

HANDS-ON MINDS:FOSTERING CONCEPTUAL LEARNING THROUGH TANGIBLE ANALOGUE GAMES IN HIGHER EDUCATION

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Abstract

In this chapter, the transformative potential of using analogue games, like board or card games, in higher education is explored in order to improve conceptual learning. Analogue games offer tangible, engaging experiences that connect theoretical ideas with real-world applications. They provide tangible representations of intricate concepts, easing cognitive load and promoting knowledge transfer. Along with encouraging critical thinking, problem-solving, and analytical skills, analog games actively involve students. These games contextualise information so that students can explore ideas in contexts that are relevant to them and thus increase comprehension. In line with social constructivist learning theories, social interaction and collaboration are encouraged, improving communication and interpersonal skills. By promoting practical experience, reflection, and metacognition, analog games aid experiential learning. They encourage multisensory learning by involving a variety of senses for better comprehension. They also foster problem-solving and critical thinking abilities, which are applicable across a variety of fields. Analogue games promote metacognition, which empowers students to manage their own learning by enabling self-regulated learning. Finally, analogue games provide a dynamic and engaging approach to conceptual learning in higher education, encouraging active engagement, teamwork, critical thinking, and multisensory experiences, ultimately enhancing the learning process.

Keywords: Analogue Games; Higher Education; Conceptual Learning; Experiential Learning; Multisensory Education.

Introduction

Through tangible elements and interactive experiences that go beyond conventional instructional methods, the use of analogue games in education, such as board or card games, has proven effective in fostering conceptual learning. Analogue games offer a special way to foster conceptual understanding and advance learning because they get students actively involved in hands-on learning. This chapter explores the various ways that analogue games can improve conceptual learning in higher education.

Concrete Representation

Board or card games are examples of analogue games that provide tangible elements and interactive experiences that improve conceptual learning in higher education. The abstract ideas and imaginary scenarios are brought to life in these games by tangible representations. The use of ramps and blocks in a board game that simulates forces and motion is an example of how students can learn through tangible manipulation of how variables affect outcomes (Merkouriset al., 2019). By helping students embody and put concepts into practice through cognitive processes, this concrete representation closes the gap between theoretical knowledge and real-world application (De Freitas, 2006). Additionally, analogue games' physical manipulation gives players a multisensory experience that strengthens conceptual understanding (Su, Cheng, & Lin, 2014). By providing physical representations of complex concepts, analogue games also lessen cognitive load, allowing students to devote more mental resources to more in-depth cognitive processing (Göbel, Hardy, Wendel, Mehm, & Steinmetz, 2010). For instance, a math card game in which players arrange cards to create equations helps students effectively understand mathematical concepts (Nicole R. Scalisea, Emily N. Daubertb, 2020). Additionally, analogue games help students apply their conceptual knowledge outside of the confines of the gaming environment (Clark, Tanner-Smith, & Killingsworth, 2016). For example, historical strategy games that use physical tokens to represent territories and resources, help students better understand geopolitical dynamics and their capacity to apply knowledge in practical situations (Klopfer, Osterweil, Salen, Groff, & Roy, 2009). Analogue games provide a special way to advance conceptual learning in higher education by incorporating tangible manipulation and

concrete representations. These games improve students' comprehension by giving concrete examples of abstract ideas, easing cognitive strain, and promoting knowledge transfer between various subject areas. For teachers looking to improve conceptual learning in their classrooms, analogue games are a fun and effective teaching tool.

Active Engagement

The elements of challenge, competition, and fun that analogue games provide, boost students' engagement and motivation to learn. These games' engaging and interactive features pique students' interest and motivate them to participate actively in their education (Connolly et al., 2012). As students make decisions, solve problems, and apply knowledge and strategies to effectively play the game, this active engagement fosters deeper learning, critical thinking, and analytical skills. For instance, a board game with a scientific theme can pique players' interest and enthuse them about scientific ideas, increasing engagement and motivation (Clark et al., 2016). By requiring students to analyse information, weigh options, and make decisions based on their comprehension of the concepts, analogue games help students improve their problem-solving and decision-making abilities (Vlachopoulos & Makri, 2017). As students evaluate resources, predict opponents' moves, and adjust their strategies accordingly, strategic card games also encourage analytical thinking (Gutierrez, 2014).

Additionally, since students actively engage in the game's mechanics and decision-making procedures, analogue games offer an immersive experience. For instance, playing the parts of historical figures in a board game with a historical theme helps players understand historical events and their implications (O'Neill & Holmes, 2022). Additionally, analogue games promote social interaction and cooperative gameplay, which promotes teamwork and effective communication skills (Adachi & Willoughby, 2013). Cooperative board games that require communication and coordination between players to solve problems improve interpersonal and teamwork skills (Zagal, Rick, & Hsi, 2006). In general, analogue games encourage active participation, critical thinking, problem-solving, and social interaction, which makes them useful teaching tools, for conceptual learning, in higher education.

Contextualisation

Analogue games provide contextualised learning opportunities that let students investigate and comprehend ideas in useful contexts. Analogue games offer a rich environment for applying knowledge and skills because they immerse students in particular themes or scenarios (Ritzhaupt & Squire, 2013). This contextualisation aids students in making the connection between theoretical knowledge and practical applications, deepening their comprehension of how ideas appear in real-world contexts (Clark et al., 2016). For instance, historical board games allow students to re-enact historical events while understanding the complexities and connections of history (Wright-Maley, Lee, & Friedman, 2018). When the game context is in line with the desired learning outcomes, analogue games help players transfer what they learn from the game environment to real-world situations (Zagal et al., 2006). When playing analogue games, students are frequently presented with real-world issues or situations that call for information analysis, judgment calls, and solution-finding. This encourages real-world problem-solving abilities and a deeper comprehension of ideas and their applications (Gutierrez, 2014). Students learn to think critically and make decisions by interacting with the game's meaningful challenges. To help students better understand environmental issues, an environmental-themed game, for instance, can ask them to make choices regarding the management of pollution and resource allocation. By making learning relevant and personally meaningful, the contextualisation of analogue games improves student engagement and motivation (Prensky, 2003). Students become more engaged in the learning process when they can relate the context of the game to their own lives or interests (Clark et al., 2016). These higher levels of motivation, effort, and perseverance result in better learning outcomes as a result of the increased engagement (Zagal et al., 2006). For instance, a biology-themed game built around a medical mystery can pique students' interest and encourage them to investigate biological ideas and problem-solving techniques (Adachi & Willoughby, 2013). In general, contextualised learning experiences offered by analogue games help students in higher education develop their understanding of complex concepts, solve real-world problems, and become more engaged and motivated.

Social Interaction

Analogue games promote social interaction and collaboration among students, fostering a collaborative learning environment. Through gameplay, students engage in dialogue, cooperative problem-solving, and teamwork, which enhances their understanding of concepts (Cranley et al., 2017). The social interaction in analogue games aligns with social constructivist learning theories, where students actively construct knowledge through meaningful discussions and the exchange of perspectives (Vygotsky, 2019). This promotes the co-construction of knowledge and shared understanding (D'Aprile, Di Bitonto, De Asmundis, & Severino, 2015). Communication and language skills are also developed as students engage in effective communication, express their thoughts, and listen to others (Phuong, Nguyen, & Nguyen, 2017). Analogue games provide a platform for students from diverse backgrounds to learn from each other and gain cultural competence (J van Gaalen et al., 2021). Additionally, analogue games facilitate the development of emotional and social intelligence as students manage their emotions, understand others' perspectives, and practice empathy (Bagwell & Schmidt, 2011). The cooperative nature of analogue games nurtures teamwork and interpersonal skills, which are essential for higher education and professional settings.

Experiential Learning

Students can learn through hands-on experience and experimentation by playing analogue games, according to (Bergquist et al., 2009). Students gain a deeper understanding of concepts through these games' hands-on activities, choice-making, and observation of the results (Kolb, 1986). Analogue games help students actively construct knowledge by interacting with the game's elements and drawing connections between abstract ideas and real-world experiences (Piaget, 1973). Through analogue games, reflection and metacognition are encouraged, enabling students to reflect critically on their gameplay experiences, pinpoint knowledge gaps, and hone metacognitive skills (Foster & Shah, 2015; Schraw et al., 2006). By giving students the chance to use their knowledge and skills in fresh contexts, analogue games also aid in the transfer of learning. Students can transfer their understanding to real-world situations by playing contextualised games to close the gap between theory and practice (Romero et al., 2017).

Critical Thinking and Problem-Solving

Through their intricate rules and engaging gameplay, analogue games encourage students' critical thinking and strategic abilities (Noroozi et al., 2020). To improve their problem-solving skills and conceptual understanding, students must analyse the game situation, weigh their options, and predict outcomes (Gardner, 1993). By requiring students to think critically, take into account various viewpoints, and reach well-informed conclusions, these games foster higher-order thinking skills (Freire et al., 2016). Within the context of the game, students apply problem-solving techniques, dissecting issues, spotting patterns, and coming up with solutions (Egenfeldt-Nielsen et al., 2020). Additionally, analogue games foster transferable abilities like critical thinking, problem-solving, and decision-making that can be used in a variety of academic fields and real-world contexts (Girard et al., 2013). With the abilities developed through play, students can approach complex problems methodically and analytically, giving them power across a variety of domains (Clark et al., 2016).

Metacognition

As players reflect and evaluate their own performance, analogue games encourage metacognitive processes (Ross, 2011). Students gain metacognitive awareness and become aware of their areas for growth by observing how they make decisions and analysing the effects of those decisions (Vlachopoulos & Makri, 2017). With this knowledge, they can modify their tactics and make better decisions (Bjork, Dunlosky, & Kornell, 2013). As students actively participate in directing, controlling, and monitoring their learning experiences, analogue games also encourage self-regulated learning. They establish agency and autonomy, make plans for their actions, set goals, and modify their strategies in response to input (Dignath & Büttner, 2008). Through cooperative gaming, students participate in discussions and keep track of their teamwork (Colman, 2003). Metacognitive processes can be used to support lifelong learning by transferring them to other contexts when they are used in analogue games (Schwarz, 2015). In both academic and practical contexts, students can use their reflective practices and metacognitive techniques (Whitebread et al., 2009). Through educational board games, for instance, metacognitive skills can be developed that help with self-evaluation and monitoring in

other academic tasks (Winne & Hadwin, 1998).

Multisensory Learning

Analogue games feature tangible elements that appeal to a variety of senses while being played (Chen & Tu, 2021). These games offer different modalities for processing information by involving the visual, auditory, and tactile senses (Ke, 2008). According to Sousa (2022), the sensory integration provided by analogue games improves student engagement, attention, and learning outcomes. The idea of embodied cognition, in which physical actions support cognitive processes, is also supported by analogue games (Wilson et al., 2009). For instance, moving game pieces in mathematically based board games reinforces numerical concepts through physical movements (Alibali et al., 2013). Analogue games' multisensory design encourages students to make stronger connections between abstract ideas and sensory input, leading to improved conceptualisation (van der Kamp, Withagen, & Orth, 2019). It is easier to conceptualise and internalise underlying concepts when there are physical game elements that represent abstract ideas (Skulmowski & Rey, 2018). Additionally, the multisensory experiences offered by analogue games boost students' motivation, engagement, and active participation in their studies (Philip, 2015). Higher levels of motivation and engagement result in more thorough information processing and fulfilling learning opportunities (Ewijk et al., 2013).

Conclusion

Numerous analogue games encourage cooperative learning settings where students cooperate to accomplish shared objectives. Students gain skills for effective communication, bargaining tactics, and group problem-solving through teamwork. By encouraging conversations and the expression of ideas, these social interactions improve conceptual learning. Furthermore, the cooperative aspects of analogue games can promote a sense of community among students, improving the learning environment. In higher education, analog games are a tangible and engaging way to encourage concept learning. These games provide a supportive, dynamic learning environment pedagogy through active participation, multi-sensory experiences, collaboration, critical thinking reflection and experiential learning. Analog games can be a useful tool

to promote student understanding and engagement in higher education as educators continue to explore cutting-edge approaches to advance conceptual learning. Although analog games have potential, promotes conceptual learning, it is important to remember that students' success depends on careful play selection, consistent with learning objectives and effective teaching design. To make sure that similar games have the greatest possible educational impact, educators should carefully integrate curriculum, creating a clear connection between play and learning goals, and supporting communicate and reflect effectively.

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