadowed by educators' concerns about the adverse effects of digital games (Bulut et al., 2022), such as game addiction, misleading violent and sexual content, and unhealthy lifestyle behaviours (Chan, et al., 2022), leading to strict regulations or banns on the youth's digital gameplay. Although these risks are acknowledged, the protective approach is ineffective because of the increasing percentages of young game players in both urban and rural areas (Rideout et al., 2022). In this case, the lack of formal instructions for meaningful engagement with digital games may intensify the risks in the youth's gameplay, particularly for LBCs receiving little guidance and supervision at home.

The extant empirical studies illuminate how students demonstrated multimodal literacy in DGBL such as critical game viewing (e.g., Stufft & von Gillern, 2021; Tanner, 2020) and game-based multimodal composition (e.g., Strømman, 2021). However, they are all situated in more developed Western contexts. There is no study pioneering digital game-based multimodal literacy programs in rural areas and probing its possibilities of enhancing LBCs' multimodal literacy as well as challenges during its implementation in such resource-limited contexts. Consequently, this study formulated a systematic instructional approach to teach multimodal literacy to zero-experienced students using DGBL, incorporating both digital gameplay and game paratext-making to address critical viewing and effective application in multimodal literacy learning (van Leeuwen, 2017). It further explored the possibilities and challenges of enacting this approach to foster LBCs' multimodal literacy in a rural classroom in northern China. The research questions (RQs) are as below:

RQ1: How does DGBL foster multimodal literacy in left-behind children in rural areas?

RQ2: What are the challenges of implementing DGBL for left-behind children's multimodal literacy learning?

Literature Review

Conceptualizing Multimodal Literacy in DGBL

The core of multimodal literacy is multimodality (Jewitt et al.,2016; Kress, 2010), which accentuates the collective contribution of multiple semiotic modes (e.g., images, sounds, and gestures) in all forms of communication. Semiotic modes refer to "socially and culturally shaped resources or organized semiotic structures for meaning-making" (Kress, 2010, p. 79), with distinct affordances (i.e., potential and limitations) in multimodal texts. Multimodal literacy entails having textual and contextual knowledge of semiotic modes to critically view and appropriately apply them in multimodal meaning-making (van Leeuwen, 2017). Kress and van Leeuwen(2006) conceptualize a visual grammar, eliciting three metafunctions of semiotic modes in multimodal texts, namely, representational (i.e., representing participant, process, and circumstances to show experiences, ideas, and relations), interpersonal (i.e., enacting social relations through contact, social distance and attitude expression) and compositional (i.e., combining representational and interpersonal meaning into a coherent text regarding information value, salience, and framing). The theoretical framework has been widely applied in previous empirical studies on students' multimodal meaning-making across genres (Zhang et al., 2023), such as making digital game walkthroughs (Strømman, 2021), analysing digital storytelling (Kim et al., 2021), and appreciating visual narratives (Wünsch-Nagy, 2020). Hence, this study adopts the framework as the theoretical foundation of students' multimodal meaning-making in DGBL, which contains various genres of multimodal texts.

Meantime, we integrated Toh and Lim's (2021) metalanguage of digital gameplay to specify multimodal literacy in DGBL. Toh and Lim framed three layers of meaning-making in digital gameplay: representation, engagement, and organization, echoing each metafunction of Kress and van Leeuwen (2006) as discussed above. Representation refers to what is shown in the game regarding game characters (i.e., gender, race, and ability), topic (i.e., type, purpose, and theme) and context (i.e., designers' ideology); Engagement focuses on gamers' perspective (i.e., focalization and shift), emotions (i.e., affect, judgment and aesthetic appreciation), and interactivity (i.e., sole, peer and multiplayer); Organization deals with the structure of game narrative and game mechanics, and game actions (i.e., embodiment in multisensory experience, and subversion, or counter-intuitive actions). The metalanguage provides teachers and students with instructional knowledge to critically engage with digital games as both multimodal texts and interactive multimodal literacy practice.

Pedagogical Perspective of Teaching Multimodal Literacy

A sound pedagogical framework is crucial for systematic multimodal literacy teaching. This study employs Cope and Kalantzis' (2015) "learning by design" model built on NLG's (1996) pedagogy of multiliteracies. The framework consists of four elements of multimodal practice: experiencing, conceptualizing, analysing, and applying. Regarding experiencing, students engage in immersive and close-to-life practice, building connections between the known (familiar, prior knowledge) and the new (intelligible, unfamiliar domains), with the teacher's or peers' scaffolding; Conceptualizing means using abstract and generalizing terms to describe semiotic meanings by naming and with theory, thus transferring "tacit knowledge" into "explicit knowledge"; Analysing refers to examining multimodal texts and frame patterns from functional (e.g., cause, effect, structure, and function of semiotic choices) and critical dimension (e.g., the underlying human agency, interest, and intent); Applying means students utilize "experiential,

conceptual or critical knowledge" to appropriately reproduce and creatively transfer their knowledge into a new product in a different context (Lim, 2018, p.5). The framework addresses the notion of multimodal literacy and has been proven effective for classroom-based literacy practices in past studies (Lim, Toh, et al., 2022). More importantly, it fits into DGBL in which students conceptualize and analyse digital gameplay through experiencing it and transfer their knowledge into game paratext.

Integrating DGBL in Multimodal Literacy Classroom

Definitions of DGBL vary. Drawing on Prensky (2003) and Marsh et al. (2016), this study conceptualizes DGBL as applying games played on any digital devices (e.g., computers, laptops, smartphones, tablets and consoles) for learning purposes—multimodal literacy learning in this context). Scholars explored the possibilities of DGBL for multimodal literacy learning from different angles. Highlighting digital games as an interactive process, von Gillern and Stufft (2023) encouraged adolescent students to write reflections on how diverse communicative modes function in their decision-making while playing Minecraft. They reported using the Gamer Response and Decision framework to scaffold students' reflection, whereas no details were revealed regarding how the framework was taught. Viewing digital games as narrative, Tanner (2020) played Grand Theft Auto in the classroom and guided students to critically view the ideologies underlying the game character representation (e.g., gender and racial stereotypes). However, the lesson was conducted in an improvisational and dialogic manner underpinned by the researcher's deep understanding of the game, offering limited instructional guidance for common teachers.

Beyond digital gameplay, Apperley and Walsh (2012) incorporate game paratexts into the scope of DGBL for multimodal literacy practice, which show tangible literacy outcomes and are more accessible to teachers and students. Empirical studies further evidenced the potential of class-based game paratext composition to foster adolescents' semiotic and audience awareness as designers of multimodal texts. A few examples are producing digital game reviews using PowerPoint and a webpage (Walsh & Apperley, 2012); sharing game experiences through social media posts (e.g., Marcon & Faulkner, 2016); and constructing electronic game walkthroughs on the tablet (e.g., Strømman, 2021). However, the previous studies provided little instructional guidance for teachers to offer cogent support in cogent support in students' game paratext design process.

Therefore, we synthesize Kress and van Leeuwen's (2006) and Toh and Lim's (2021) metalanguage of digital gameplay to construct the instructional knowledge to teach digital gameplay and game paratext making, thus filling teachers' knowledge gap. The structured knowledge is then framed into the pedagogical approach of "learning by design" (Cope & Kalantzis, 2015) to guide the teaching and learning process. The conceptual framework of the instructional approach is shown in Fig. 1.
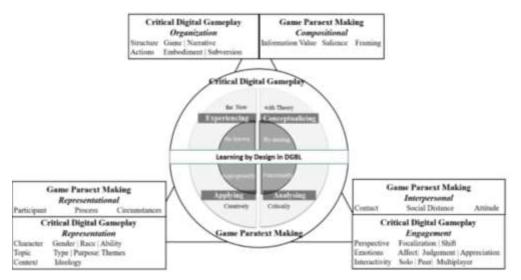
Fig. 1 Conceptual Framework of Teaching Multimodal Literacy in DGBL

Methodology

Context and Participants

We trialled the program in a suburban secondary school in a small town in northern China. As reported by one school principal, a large part of students' parents are migrant workers in cities, while their children remain in their hometown usually taken care of by grandparents. Literacy classes are print-based and exam-oriented, with no activities or assignments related to multimodal literacy, regardless of multimodal literacy being emphasized in the national curriculum standard (Ministry of Education of the People's Republic of China, 2022). Besides, they are regulated by strict restrictions on digital technology use (especially digital gameplay) at school to focus on academic study. Similarly, the students are discouraged from using digital devices by their gradians at home, which, however, fails to keep them from being regular media users. With little guidance, their media practice features a narrow scope, mainly centring on online video viewing, digital gaming and chatting on social media platforms.

We launched a 16-session program as an optional course, conducted in the fourth afternoon class (45 minutes per session, three sessions per week). A total of 16 students participated in the program, comprising eight males and eight females (all from the eighth grade and aged 14). The participants were all LBCs with their parents working in different cities. For class activities, the students were divided into four groups, designated as G1, G2, G3, and G4. All of them reported to be regular media users with varied game experience whereas had no experience in game paratext design. Two male school teachers Zack and Jay (pseudonyms), with over three years of literacy teaching experience, worked with the researchers to finalize and conduct the sessions. One researcher (the first author) gave class briefings to teach instructional knowledge and facilitated the whole learning process. The teachers were assistants, taking turns to observe the class, offer real-time support to students, and examine the instructional approach.

Research Design and Process

This study employed the qualitative case study approach to pursue a holistic and in-depth investigation (Merriam & Tisdell, 2016). The program included two phases and was conducted according to the syllabus (Appendix A) underpinned by the conceptual framework. In Phase I, students played the two-dimensional adventure game Tale of the Neon Sea (Fig.2.), playing the roles of detective Rex (Fig. 2-a) to unravel serial murder cases by collecting multimodal clues and solving multiple game puzzles (Fig.2-b, 2-c).

Simultaneously, they were tasked to address a series of guiding questions in the handout (Appendix B) and document the evidence for critical game analysis (e.g., taking snapshots).

Fig. 2. Samples of the instructional design

In this process, students first analyzed the game with no guidance and then guided by Toh and Lim (2021) taught in a 5-to-10-minute class briefing from Session 3. We simplified terminologies and explained them with concrete examples for students' easy comprehension and effective application (Fig.3). For instance, the researcher illustrated gender, race, and ability embodied in the game character design of several popular games to guide students' game character analysis (Figure 3-a). In Session 9, students finalized the handout and further discussed the evidence of their game analysis in a group interview. Sample interview questions are: "Could you give some evidence or an example?", and "Anything else do you want to add in this part of analysis?".

In Phase II, students engaged in digital game video design, during which the researcher taught video-editing skills and the basic concepts of Kress and van Leeuwen (2006) with specific examples in video-making contexts (Fig.3-b). With this knowledge, students transformed their game experience and knowledge into a short video of a game review (1-3 mins) using the video-editing software Jian Ying. In Session 16, they submitted the game video and discussed their design rationales in a group interview. Sample interview questions are: "What are the functions of this design element? Why do you apply it here?", and "What position did you take when showing your game review to the audience?". In the last session, both teachers attended an interview to discuss their perceptions of the possibilities and challenges of the program. Sample interview questions are: "How does the gameplay and analysis enhance students' multimodal literacy?", and "What challenges do you perceive in teaching multimodal literacy in DGBL?".

Fig. 3. Samples of the Instructional Design

Data Collection and Analysis

This study applied multiple data-collection methods for rich and robust data (Merriam & Tisdell, 2016). It includes the researcher's participant observation throughout the program, with the data recorded by field notes and video recordings of gameplay and game video-making; student-authored artefacts (i.e., four handouts of game analysis and four game videos); two semi-structured group interviews with each student group in Session 9 and Session 16; and one semi-structured interview with the teachers. Multiple data sources reveal final learning outcomes and how students progressively develop multimodal literacy with the instructions, thereby addressing the possibilities of the instructional approach. Meanwhile, the three instructors' emic views of the program implementation informed emerging challenges.

This study applied thematic analysis (Braun & Clarke, 2012), aligned with multimodal analysis (Bezemer & Jewitt, 2010), to process multimodal data. To address RQ1, we did a frame-by-frame multimodal analysis of students' actions and group discussions in the gameplay recordings in NVivo 12, and generated initial codes of how they critically viewed the gameplay with the instructions based on Toh and Lim (2021). Likewise, their game video-making recordings and final products were analysed, yielding codes of how they utilize semiotic modes and digital tools to design meaning underpinned by Kress and van Leeuwen (2006). Besides, we did a line-by-line analysis of students' handouts, verbatim interview transcripts, and the researcher's field notes for supplement and data triangulation. For instance, the code "analysing stereotypical portrayal" was generated from students' verbal comments in the game recording (i.e., finally comes a female character), and was substantiated by the written accounts in their handouts (i.e., male characters are dominant).

We paid particular attention to the timeline of codes and corresponding instructions to find patterns of students' progress under guidance, based on which we formulated key themes. For example, we sequenced the codes "literal descriptions of game events", "a

summary of key themes", and "critical discussion of the game theme in reality" respectively generated in session 1, 3, and 6, and related them with corresponding instructions (i.e., guiding questions and probing questions), contributing to the theme "deepening the critical understanding of multimodal texts". To address RQ2, we coded the researcher's reflective field notes and two teacher assistants' interviews to inductively analyse the main challenges emerging in the program implementation, aligned with the students' corresponding behaviours. For instance, "limited time" was mentioned by both teachers and the researcher's note, echoing students' hurried actions during class activities and their complaints in the interviews.

Findings

Possibilities of Learning Multimodal Literacy through DGBL

Broadening the Scope of Interacting with Multimodal Texts

The systematic instructions significantly broadened how students view and apply multiple semiotic modes in the game texts and video compositions. As shown in Fig.4, the participants' initial self-guided game analysis narrowly centred on recording names, time, and main game events (Fig. 4-a). Guided by Toh and Lim (2021), the students gradually pushed their boundaries to wider unknown areas and achieved a comprehensive game analysis (Fig. 4-b). Specifically, they mapped the protagonist's multifaceted identities and the stereotypical portrayal; summarized the game type, theme and purpose; discussed their interactions with the game and peers; evaluated the aesthetic design of the game; and analysed the game level design and game story structures. Some students highlighted the broadened perspective in the interview, as one suggested: "It's mind-blowing that digital games can be analysed from many angles, like a textbook. I used to play them just for fun and people just keep saying that no more games."

Likewise, students widened the scope of using semiotic modes for multi-layered video-making, scaffolded by Kress and van Leeuwen (2006). Under the instructor's guidance, students started to shift part of their attention from presenting the game content using game recordings and screenshots to interacting with the audience and addressing the coherence when making semiotic choices (Fig. 4). For instance, the class briefing on making contact via gaze inspired G3 to insert a self-filmed video in Session 14, in which one student recommended the game with direct eye contact to imaginary viewers (Figure 5-a). They further added dynamic stickers in bright colours to stress salient information in Session 15 (Figure 5-b), as recommended by the instructor when teaching compositional meaning-making. One student reflected on the expanded view in the class-based video composition:

It's totally different from how I made videos before. There are more factors to consider, like choosing suitable game scenes, attracting the audience and making everything logical and clear… I used to just film what I like and make it look good.

Fig. 4 Improvements in Students' Game Analysis (G1)

The digital game-based activities allowed the students to interact with a wider range of semiotic modes than in their previous language-centred literacy practice, as both teachers acknowledged. While gaming, the students collected multimodal clues (e.g., visual illustrations, cutscenes, sounds, spatial information in the game map, and written instructions), analysed visual feedback of game puzzles, and responded accordingly to solve puzzles. Besides, their game analysis synthesized multimodal sources, including the dynamic game story (e.g., evaluating the protagonist as highly competent from the case investigation process), dialogues (e.g., commenting one character "arrogant" from his tone and word choice), game characters' actions (e.g., empathizing with the main character's pain from his staggering gait), characters' portraits (e.g., inferring the cat character as "sociable" as it carries a rose), and the relevant circumstances (e.g., understanding the protagonist's financial condition from the worn-out furniture in the backdrop) (Kress & van Leeuwen, 2006). Similarly, students incorporated multiple semiotic modes to collectively express their design ideas in their game videos, including various types of images (e.g., game recordings, screenshots, stock footage, etc.), sounds (e.g., background music, voiceover, and sound effects), visual effects (e.g., face filters in Fig 5-a), gestures (e.g., gaze), emojis (Fig 5-c), dynamic stickers (Fig 5-d) and written texts.

Deepening the Critical Understanding of Multimodal Texts

Along with the broadened perspective is the increasing depth of students' understanding of multimodal texts. In the initial phase, students' game analysis featured general attitudinal adjectives (e.g., interesting) and brief literal descriptions of the game content (Fig.4-a). By contrast, they developed a more nuanced and precise vocabulary to conceptualize multimodal game texts, drawing on Toh and Lim (2021). This was evident in their written handouts (Fig.4-b), where they employed terms such as "gender discrimination", "pixel-style images", "difficulty level is increasing", and "timely feedback". Besides, their responses to the guiding questions embodied multiple critical thinking skills like categorization, inference, and evaluation (Facione, 1990). For instance, G4 classified the game type as a "puzzle-solving game". G3 inferred the protagonist's acceptance of robots from his criticism of anti-robot posters. G1 commented

the vibrant colours may cause fatigue. Furthermore, the students showcased deeper and specialized knowledge in their game video composing, as evidenced by their utilization of newly acquired terminologies to articulate their design ideas, such as "gaze", "social distance", "salience", and "coherence" (Kress & van Leeuwen, 2006).

Fig. 5. Students' Application of Semiotic Modes in the Game Video

The follow-up interviews inspired students to venture deeper into the functional analysis of multiple semiotic modes in conveying meanings. For instance, G3 elucidated that characters' dialogues, portraits, profiles, and decorative elements collectively represent the traits and backgrounds of game characters. G2 provided an illustrative instance of how lighting conveys emotions (i.e., dark lights communicate a sense of oppression); G4 conceptualized the utilization of sound effects to provide players with feedback, such as indicating the winning condition. Likewise, students explained the rationales of their semiotic choices in the game video for multi-layered meaning-making. For instance, G1 and G3 agreed upon utilizing game recordings to "illustrate the dynamic game process", whereas employing snapshots to "display intricate details". Additionally, three groups justified their incorporation of gentle and cheerful background music to evoke a sense of light-heartedness in the audience. These instances illustrate the students' development of chains of reasoning based on their experimental knowledge from the game activities (Cope & Kalantzis, 2015).

From the critical dimension, students interrogated the socio-cultural implications and human interests of multimodal game representations. For instance, G1 deepened their game character analysis from mapping individual identities (e.g., name, occupation and personality) to critical evaluation of the gender stereotypes (e.g., dominant male characters in contrast to marginalized female characters); Another example is G3's game topic analysis, which progressed from a brief summary of the game themes (i.e., social divide and corruption) to a critical discussion of how the game themes epitomize social issues in reality. One group member elaborated:

The problems are similar to the real world. Poor people live in rundown districts whereas the rich enjoy good living environments…the crime case was taken over by the authority shielding privileged people, which also happens a lot in our everyday lives.

Students also delved into ethical decisions in the game. For instance, G1 and G2 discussed whether to practice euthanasia for a lady suffering from an incurable genetic disease. Beyond their initial decontextualized remarks on the meaning of life (e.g., it is meaningless to continue a miserable life), they considered the legality of euthanasia and

the consequences of practising it (e.g., being imprisoned). Bridging the game topic with the lifeworlds, students critically examined the point of view represented in the game, whose interests it serves, and shifted their role from a distant onlooker to an accountable stakeholder considering the social consequences of the issue in relation to their own interest as human beings (Cope & Kalantzis, 2015; De Sousa et al., 2018).

As designers, students critically reflected on the congruency between their semiotic choices and their intended meaning. For instance, one student in G3 admitted: "some materials were randomly selected and were not very suitable to express what we want to show to the viewers.". They also acknowledged that the mediocracy of their video content fell short in conveying their affection for the game to achieve the purpose of recommendation. At the end of the program, students recognized the usefulness of the instructions for in-depth exploration, as one commented: "It is important to have that knowledge to go deeper because we don't know how to describe it and sometimes can't think that much.". It corresponds to Jay's remark that students started to talk like an expert with critical insights.

Enhancing Proficiency in Using Multiple Digital Tools

The program enhanced students' proficiency in using multiple digital tools for authentic multi-tasks, encompassing hardware (the tablet) and software (e.g., the game, search engines, and the video-editing application). Initially, students exhibited unfamiliarity with the functions of the tablet (e.g., taking screenshots, video recordings, and typing) and usually called for technical support. G2 particularly struggled with the game control in the first two sessions, reflected in their slow in-game responses, confused facial expressions, and frequent hesitation during operation. With little prior knowledge of video-making, most students felt disoriented when first entering the video-editing software, as Zoe stated: "We know nothing about it, looking so complicated.". Progressively, all the groups gained fluency in operating the game features to progress the game, and meanwhile, naturally took game snapshots to collect design resources for game paratext composition. G1 and G2 harnessed the search engine on the tablet for online game walkthroughs to effectively conquer challenging game puzzles and additional design resources (e.g., internet images) for video-making.

Most notably, all the groups learned video-editing skills from scratch, quickly gained the mastery of essential editing techniques (e.g., inserting, cutting and adjusting images, sounds, and texts on multiple tracks), and managed to produce a complete game video by the end of the program. G4 displayed considerable progress in capitalizing the technological affordances of the editing software for effective multimodal meaning expression, such as setting motion tracks of written texts to follow the moving represented participants to ensure clarity and using three distinct types of automatic voiceover to represent different identities. One student elaborated on her enhanced ability to utilize digital tools, which seem to be common but inaccessible in her everyday life:

I learned to use the tablet and edit videos. They are very common nowadays, as lots of people are using them. But I have no tablet, only a smartphone. Nor could I edit videos, which is difficult to learn from scratch by myself, and no one taught me that.

Challenges of Enacting the Instructional Approach

Students' Varied Competencies and Motivations

Students' individual differences in competency and motivation posed challenges to the program enactment. Regarding competency, 16 participants demonstrated different multimodal literacy levels in the class activities, causing unequal participation within the group work and asynchronous progress across groups. Within three groups, one or two more capable students took the dominant position, whereas the others sat and observed quietly. Although we reiterated an equal labour division, complaints about the unfair teamwork were frequent (e.g., "they just sit around and do nothing" and "he decided

almost everything!"). Among four groups, G2 encountered challenges in keeping up with the pace of gameplay and video-editing but rarely seeking assistance, which required closer monitoring, extra instructions, and readjustments of the class progress. Jay was concerned about coordinating larger class sizes with more varied students.

Besides, different motivation levels among the students further contributed to the asynchronous learning progress. Three groups showed great enthusiasm for the program, as they always arrived early, fully absorbed in the class activities, and actively engaged in group discussions. By contrast, G2 appeared less motivated, reflected in their higher absence rate, more salience, and unpleasant facial expressions during the class activities. It was further confirmed by Zack, who reported that G2 occasionally favoured doing homework in the classroom over attending the program. He further explained some students' lower motivation might relate to the burden of heavy homework and the exam-focused education system, stating that students may perceive the program as "irrelevant to exams that decide their future" and "time-wasting". Probing questions revealed the students' worries about their future as a marginalized group: "We are not from rich families, and we have more pressure in this competition. So, we have to study harder and get good grades.".

Time Constraints and Limited Access to Digital Devices

Another primary challenge is to accommodate the program into the tight schedule and the rural classroom with limited digital devices to support interactive DGBL. The program was shortened to fit into the dense school schedule, resulting in limited class time and restricting comprehensive and in-depth learning. Students found the class time insufficient to complete all the game chapters for a holistic view and deeper insights into the game, as one student suggested: "We don't know the whole story and may lose some important points when analysing the game.". Time pressure was more evident in the game video composing activity, as all the groups expressed difficulty in making meticulous semiotic choices to present the most captivating game segments due to the limited time frame, leading to less satisfactory outcomes. Additionally, the class time of a few sessions was occupied by other school teachers for extra teaching, causing a high absence rate in those sessions. Unfortunately, make-up sessions were inapplicable due to the prescribed school curriculum. Assigning after-school tasks was also not feasible due to students' heavy homework on eight school subjects, as Zack reported.

For another, the school did not provide students with tablets or other digital tools for interactive classroom learning, which were deemed as "luxurious, difficult to control and unnecessary". Jay suggested: "Tablets are expensive, and we can't guarantee that students can keep them safe. As a rural school, we have a tight budget only for essential investments, like infrastructures and reference books for school subjects." He then elicited that asking students to bring personal smartphones for schoolwork is also not feasible, because it contradicts the school rule banning any kind of electronic devices at school and would be questioned by their guardians. In this study, the devices offered by the research team were limited in number, which affected the students' equal engagement in classroom activities. Given the practical constraints, both teachers were concerned about the future implementation of the program in rural schools.

Discussion

This study conceptualized a systematic instructional approach to support LBC's multimodal literacy learning using DGBL and exhibits empirical evidence of the possibilities and challenges of enacting it in a rural classroom. Regarding possibilities, the findings reveal the game activities increased the breadth and depth of students' critical viewing and application of multimodal texts and enhanced their proficiency in using multiple digital tools for effective multimodal communication, addressing the essential

aspects of multimodal literacy (van Leeuwen, 2017). It is consistent with the findings of Wünsch-Nagy (2020) and Lim and Tan (2018) that systematically teaching a metalanguage of multimodal meaning-making heightens students' semiotic awareness and facilitates "richer", "more extensive", and "nuanced appreciation of the ideas and layers of meanings" (p.297). Compared with learning multimodal literacy using other media types (e.g., films and advertisements), DGBL provides the students with more agency to construct semiotic knowledge through immersive and interactive game experiences. Beyond that, this study validates the value of incorporating Toh and Lim (2021) and Kress and van Leeuwen (2006) to effectively address the knowledge gaps of zero-experienced students in utilizing digital games for literacy learning.

Second, this study contributes to the LBCs' dynamic learning progress mediated by systematic guidance and real-time support. Through the guided digital gameplay and analysis, the students demonstrated a discernible shift from casual players to critical gamers engaging in scrutinizing, conceptualizing, and analysing multimodal communicative modes in the game texts from multiple dimensions. The findings resonate with the previous studies (e.g., Stufft & von Gillern, 2021; Tanner, 2020) regarding how digital games function as legitimate literature to cultivate students' critical insights into multimodal texts. It further offers a new perspective that the theoretically grounded instructional strategies enable zero-experienced students to make these critical insights more "explicit, overt, systematic, analytic and conscious" (Cope & Kalantzis, 2015, p.20). Game video design allows the LBCs to be producers. They harnessed multimodal design resources and digital tools, transforming their game experience into a new product in a different context (Lim, 2018). Corroborating earlier findings in Marcon and Faulkner (2016) and Strømman (2021), the students exhibited semiotic and audience awareness when engaging with game paratext making. This study further evinced that this awareness can be emphasized, articulated, and confirmed through instructions (e.g., metalanguage teaching and probing questions) to yield more tangible learning outcomes. The students' transformation affirms the potential of fostering multimodal literacy through critical game analysis and game paratext-making for students to explore and express multiple identities (Apperley & Walsh, 2012; Gee, 2007). It echoes the tenet of multimodal literacy to "create a kind of person, an active designer of meaning" beyond developing competencies and skills (Cope & Kalantzis, 2009, p. 10). Also, their noticeable progress proves the value of the "learning by design" pedagogical approach to facilitating inexperienced students to walk through the knowledge process in multimodal literacy practice (Cope & Kalantzis, 2015). Meantime, it confirms and specifies the instructor's key role in scaffolding students' media practice (Selwyn, 2009).

Moreover, this study also reports a noticeable enhancement in the LBCs' proficiency in using multiple digital tools, compared with their initial unfamiliarity. For one thing, it proves the affordances of DGBL to provide students with rich, interactive, and authentic media experiences (Stufft & von Gillern, 2021). Besides, it substantiated the unequal access and competencies in the youth's digital media usage (Dahlström, 2022). For instance, the students in this study gradually mastered using tablets and video-making software with the researcher's guidance, compared with those in Strømman's (2021) study showing an initial fluency in tablet use and independent paratext-making. In this sense, the program enabled students to communicate and learn with multimodal tools beyond the printed form for creative and complex expression (Cappello et al., 2019), thus narrowing the digital divide between students in different social-cultural backgrounds.

On the other hand, this study identified challenges in implementing such programs in rural classrooms, including students' varied competencies and motivations, time constraints and limited access to digital devices. The findings echo Yin's (2014) work regarding the difficulty of accommodating students with varied abilities for active, equal participation in classroom-based multimodal practice. Additionally, we discovered lower motivation levels in some students (e.g., G2) in comparison to previous research

highlighting increased motivation in DGBL (e.g., Marcon & Faulkner, 2016; Walsh & Apperley, 2012). This discrepancy can be attributed to conflicting time commitments between attending the program and completing other schoolwork essential for academic performance, which the students felt more obliged to prioritize based on their individual value orientations (Hofer et al., 2007). Their identity as a marginalized group seems to reinforce their commitment to academic study directly associated with their future opportunities. Another possible contributing factor is a psychological barrier to active engagement in digital media practice (Van Dijk, 2004), due to the limited proficiency and the lack of prior experience in game activities. The students' variations further evince the digital divide among young people from different economic and social backgrounds and emphasize the urgent need for educators to address the issue in the classroom (Selwyn, 2009), especially in rural areas.

Furthermore, the constraints of time and digital devices further discourage the students' multimodal literacy learning through digital games. The time constraint resonates with the class-based multimodal literacy programs conducted in Singapore secondary schools (Lim, 2018; Lim & Tan,2018), but is rarely mentioned in studies situated in Western contexts. This difference could be associated with dense and rigorous school timetables in Asian contexts. Limited access to digital devices at school, unmentioned in the previous literature, once again proves the unequal access to digital media practices in school settings. One explanation is socioeconomic and epistemological disparities (e.g., the lack of financial resources and recognition to invest in interactive educational technologies). Another contributor is the "protective" school policies against students' technology usage. The above challenges are all related to the dominance of prescribed school curricula and language-centred assessment systems in the school learning environment (Yin, 2014), which consume the most educational resources and challenge pedagogical innovations.

Conclusion

In conclusion, incorporating DGBL in a rural classroom has great potential to enhance students' multimodal literacy. For LBCs, learning multimodal literacy through digital games compensate for their lack of parental guidance and supervisions on digital media practice at home. On the other hand, perennial challenges exist during its implementation, rooted in the unchanged nature of the existing school system. With the growing importance of multimodal literacy in the digital era and the ongoing prevalence of digital games among the youth, systematic guidance in school classrooms can help students leverage the pedagogical affordances of digital games and provide substantial support for their productive multimodal learning. Furthermore, researchers, teachers, and policymakers all have the responsibility to promote this pedagogical transformation, thus addressing the evolving demands of the digital age and preparing adolescent students for active participation in their future lives.

This research has implications for future studies. Practically, our findings provide a systematic syllabus incorporating concrete instructional knowledge and a pedagogical approach for regular teachers to expand and enrich students' interactions with multimodal texts, in response to the reshaped goal of literacy education. Our research also offers valuable insights to researchers seeking to promote digital game-based literacy programs in similar educational contexts. It includes conceptualizing a systematic knowledge structure for zero-experienced students, providing real-time support and resources to support students' learning, and working with school management teams to secure recognition and support in addressing external constraints. It further sheds light on policymakers to address the existing incongruency between the emphasis on multimodal literacy in national curriculum standards and the existing school systems (Lim, Chia, et al., 2022). Theoretically, this study contributes to the further theorization of DGBL within the context of multimodal literacy. We recommend an updated metalanguage with more

concrete examples and plain explanations. It can reduce students' pressure to comprehend abstract concepts, thus increasing their critical engagement with digital games. Methodologically, our study offers implications for utilizing multiple data collection methods to uncover the dynamic learning process. Besides, we provide an example of integrating digital gameplay and game paratext-making to fully harness digital games in multimodal literacy education.

Admittedly, we acknowledged the limited generalizability of this study due to the small sample size. However, the small-scale classroom and noticeable variations among the participants deepened the exploration of students' learning progress with the instructions to address the research questions (Merriam & Tisdell, 2016). Another limitation was the insufficient duration limiting the depth of students' learning. Notwithstanding, the research findings resonate with those of previous studies and offer new perspectives as an entry point for future implementations and advancements of digital game-based instructional approaches for literacy education, especially in overlooked and marginalized contexts. We recommend researchers explore the utilization of digital games in larger literacy classrooms to promote larger-scale implementations. Researchers can also incorporate the instructional approach for teacher training programs in rural schools to foster teachers' expertise in utilizing DGBL for multimodal literacy teaching. Working together, teachers, researchers, and school policymakers can develop strategies to overcome obstacles and pursue its successful integration within the school curriculum to offer more educational opportunities.

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