Beyond the Digital: Analogue Games´ Creative Potential in Deepening Data Literacy

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Abstract: In an era where digital technology often dominates the educational landscape, the enduring appeal and educational potential of analogue learning games remain significant. These traditional, non-digital games, offer a tactile and interactive approach to learning that is both unique and impactful. Unlike their digital counterparts, analogue games require physical presence and direct interaction, which bring benefits to the educational process (Ribeiro, 2019; Medeisiene et al., 2021). This small case study explores, through a sociocultural lens, how analogue learning games influence creative learning processes in Continuing Education students. The results of a questionnaire to 43 participants enrolled in a course on Data Literacy in Norway, show that analogue learning games promote active engagement, foster social interaction, and stimulate innovative thinking connected to the course content when the setting around the activity feels safe for the participants. Participants also expressed that the tactile and social nature of analogue games encouraged more profound group discussions, leading to diverse perspectives and novel ideas. This resonates with findings from Medeisiene et al. (2021) who highlight the pedagogical value of game-based learning in enhancing engagement. These interactions not only bolstered creativity but also enhanced and deepened understanding and retention of knowledge from the Data Literacy course content. Moreover, the study highlights the importance of context and facilitation in maximising the benefits of analogue games for Continuing Education students. The findings suggest a promising avenue for further exploration into using analogue games in educational contexts. The study concludes with advocating conducting more research on the integration of learning games into continuing education curricula as a strategy to leverage the benefits of social interaction and active engagement, and to enhance creative learning that can deepen learning of course content.

Keywords: Analogue Learning Games, Creative Learning, Psychological Safety, Continuing Education, Data Literacy

1. Introduction

Analogue games demand physical participation, playing a vital role in bolstering creativity in the educational process. This reflects a long-recognised connection between play, creativity, and learning, which is one of the most studied relationships within a sociocultural approach to learning. Creative learning is a concept that advocates nurturing one's creativity while simultaneously enhancing the ability to absorb and integrate new knowledge (Mestre, Ness & Glaveanu, forthcoming). Creativity is one of the essential skills of digital literacy: the ability to use, access, filter, evaluate, create, program, and share digital content; manage and protect information, data, and digital identities; and entrepreneurship; imagination, strategic thinking and problem solving, critical and constructive reflection in the context of evolving creative processes and innovations, and the ability to collaborate both as individuals and in teams (Boghian et al., 2022, p.89).

According to Anderson et al. (2009) there is a synergistic potential of blending digital and traditional game-based learning in adult education for both students and teachers, as outlined by Caffarella (2002). However, despite the growing dominance of digital technologies in educational settings, analogue games continue to offer unparalleled interactive and hands-on experiences that enrich learning in ways digital mediums cannot match.

This paper reports from a small case study of analogue game play and creativity in continuing education students participating in a data literacy workshop at the University of Bergen, Norway. This guiding research question was formulated:

How do analogue learning games influence creative learning processes in continuing education students?

Our study revealed many benefits in integrating analogue learning games into a workshop as part of a course on data literacy and we argue that enhancing creative learning processes when playing games also deepens learning of the course content.

2. Games in Education

In our study, we investigate the role of analogue learning games in influencing the creative learning processes of adult students in continuing education. Games have long been recognised as powerful tools for facilitating learning experiences (Breien, 2023; Sousa et al., 2023). Game-based learning (GBL) has in recent years gained significant attention in adult education due to its ability to incorporate playfulness into learning, emphasising creativity in learning and personal growth in education (Jensen et al., 2022; Heidari-Shahreza, 2024). GBL utilises the social dynamics of gaming within an educational setting (Susi, et. al., 2006), enabling educators to implement gaming principles that encourage engagement and support a variety of defined learning outcomes (Plass et al., 2019).

Frossard et al. (2012) highlight the widely accepted notion in educational research that creativity can be taught, referencing seminal works in the field of creativity (Kaufman & Beghetto, 2009). They emphasise that for students to cultivate their creative abilities, educators themselves must embody creativity and foster an environment that cherishes creative expression (Craft, 2005). Analogue learning games, including board games, tabletop games, card games, and dice games (Sousa, et al., 2023), offer a tactile and interactive experience that has been a part of educational practices long before digital technologies became prevalent. These games naturally facilitate creativity by actively allowing students to explore and implement new ideas, linking them to the early development of human culture and society, similar to narratives and storytelling (Breien, 2023, p. 52).

Moreover, when using games in educational settings, it is crucial to balance and integrate educational content with game elements to optimise the learning experience (Barendregt & Wasson, 2016).

3. Theoretical Framework and Key Concepts: A sociocultural Perspective on Learning

This study is framed within a sociocultural approach to learning which emphasize the role of language, cultural norms, and tools in shaping cognitive development, viewing learning as inherently collaborative. Knowledge is constructed dialogically and through participation in communal activities, deeply influenced by the cultural and social milieu (Vygotsky, 1981; Wertsch, 1991). Key concepts include:

Mediation: Vygotsky's concept of mediation is crucial to understanding the interaction between learners and their environment. He asserts that human action, both individual and collective, is mediated by tools and signs, such as language, various systems of counting, mnemonic techniques, and symbolic systems like algebra, art, and writing. These tools, often referred to as "psychological tools" play a pivotal role in the cognitive development process by shaping and supporting the learners' interaction with their world (Vygotsky, 1981; Wertsch, 1991).

The Zone of Proximal Development (ZPD): ZPD further elaborates on how learning unfolds within social settings. Defined by Vygotsky as the difference between what a learner can achieve independently and what they can achieve with guidance from more knowledgeable others, the ZPD underscores the importance of cooperative learning environments. Such settings utilize cultural tools and social interaction to scaffold learning, facilitating the co-construction of knowledge (John-Steiner & Mahn, 1996; Vygotsky, 1978).

Creativity: Creativity in learning is a multifaceted concept that can manifest as both a process and a product. Rooted in the act of creation, it may involve conceiving entirely new ideas, recombining existing knowledge in novel ways, or producing tangible outputs. Creativity spans from minor personal insights ('little c') to transformative innovations ('big C') that can significantly impact broader societal contexts (Kaufman & Beghetto, 2009; Craft, 2005). Contemporary research in creativity emphasizes the dynamic interplay between the individual and their social environment, suggesting that creativity is not only an individual trait but also a collective phenomenon that flourishes in socially supportive settings (Moran & John-Steiner, 2004; Ness, 2020).

Psychological safety (PS): PS is not being afraid to contribute (Edmondson, 2019) and asking "silly questions". Psychological safety in teams contributes to increased knowledge and innovation (Ness, 2017). According to Marjanovic-Shane et al. (2010, p. 225) the way learning environments are organized fosters or dissuades the emotional and relational conditions for creativity. Positive relationships will stimulate engaging in creative work which results in novel insights and accomplishments for all participants. Emotional safety and respect are essential conditions for creativity (Ness, 2016).

Deep learning (DL): DL is characterised by a learner's active engagement with content in a manner that fosters a profound understanding and meaningful interpretation of the subject matter. According to Smith & Colby (2007) this educational approach involves students actively engaging in analysing the relationships between

different facets of the content, generating hypotheses, and forming well-grounded beliefs about the underlying structures of concepts. Such engagement typically leads to an intrinsic interest in learning and understanding of the material. Additionally, educators play a crucial role: those who structure their lessons to challenge students intellectually, provide constructive feedback, and set tasks that encourage critical thinking and problem-solving are more likely to promote deep learning (Hattie, 1998).

4. Methods

To investigate how analogue games influence creative learning processes among Continuing Education students, we designed a case study, approached as a focused and responsive inquiry into a situated and finite number of incidents (Yin, 2018), around a university-level data literacy course.

As part of the course design, the students were invited to take part in one of six non-mandatory, 3-hour face-to-face workshops designed to foster interdisciplinary collaboration when engaging with the complexity of data literacy. The analogue learning games used in the workshop were created as part of an Erasmus+ project, DALI[1] that aimed to support basic data literacy for citizenship (Castañeda et al. 2024). Our case study was conducted across four of these workshops, attended by 43 adult students from diverse professional backgrounds from both public and private sectors.

During each workshop, groups of three to five students played two analogue games for data literacy from the DALI project[2] chosen as they raise awareness and understanding of data (Castañeda et al. 2024). The students were grouped strategically, ensuring that each group represented a mix of backgrounds, expertise, and professional experiences. First, Game of Phones, a card game, had students using mobile phones to search for information, share stories, and discuss the use and creation of data. Second, Data Iceberg, a card game, involving finding card pairs and categorising them by data type on individual player boards.

At the conclusion of the game sessions, students were given a qualitative questionnaire (Braun, et al. 2021), designed to probe their experiences with the analogue games as a supplement to the digital course and the potential influence on their creative learning. The questionnaire comprised two open-ended questions: 1) How can games promote creative learning processes? and 2) During the games, in what way did you have to be creative? Additionally, they were given the opportunity to provide further feedback and reflections.

Responses were collected via paper questionnaires to maintain anonymity and the students were verbally informed that answering was voluntary (Klykken, 2022; NESH, 2024). All 43 students chose to provide their insights, giving the dataset that formed the foundation of this study.

4.1 Analyses

Drawing upon this qualitative survey dataset, we explored how analogue learning games influenced the students' creative learning processes. According to Braun et al. (2021) qualitative surveys offer something unique within qualitative data collection methods - both the opportunity to have a wide-angle lens and get rich and focused data (p. 643). Our analysis employed an inductive approach (Hatch, 2002) grounded in sociocultural theoretical principles, which guided the formulation of survey questions, and the interpretation of how analogue games stimulate creative learning. This was complemented by a hermeneutical interpretation method, as recommended by Kvale and Brinkmann (2009, pp. 213-218), allowing for a deeper understanding of the textual data. The research team analysed the transcripts from the surveys, focusing on responses to open-ended questions and integrating observations to identify meaningful themes relevant to our research question. Through this rigorous examination, we categorized the data into several key themes that describe the influence of analogue games on the participants' creative learning processes. These categories included Active Engagement, Physical and Interactive Elements, Social Interaction, Innovative Thinking, Fun and Safe learning environments, and Deep Reflection. Once these categories were established, we synthesized our findings to present a comprehensive view of how analogue games enhance creative learning, detailed in the results section.

4.2 Findings

The study revealed that analogue games influenced the creative learning processes through: *Active engagement* and *Social interaction*. Further, we found that the physical and interactive elements of analogue games were encouraging various perspectives fostering *Innovative thinking* and *Deeper learning*. However, participants indicated that the success of game-based learning activities hinged on the creation of *a safe setting*, which are essential for stimulating creative learning processes.

The first finding was that analogue games influence the creative learning processes through active engagement: Analogue games, by design, require participants to be physically and mentally present, fostering a hands-on and minds-on approach to learning. This engagement is not merely about keeping students busy; it's about deeply involving them in the learning process, encouraging them to explore, question, and connect with the material in a meaningful way.

One of the participants reported: "By playing together with people of different backgrounds, ages, and professions, we learn from each other in conversation."

The findings reveal that analogue games excel in making the learning process interactive and engaging, fostering an environment with active and also emotionally and intellectually invested students.

The second finding was on how creative learning happened through Social interaction. Through the collaborative gameplay, the students negotiated and shared ideas. The students reported: "Social interaction during games can lead one to question their immediate thoughts and think anew."

Another response was this: "By being forced to think in new ways, one also gets to exercise creativity. Additionally, receiving input from others (both people and processes) can change one's own mindsets and ideas."

Analogue games foster a collaborative environment where social interactions contribute significantly to the learning process, enhancing it through continuous peer engagement and communication.

The third result was that analogue games seemed to influence creative learning processes leading to Innovative thinking. Sparked by the creative challenges connected to Data literacy presented in the analogue games, this pushed the students beyond traditional learning boundaries. The students navigated the rules and strategies within games. In this way students were encouraged to think outside the box and apply knowledge in new and imaginative ways.

The students reported that the games helped them to: "…Think outside the box and see the whole picture in other and new ways, and also 'go deeper' (deep learning)". This form of learning is also crucial in today's rapidly changing world, where the ability to adapt and innovate is as important as the knowledge itself.

Fourth, the exposure to diverse perspectives, enriching the learning experience by incorporating a variety of viewpoints, resulted in a deeper exploration of topics. Through gameplay, the students reported that the games led to deeper learning: "The games contributed to better and deeper learning of the course content – we needed to apply the theoretical knowledge in a practical setting".

Fifth, the results showed that there were some underlying conditions involved for the adult students to succeed with their creative learning with games. The effectiveness of game-based activities relied significantly on creating an environment that fostered fun and safety. The students expressed that: "Good, safe frames for the game setting, even if it was hard , it was "not important" to win"

Further, the students reported that it was fun to play games: "It was fun to play in groups. I enjoyed that the games were analogue – gave more room for discussions and social interaction."

Such a fun and safe setting was paramount for unlocking the creative potential within participants, as it encouraged them to share ideas without fear of judgment. This atmosphere enabled them to speak their minds, which is a crucial component of the creative process. In these environments, students felt supported in exploring novel concepts and engaging in discussions around data literacy, leading to a richer learning experience.

5. Discussion

In this section we will discuss how the analogue games influenced creative learning processes through: *Active engagement* and *Social interaction*. Further, how these were fostering *Innovative thinking* and *Deeper learning*. Finally, we will discuss how some conditions were involved in the success of creative learning: *the creation of a safe setting*, and present a visualization of the processes: "Psychological safety in Creative Learning Processes through analogue games". (See figure 1).

5.1 Active Engagement & Social Interaction

The findings underscore how the analogue games promoted active engagement among the participants. By requiring physical and social presence, these games created a hands-on learning, tactile environment that

encouraged the students to engage deeply with content. This goes beyond keeping participants occupied; it shows the potential to involve them profoundly in the learning process, through prompting them to explore, question, and connect with each other and the material in meaningful ways.

Quotes from the data suggest that playing with individuals of varying backgrounds enhances mutual learning. The playful nature of games contributed to making tasks more enjoyable and intellectually stimulating, which in turn supported engagement and learning as a socially mediated process (Vygotsky, 1981). We interpret the analogue games as mediating artifacts facilitating interactions between students and the educational content (Plass, et.a., 2019). The games used in the data literacy workshops served as both cognitive and cultural tools, bridging the gap between abstract concepts and tangible experiences. The diversity of backgrounds among the students brought various cultural perspectives into the game, enriching the learning experience. As expressed by the players the game can introduce new ways of thinking and understanding, contributing to a richer, more comprehensive collective knowledge base. Active engagement opens up for creative learning (Beghetto, 2016; Mestre et al., forthcoming). In other words, the findings align with previous studies that indicate playing analogue games can, in particular, nurture soft skills such as creativity, whilst supporting the call for further research into the potential for analogue games to enhance the learners' ability to absorb and integrate new knowledge (Sousa, et al., 2023).

The findings also highlight social interaction facilitated by analogue games. Quotes indicate that being challenged to think creatively and receive inputs from others can transform one's own ideas and thought processes. For instance, questions raised during gameplay encouraged rethinking of initial assumptions. As such, gameplay can help students to collaborate and learn creatively through sharing ideas and exposure to diverse perspectives. This aligns with Vygotsky's (1981) Zone of Proximal Development (ZPD), where learning is optimized through collaboration with more knowledgeable others . G ames have the potential to facilitate this zone (Plass, et.a., 2019), shown in our data through the students' reporting the exchanging ofideas. This collaboration provided a scaffold for students, allowing them to achieve more than they would independently. In this case, the adult students came from different backgrounds and could thus shift on the role of being the more knowledgeable other (Ness, 2016).

5.2 Leading to Innovative Thinking and Deeper Learning

Continuing education students reported that analogue games enhanced their ability to think outside the box and apply knowledge in innovative ways. As they played, the diversity within the groups introduced new perspectives that stimulated creative knowledge processes. Creative knowledge processes pans from generating entirely new ideas to recombining existing knowledge into novel outputs (Ness & Søreide, 2014). Typically, such creativity at the 'little c' level involves minor personal insights, while transformative 'big C' creativity impacts broader societal domains significantly (Kaufman & Beghetto, 2009; Craft, 2000). Although the students mainly engaged at the 'little c' level during games, these interactions are crucial for fostering 'big C' creativity and innovation. The gameplay also prompted participants to challenge conventional thinking, which in turn fostered a culture of innovation and critical inquiry. This demonstrates how analogue games can catalyse creative and innovative thinking, encouraging students to reimagine knowledge in new ways. The shared cultural tools and symbols within the games allow students to construct new meanings and solutions, a process deeply embedded in the sociocultural context of learning (Plass, et.a., 2019).

Moreover, the tactile and interactive aspects of analogue games promoted deeper group discussions, enhancing understanding of data literacy. Such dynamics align with Medeisiene et al. (2021), who noted that game-based learning significantly boosts engagement and satisfaction. The tangible elements of these games not only enrich the learning experience, but also underscore the sociocultural importance of tools in cognitive development (Plass, et.a., 2019)., thereby deepening students' comprehension and facilitating a more engaged and creative learning environment.

5.3 A Need for: Creating a Safe Learning Environment

The students emphasized the importance of creating a safe and supportive environment where winning is not prioritized, underscoring the critical role of psychological safety in learning environments (Ness, 2020; Edmondson, 2018). Such an environment fosters sharing of ideas, essential for creative learning, and necessitates proactive educator involvement to engage students fully. Observations during game sessions revealed that laughter and humour reduced apprehension about speaking up and encouraged open sharing, enriching discussions. Games have been argued to foster safe learning spaces through introducing new rules and

novel options for interaction (Whitton, 2018). Frossard, Barajas, and Trifonova (2012) note that games enhance creative learning environments by promoting question-asking and incorporating humour. Friendly interactions, positive emotions, expressed through laughter, significantly enhance learning experiences by facilitating emotional bonds among participants (Ness, 2020; Klykken, 2023). Research by Crocco et al. (2016) indicates that enjoyment during lessons correlates with deeper learning outcomes, enhanced whether games are used or not. Craft and Wegerif (2006) also describe collaborative creativity as involving both verbal and non-verbal communication, contributing to deeper interpersonal connections.

The facilitation team's awareness of maintaining a positive environment encouraged everyone's active participation. Marjanovic-Shane et al. (2010, p. 225) argue that well-organized learning settings support emotional and relational dynamics conducive to creativity. Positive relationships stimulate risk-taking and creativity, leading to significant insights and achievements within the learning community (Ness, 2016).

Taken together, analogue games appeared to influence creative learning processes through their tactile nature expressed as Active engagement and sharing ideas in Social interaction, leading to innovative thinking and deeper learning of the course content on Data literacy, aided by psychological safety. (See figure 1).

These observations resonate with Medeisiene et al. (2021), highlighting the pedagogical value of game-based learning in enhancing engagement. The interactions not only boosted creativity but also deepened understanding and retention of Data Literacy content. This study underlines the importance of thoughtful integration of analogue games into curricula to optimize their educational impact for Continuing Education students.

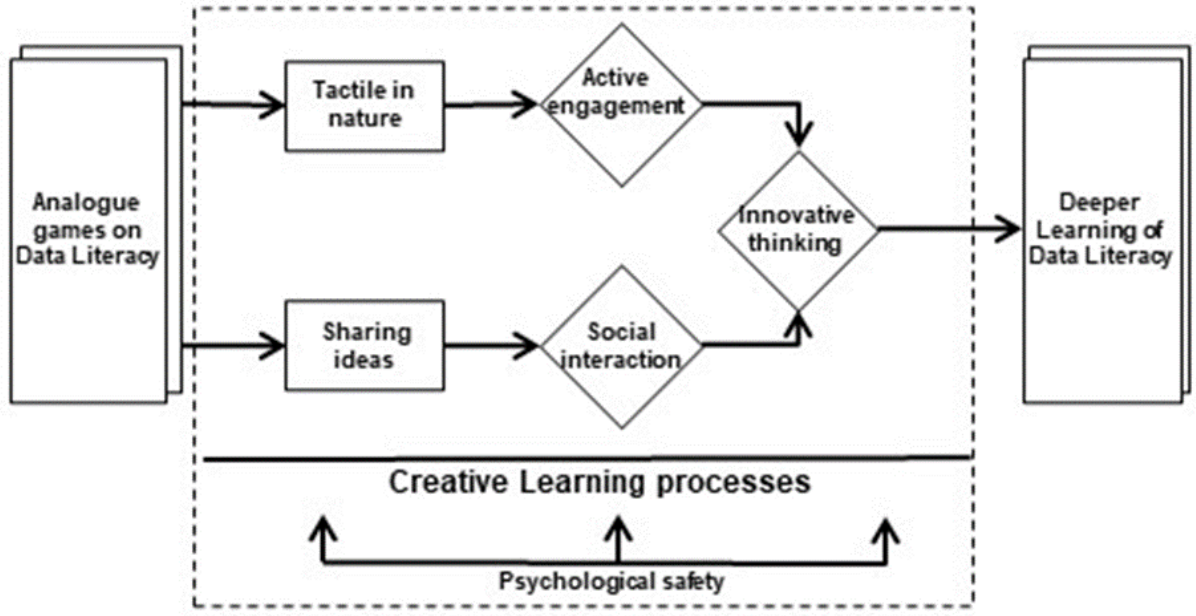

Figure 1: Deeper learning of Data Literacy through Creative Learning Processes in analogue games

6. Implications and Conclusion

Our study underscores the importance of context and facilitation in leveraging the educational benefits of analogue games, highlighting the educator's role as pivotal. From a sociocultural perspective, educators structure the learning environment to foster exploration and creative learning and ensure inclusivity and psychological safety. This strategic approach appears to contribute to the analogue games potential to enhance continuing education programs by promoting a collaborative and engaging learning environment. The study underscores the multifaceted benefits of analogue games in a course on data literacy, highlighting their potential role in promoting active engagement and social interaction, leading to more innovative thinking and deeper learning. Crucially, the success of these game-based activities depends on establishing a safe atmosphere, thereby enhancing the educational experience significantly. The findings suggest a promising avenue for further exploration into using analogue games in educational contexts. The study concludes with advocating for conducting more research on the integration of learning games into continuing education curricula as a strategy to leverage the benefits of social interaction and active engagement, to enhance creative learning processes that can deepen learning of course content.

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[1] https//:dalicitizens.eu

[2] https://toolkit.dalicitizens.eu/catalogue