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Paper Title Echoes of the Unheard: Learning Through Playce-Making to Foster Meaning Making and Creativity in STEM Education

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Echoes of the Unheard: Learning through Playce-making to Foster Meaning-making and Creativity in STEM Education

Abstract

In this study, we explored the emergence of personal meaning-making and creativity to go beyond productivity in STEM education. We investigated learners' meaning-making in the context of an interest-driven participatory game-design project where immersive learning and playce-making (constructing playful experiences linked to a place) intersected in Career and Technology Foundations class. Taking a qualitative approach, we collected data from nine graders in a suburban junior-high school in Western Canada. Drawing from constructivist perspectives, we discuss how learners within a group demonstrated personal meaning-making and creativity when they were immersed in playce-making. Our findings suggest that the intersection of immersive learning and playce-making can support learners curate their own learning experiences by integrating personal meanings and lived experiences into their project.

1. Objectives

Science, technology, engineering, and mathematics (STEM) education is frequently linked to productivity, whereas human capability can and should go beyond productivity in the context of STEM education (Takeuchi & Dadkhahfard, 2019). Although immersive learning (i.e., virtual) and place-making (i.e., physical) may initially appear distant, there exists a potential where these two concepts meet, creating a fertile ground to go beyond productivity in the context of STEM education. Playce-making, constructing playful experiences linked to a place, provides learners with opportunities not only to immerse themselves in storytelling but also to integrate their own knowledge and lived experiences (Authors, 2023).

What sorts of personal meaning-making and creative endeavours emerge in STEM education if we place human capabilities and unheard voices at the center of a game design project? To answer this question, we describe a group of nine grader's involvement in a game design project in a Career and Technology Foundations class of a suburban junior-high school in Western Canada. We discuss how three learners within this group demonstrate personal meaning-making and creativity by echoing their unheard voices in their project when they were immersed in playce-making. Drawing from constructivist

perspectives, the learning process described involves actively constructing and adapting internal meanings and models of reality through interactions with the environment (Doolittle, 2013).

2. Theoretical Framework

Immersive learning can be defined as an innovative approach to support learning through artificial experiences that can be perceived as non-mediated (Dengel, 2022). In this context, learning refers to the multifaceted experience that can result in a variety of outcomes, such as acquiring new knowledge, developing skills, deepening understanding, reshaping attitudes, questioning values, transforming identities, exercising creativity, and making personal or collective meaning (Celine, et al. 2022). These learning outcomes are influenced by a myriad of factors, including the subject matter, the context in which it occurs, the individual or group involved, cultural influences, age, and more (Munali et al. 2021). Spanning from profound psychological focus (flow) to complete physical sensory engagement (presence), immersion can play a pivotal role in attaining such learning outcomes (Mystakidis & Lympouridis, 2023). Depending on the desired learning outcomes, different technologies (e.g., extended reality; XR) or learning strategies (e.g., simulation, role playing, game-based, and playce-making) can be used for immersive learning purposes (Christopoulos, et al. 2022).

One such means, particular to this paper, is playce-making which is defined as creation or reconstruction of playful experiences attached to a place (Authors, 2023). Playce-making has conceptual and typological characteristics that make it particular to immersive learning. Conceptual characteristics, such as playfulness and meaningfulness, are as important as typological characteristics, like connection to actual vs. virtual vs. hybrid space, in transforming a space into a playce (Authors, 2023). Although immersive learning and playce-making are discussed separately in the literature, there exist intersecting spots. For example, a physical role-playing game at the actual Colosseum tied to historical events is a powerful way to accelerate flow and presence while adding a new layer of playfulness and meaningfulness to the place. A step further is when players are designers of their own games (Laine & Lindberg, 2020). Playce-making can be traced in participatory game design projects wherein an iterative

process of exploring inspirations, developing ideas, and creating games occurs (Authors, 2019). It seems that a cultivating ground exists at the intersection of immersive learning and playce-making to gives learners opportunity for bringing personal meanings and creativity to curate their own experience of learning.

3. The Study

We worked together with grade nine students (age 14–15) and their teacher, Megan (pseudonym) in a Career and Technology Foundation (CTF) class at a suburban junior-high school in Western Canada. CTF is voluntary and centers around nurturing students' problem-solving abilities while encouraging them to explore their unique interests and passions (Alberta Education 2016). The class had 27 enrolled students divided into eight teams of two to five members, based on their preferences. The teams generated initial game design ideas before the winter break. Following discussions with us, Megan encouraged learners to test their ideas and create games with a topic of their choice throughout the semester. Learners chose to create playable games in various forms, such as physical card games, board games, mobile augmented reality (AR) games, and 3D video games.

According to Fereday and Muir-Cochrane (2006), taking a hybrid approach that combines inductive and deductive coding increases the rigor of qualitative analysis. As such, we employed a hybrid approach of inductive and deductive coding to understand students' discourses. The main code clusters focused on space transformation, game design elements, learning outcomes, issues and solutions, as well as experiences. Two rounds of coding and categorizing in NVivo 12 (the first inductive and the second deductive) were conducted by two researchers, and learners' quotations were then selected for inclusion, with consensus achieved through discussions.

4. Data Sources

Data collection involved multiple sources, including weekly observations, video recordings, group presentations, written individual reflections, paired group feedback on each other's games, and

group interviews (eight interviews, 30–45 minutes each) at the end of the semester with video recordings. Informal conversations with the teacher were also held throughout the term to complement our observations with her perspectives. Transcriptions of interview recordings and video logs of class sessions were coded, categorized, and themed in NVivo 12.

For this paper, we focused on one of the groups (three boys, Tim, Ryan, and Ben) investigating occasions where learners connect a personal experience or their untold stories to place to create a playful experience for players of their game (i.e., playce-making). This group was selected as their interactions were limited to themselves, but focused on integrating a silhouette of a lived experiences into their game which makes it pertinent to the purpose of this paper.

5. Findings

Emergence of Introvertive and Extrovertive Approaches to Playce-making

Tim, Ryan, and Ben created a playable board game, *Z-Days*, wherein varying locations in the town were referenced and the school was considered a safe zone in the context of a massive zombie outbreak (Figure 1). Tim explained in the interview that the game ‘starts with a car accident, someone gets hit, and then we’re in town so we just go to the hospital over there that’s right next to the school and then that’s overrun by zombies and then the person that got hit died’. Ben wrote that ‘we fortified the school so it could be safe inside and we could survive inside here but still go outside to collect resources to survive’. When we contrasted the story with the town map, we noticed that there is a main road and a hospital right across from the school. In their game, they assigned meanings to different locations in town and made meaningful playces in relation to the backstory. At first glance, the backstory may recall bits and pieces from the first episode of *The Walking Dead* (TWD) series, adopted and localized in the *Z-Days*. This also indicates that learners were inspired by and immersed in the TWD story, seeing it unfolded in their town. This can be considered as extrovertive playce-making wherein meanings derived from an external source of inspiration, like a favorite TV series, are adopted and localized.

In a video recorded conversation with Megan, she explains that Ben had struggled to find interest in school and how he had been adopted four or five years prior to this study, separated from his brother, who was involved in a juvenile crime. His story might indicate how Ben perceived the school as a positive space. In the reflections, Ben wrote 'I love the idea of how real the idea of this game is, it feels like this might actually become a real story'. Z-Days backstory may be considered as the silhouette of a life or a metaphoric playce-making wherein the conceptual transformation of space metaphorically refers to personal experiences. Although for Tim 'it was hard to come up with some ideas' for Z-Days as they were probably more meaningful to Ben, deep engagement in the game design project could help both Tim and Ben make the school their living place. This can be considered as introvertive playce-making wherein meanings are derived from personal life and lived experiences of learners, providing an opportunity to implicitly relate to and reflect on a life changing experience.

Intersection of Playce-making and Immersive Learning

According to Megan, Tim, Ryan, and Ben did not show significant interest in the course at the beginning. However, the interest driven, and participatory game design project could captivate their attention later in the semester. In several informal conversations that we had with Megan, she told us that this is the first time in three years that she has seen Tim this much engaged in an activity. She explained that 'he is not really academic and listed on individualized program plan (IPP). But last week, I saw him and Ben working on their game even at lunch time'. Our observational notes confirm this, as one of the researchers involved in this study wrote "they seem to be deeply engaged in, and focused on, the activity that they lost track of time. I overheard Tim whispering in Ben's ear because the class ends so soon." This observation may indicate that Tim was experiencing a level of immersion and concentration on the activity to forget about time as playce-making gave him an opportunity to flourish their team's potential. This was evident later in a few follows up conversations that Tim and Ben had with Megan and us (in separate occasions), inquiring about possible future careers in game industry.

These findings describe some actions taken by learners in transforming a familiar place into playce within an interest-driven participatory game design project. Findings indicate that learners took multiple approaches to playce-making. Learners localized external stories inspired from the virtual spaces and imaginary events in a TV series to give meaning to actual space and familiar places in their town and make them playful in the context of their game (extrovertive playce-making). Moreover, our investigation showed that learners' co-created game included echoes of a life lived by one of the teammates to make the places in the game more meaningful to them (introvertive playce-making). Extrovertive playce-making not only accelerated flow but also facilitated creativity by offering learners a chance to bring in personalized sources of inspiration from media. Introvertive playce-making laid the foundations for learners to integrate personal meanings and lived experiences into their game. As such, this can be considered an occasion where creativity and personal meaning-making emerge where immersive learning and playce-making intersect (Figure 2).

6. Scholarly Significance of the Study

We believe that our findings demonstrate how the intersection of immersive learning and playce-making can support learners in drawing on their own interest to curate their own learning experiences by integrating personal meanings and lived experiences into their game design. Playce-making could grow the interest in learners to get engaged in game design in their own way to the point that they ignored external stimuli, like time, to achieve their goal. Playce-making facilitated the process of creativity as it provided learners with opportunities to connect the worlds of fantasy and reality in a novel way.

We concur that playce-making can be an effective means of immersive learning by facilitating the process of flow when learners are engaged in creative activities relatable to personal meanings, unheard experiences, and external inspirations. Playce-making activities were particularly suitable for CTF as it is a more flexible junior-high school curriculum. Similar approaches could be adopted in other areas with or without using technologies to further demonstrate that human capability can go beyond productivity in the context of STEM education. We are further exploring the links between playce-making, immersive

learning, and participatory practices to better support learners' creative thinking and personal meaning-making.

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Figure 1

Learners present sources of inspiration for Z-Days and showing a map of their town that includes their school and a nearby hospital (left) and their game being played by peers (right).

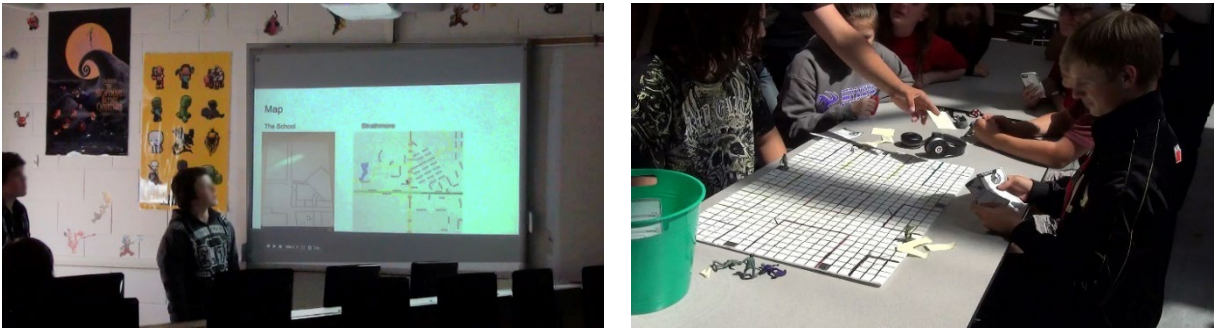


Figure 2

Emergence of creativity and personal meaning-making at the intersection of immersive learning and playce-making.

