

From Player to Level Designer: Exploring Design Thinking Through *Mario Maker 2*

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Abstract: This paper reports on a game design study that took place in April 2025 over nine days with 53 school-aged students, in a small, rural town on the west coast of Canada. Led by the researchers who took over the one-hour class, while the teacher supported, the study was centred on both game play and playful game design, and we centred play as a central, core, engaging part of both playing and designing digital games. To that end, participants first played a simple, fast paced game (*WarioWare: Get It Together!*) in pairs on Nintendo Switch Lites, and were asked immediately begin thinking about game design: who are the characters, what are the rules (what can and can't they do), what is a "game screen" and then to make characters, rules, and game screens of their own, designing them in their own game designer "sketchbook" before moving to their own game design using the software *Mario Maker 2* also in pairs. As they designed their level, we emphasized playability and user testing, and the 10 days culminated with a play session in which the participants demonstrated their by and large very playable games (only 2 students didn't complete a level). The study shows how basic, highly engaging and enjoyable digital game design can support classroom learners to explore design thinking, and that playing and designing games can create room for a different social order, one in which marginalized students might be able to take up a more central role, for example, as having game playing expertise, or being especially talented at drawing their own levels in their game design sketchbooks. Further, we saw just how engaged most participants were with their own design process, circulating to show others in the class their games, and/or asking them to play what they had made, taking pride and interest in their varied designs. Overall, and as a short-term intervention, the project demonstrates the very big hold digital games continue to have for young people as an entertainment medium, with participants readily taking up the challenge to move from playing to designing their own games.

Keywords: Video games, Game design, Design thinking, Nintendo Switch, Game play

1. Introduction

This study took place in two elementary schools in a rural area of British Columbia, Canada that has a population of around 4,000 people. The nearest small, not research focused university is nearly 300 kilometers away. The two schools were small: one had about 150 students in grades 1-7, the other had around 80. The schools are located in an area with a large Indigenous population, including four First Nations, who make up more than 20% of the local community: a proportion notably higher than the provincial average. We mention this as it speaks to the remote location, as well as the existing population of students within the school in this community.

Unlike many of the schools that are adjacent to the universities, this school district sees very few researchers, and in fact, none of the principals had had researchers in their schools during their tenure. Perhaps because of that lack of researcher presence, we had a nearly 90% participation rate from students assenting, and parents/guardians consenting to their child's participation. And, already there was an unexpected research outcome before we even arrived at the school as research, and especially educational research, can be an enriching, wholly different experience for participating teachers and students, and yet, we rarely think about how unevenly those benefits of participating in research are distributed, and now profoundly they are shaped by geography.

This paper reports on a game-based learning study of commercial-off-the shelf games *WarioWare: Get It Together* and *Mario Maker 2*, played on Nintendo Switch Lite game controllers. The study was designed to centre playful engagements with the handheld game technology, including just playing games, while also focusing on game design (and thereby design thinking) elements like character design, level design, rules, and conditionals. The study connected to the British Columbia curriculum in three important ways: 1) literacy: the games chosen for the study required basic to intermediate reading capabilities; 2) design thinking: we deliberately scaffolded elements of game design, and 'design thinking' including testing, revision, and retesting; and 3) collaboration: we deliberately didn't directly instruct any of the game play or game design, requiring students to collaborate, design, play test, and help one another as they both played games and designed their levels. This study is needed because much of the research on digital game-based learning takes place in urban or university-adjacent settings, leaving rural and geographically remote classrooms underrepresented. By examining how students in these schools move from playing commercial games to designing their own levels, the study helps show how game-based literacies, design thinking, and collaboration can be supported in communities with limited access to formal research opportunities and classroom technologies.

2. Related Literature

Because this study involved both playing and designing games. Literature on learning and game play has shown for some time now, that games can support learning outcomes in a variety of subjects (Clark, et al., 2016; Cole, et al., 2023; Connolly, et al., 2012). Similarly, game design has been used to support the acquisition of STEM related skills and competencies (Chiazzese, et al., 2018; Denner, et al., 2014; Denner, et al., 2019; Puttick, et al., 2023; Singh & Sun, 2025). This study most closely aligns with Jasmin Kafai and Quinn Burke's (2016) framework of "connected gaming," a pedagogy that moves learners from game play into active participation in game making. For example, a student might begin by playing an existing platform game, noticing how enemies, timers, obstacles, and rewards shape the player's experience, and then use those observations to design and test a level of their own. In this sense, playing becomes part of the design process rather than a separate activity. As Kafai and Burke argue, "making and playing are no longer distinct activities but rather interrelated, mutually informing processes" (2016, p. 8).

Kafai and Burke's construct of "connected gaming" provides a useful bridge between playing and making by showing how students can move from experiencing games as players to understanding them as systems that can be designed, revised, and shared. That bridge matters because it positions game play not as a diversion from learning, but as an entry point into design practices: noticing how rules work, how levels guide players, how difficulty is managed, and how feedback from others can inform revision. It also offers students opportunities to see game design as a legitimate form of learning, while expanding their interactions with the communities that surround it (Dishon & Kafai, 2019). This study traverses that same bridge by inviting participants first to play and analyze games, and then to design their own levels using the Nintendo Switch software *Super Mario Maker 2* (MM2).

3. Study Design

The study asked the following two research questions: 1) What digital literacies can be supported through ludic focused pedagogies that centre just playing and just making digital games; and 2) How do classroom ecologies change when play is a central feature of the learning environment? To that end, we asked students working in pairs, chosen by the classroom teacher to play *WarioWare* and then make game levels, using the game building software, *Super Mario Maker 2*. A game design sketchbook was also provided to each individual student, and the researchers conducted activities over the course of the study that had students use and refer to those sketchbooks.

The study took place over two weeks (9 days), for an hour per session in two grade 6/7 classes, and one grade 5/6 class with a total of 53 participants. Overall, data collection including video recordings of the classroom, teacher and student interviews, observations and fieldnotes, and a student questionnaire which asked students about their access to technologies and their media consumption.

Each class began the study by playing *WarioWare*, which is played through a series of fast-paced (usually 5-10 seconds long) microgames, that tell players what they need to do through a 'command word' such as "jump", "spin", "hypnotize", and "align". The classes played *Wario* for 3 days for around 2 hours in total play time, as during class time participants were also asked to add elements to their game sketchbooks: drawing a character, drawing a game screen with lives, a timer, a command word, and generally discussing what elements make up a video game (Figure 1).

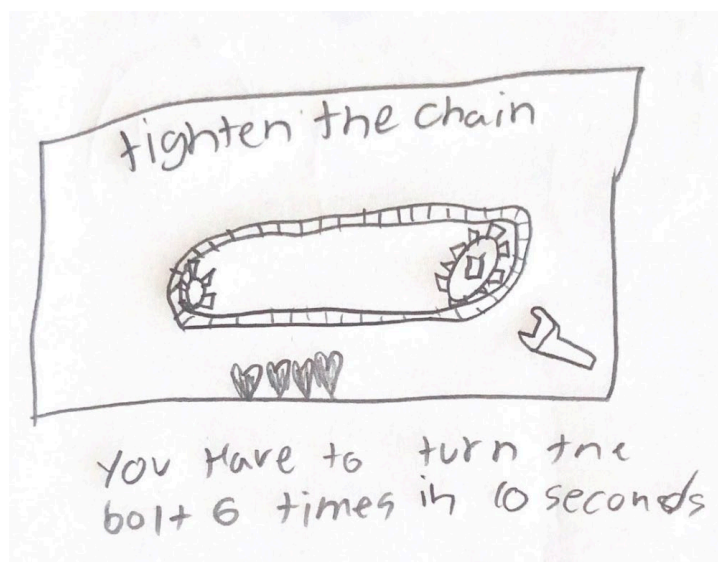


Figure 1: Game design screen in sketchbook with lives and command word.

On day 4, classes were transitioned to *MM2*, and began exploring in “story mode”, the game play portion of *MM2*, before transitioning to building their levels on Day 5. The rest of the time (days 5-8) was concentrated on level design, with participants designing, testing, re-testing, and re-designing their own levels. During that time, they also contributed entries to their game design sketchbooks, drawing their levels for *MM2*, and in some cases working hard to demonstrate fidelity between the hand drawing in the sketchbook and the game level they designed (see Figure 2).

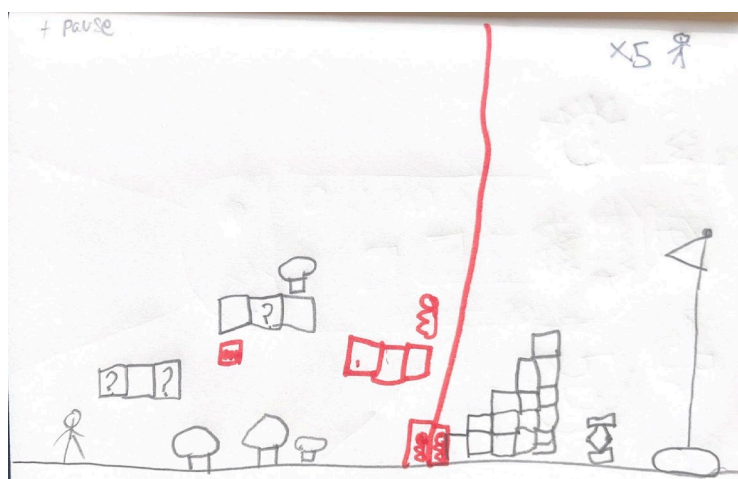


Figure 2: Sketchbook Level Design

During the “just play” portion of the study, we documented in all three classes, high affect, laughter, comradery, and benign competition. In one class, the teacher remarked how well pairs were getting along that normally did not work well together, and in another class, the teacher walked in the room and asked jokingly “what did you do to my students” as they were all, on task, focused on the game, even as they had to take turns, playing in pairs.

4. Focusing on Game Design

As stated, the play sessions, also had a design focus. On day 2, we asked students to describe their favourite characters in *WarioWare* and then asked them to either replicate that character in their sketchbooks or to design their own, and to add what ‘powers’ or ‘abilities’ their character possess (in *WarioWare* each character has a different ability – Mona, can fly shoots a boomerang or Wario, who has a jetpack and also flies, has a ‘dash’ attack where he runs into things). That meant that in addition to characters and character designs, they were thinking about the affordances of particular abilities of characters in the game. On day 3, we then asked participants to draw a game screen, with a “command word”, like “jump” or “find” on it and to add lives and a

timer (see Figure 1). This asked them to think a little bit about game rules, and game affordances like lives and timers. When we transitioned to MM2 play, and before moving into designing their own game, we asked them to focus on game assets, like bosses, objects, coins, blocks, enemies, power-ups and so on, that were available in MM2, and on Day 5, we asked them to begin sketching the level they wanted to design in MM2 (see Figure 2). Sketching also gave them something to do when the person they were paired with was designing their game, if they were not interested in participating. Overall, we collected 55 sketchbooks at the end of the study, whose designs varied based on participants' interest and skill when it came to drawing, but with even the most minimally designed sketches, at least showing some engagement with the design tasks.

During the level design portion of the study, we emphasized three design principles: 1) iteration: design, test, re-design; 2) playability: we told participants continually that we wanted their levels to be playable, and that that meant that they didn't have so many enemies that a player couldn't reach the end of the level, or that the level was designed in such a way that the player had to ask where to go and what to do; and 3) user-testing or play-testing so that they could re-design in the level wasn't playable. We also directly taught participants the concept of conditionals as it applied to MM2, emphasizing the if-then construction of conditionals: "if you have a door, then you need a key", "if you have a switch, then you need to turn it off or on", if you have a pipe, then you need another pipe". While that didn't necessarily produce a lot of working conditionals in the game, it was for a small minority, an important design feature in their game.

In terms of level design in MM2, overall, there were 34 levels built out of a possible 56 students participating. Of those, there were 7 that were incomplete, and/or not playable, 17 that participants were mostly able to play through, and that were semi-complete (sometimes missing a few elements in the level that participants said they didn't have time to add, and 5 that were exceptional, either because of the complexity of the level, the length, or a combination of the two (See Figure 3). A further 6 added a conditional (only 2 of the 5 complex levels had one), and the conditionals were operational like having a key for a door or using the pipes to move in and out of areas (see Figure 4). Given that there were 22 levels that were playable, if not complex, it meant that over half of the participants who made a level produced something that was playable, something that we emphasized throughout the study, and that many were able to accomplish.

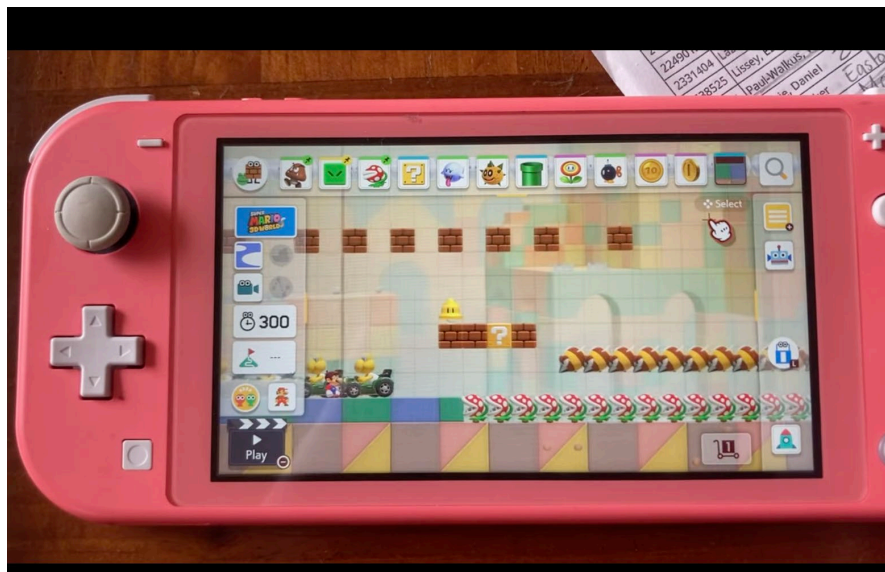


Figure 3: A level in *Mario Maker 2*

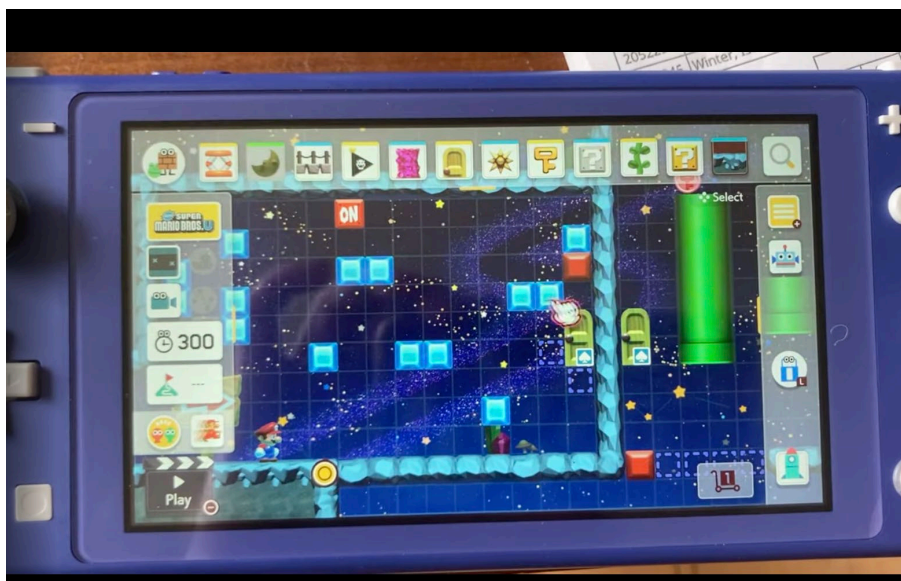


Figure 4: A level with conditionals in *Mario Maker 2*

5. Just Playing and Making Classroom Ecologies

When game technologies enter classrooms, they bring with them play, something all too often relegated to outside of classrooms, at home, afterschool, on the playground, but not *in classrooms*. In this study, play, even when designing was foregrounded: students laughed, yelled loudly when they lost a level, moved around and helped one another with levels and/or with advancing in the games we played, and they stayed playing, and making. All three teachers, for example, remarked on how their one or two students who had trouble ‘focusing’ were on task during the study. Another, was surprised by the fact that many of her students persisted, even when they were not winning or succeeding as well as they wanted to, and that same teacher and one other noted how students were able to still participate even if they had low reading skills.

In opening up the classrooms to play, another ecological change was made possible, as at least one student in each class was able to move from the more periphery of the class to the centre. For example, a boy in grade 5, who had *MM2* at home, and who was also an avid game player, and especially of Nintendo games, became the ‘go to’ person to ask for help in the class, and while his teacher had reported he hadn’t really ‘integrated’ well in the class, during the study he was sitting next to, and playing games with others in the centre of the classroom. In another class, a young woman, described as quiet and shy by her teacher and who mainly read most days, even if there were activities going on, was thrilled to be playing, and was often asked for help or offered it when others looked like they needed it, something her teacher said, had not happened before. And in all three classes, teachers reported watching students who were divided by age or other social barriers, who never played together on the playground, playing, laughing and collaborating with one another. That the classrooms were able to transform in that way, to include some who were otherwise marginalized, to level-out differences like not being able to read, but being able to be a full participant represented a large, if temporary change in the ecology of these classes.

6. Game Literacies and Other Digital Literacies: A “Digital Divide” of Sorts

In the small, rural, public elementary schools the study took place in, there was very little technology present: each school had access to one classroom cart that had enough Chromebooks for each student. Teachers had to book out the Chromebooks to use them, and the ones we spoke to said they couldn’t get access to the Chromebooks as much as they wanted to, given the shared resource. In one school, the cart was so heavy to move it took at least 2 students/adults to move it, and it was often just ‘not worth the effort’. The teachers we worked with also reported low “digital literacy skills” in their classes, by which they meant that they were often helping students either retrieve saved files, or teaching them how to appropriately name and save a file, something we also witnessed in the study when it came time to save (and or retrieve) their saved levels in *MM2*. That said, every participant we had in the study, had had their hands on a Nintendo Switch or Switch Lite, and in total 7 boys and 2 girls reported that they had access to a Switch at home. While that number might seem low, we did not have to show any participant how to use the Switch, or which buttons to push, so there was at least a basic, if not for many a more advanced understanding of digital games, showing that while their teachers

might indicate they lacked basic ‘digital literacy’ skills, they certainly did not lack basic video game literacies. Indeed, when asked what games participants most often played, the top four games were: *Roblox*, *Fortnite*, *Minecraft* and *Mario Kart* (see chart 1).

The questionnaire data suggest that students’ reported game preferences were unevenly distributed by gender, although not uniformly so across titles. *Roblox* and *Minecraft* were the most gender-balanced games identified by participants, with *Roblox* reported by 34 male students and 28 female students, and *Minecraft* reported by 17 male students and 15 female students. By contrast, *Fortnite* and *Call of Duty* were more strongly associated with male respondents: 28 males and 11 females reported playing *Fortnite*, while 11 males and only one female reported playing *Call of Duty*. *Mario Kart* was the only title in this set reported more frequently by female students than male students.

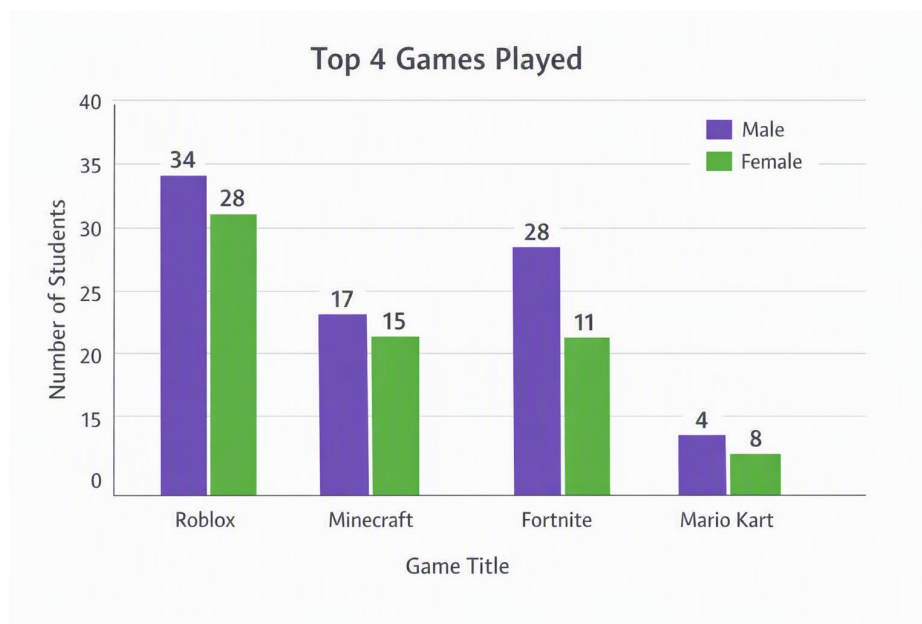


Chart 1: Top 4 games played

So while the participants had game-based literacies, part of that lack of ‘digital literacy skills’ might be explained by the fact that very few students report having access to a laptop or a PC at home (see Table 1). For example, smart phones (n=33) and game consoles (n=29) were the number one and two devices (out of 53 full responses) respectively, that participants reported they had access to, with access to a desktop or laptop limited to 8 and 4 students, respectively. Girls also reported access to more smartphone (n=20) and tablets (n=4), while the top access to technology at home for boys was a game console (n=23), followed by a smartphone n=13). So, while these students might be playing some games at home, and especially the boys, they do not use computers very often or at all at home, and instead spend their time in other media like YouTube shorts and Tiktok (the overwhelming top two choices when asked). Why does that matter? In this rise of the chatbot era, and given the rapid and opportunistic adoption of AI in K-12 and higher education, which, frankly has been at an unprecedented rate, one never before seen in the education sector, which has been notoriously resistant to change, the students we worked with in the rural schools, who not only have very little access to computers at school, but also at home are experiencing deep inequities when compared with their more urban counterparts.

Table 1: Access to technology at home by gender

Reported Access to Technology at Home by Gender		
Device	Girls	Boys
Smartphone	20	13
Game console	6	23
Tablet	3	0
Desktop computer	4	4
Laptop computer	0	4

That said, in our interviews with students and teachers in this geographically remote rural setting, we did see and hear a lot about being out of doors when compared to their more urban counterparts, with students talking about hunting, fishing, going to local parks and extra-local beaches on the weekend, hanging out with friends, playing organized sports like hockey, soccer and baseball, and their teachers talking about having access to the outdoors as their primary motivator for their living there. In the playground, students played active, highly physical games—soccer, tag, keep away, handball, and so on, with no heads bent over cellphones. So, even as many of us scramble for improved digital access and use, in this very different geographical location, things are quite different. While teachers and students recognize the importance of building technological competence, and acknowledge they do not have the resource or skill base to accomplish this, it's impossible to ignore this intentional cultural trade off: less screen time, and more time outdoors.

7. Limitations

All studies have limitations. This study's limitations were: a) the time spent in the school was limited, as we were there only two weeks, a longer duration, and longer time with MM2 could have resulted in more complex level designs, and also created room for those who were not able to complete their levels to finish designing them; and b) the number of participants, as this was a small, scale, limited in scope qualitative study. A mixed-methods study design, perhaps with pre- and post-testing could have revealed more about what the students' prior knowledge was of game design, and then what they learned having participated in the study. We did not conduct that kind of measurement in this study.

8. Conclusion

Taken together, these findings extend the literature on game-based learning and connected gaming by showing how the movement from play to design can support student learning in a rural elementary classroom context. Prior research has shown that digital games and game design can foster engagement, collaboration, computational thinking, and STEM-related learning; this study adds to that work by demonstrating how even a short, low-barrier intervention using commercial games can invite students to think like game designers. As students moved from playing *WarioWare* to sketching and building levels in *Super Mario Maker 2*, they practiced core design processes, including noticing rules and affordances, planning game screens, testing playability, revising designs, and responding to peer feedback. The impact of the study, then, is not only that students produced playable levels, but that they participated in meaningful forms of design thinking and digital literacy that connected directly to their existing game-based knowledge.

This study demonstrates that playful game design can provide a powerful entry point into digital literacy, design thinking, and classroom collaboration. By moving from playing *WarioWare: Get It Together* to designing levels in *Super Mario Maker 2*, students were invited to see games not only as entertainment, but also as systems made up of characters, rules, screens, challenges, feedback, and revision, extending the concept of connected gaming by showing how play and making can work together in everyday classroom contexts, even within a short-term intervention.

Importantly, this work also shows how bringing game technologies into classrooms can temporarily shift classroom ecologies. Game play and making created opportunities for students to participate differently: some who were usually positioned at the margins became sources of expertise, while others collaborated across existing social boundaries. These changes show how different forms of knowledge, including game-based knowledge, can become valuable when classroom activities make room for them.

The findings also complicate familiar accounts of the digital divide. Students in these rural schools had limited access to laptops, desktops, and classroom technologies, yet many had substantial experience with games, consoles, mobile media, and outdoor play. For educators, this suggests the need to build from the literacies students already bring with them to the classroom, including game-based literacies. Overall, this study shows the value of playful, low floor, high ceiling (Grover & Pea, 2013) game design as a way to support design thinking, recognize diverse student expertise, and create different and inclusive possibilities for learning.

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Ethics Declaration: This study received research ethics board approval as well as school board approval. REB approval number: H24-00690.

AI Declaration: Microsoft Co-Pilot was used to create the table and the chart for the paper, based on data that had been tabulated using an excel file.

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