Game Lab Innovations in Education: Insights from a Board Game Design Project

Robin Isfold Munkvold and Helga Dis Isfold Sigurdardottir
Nord University, Levanger, Norway

robin.munkvold@nord.no
helga.d.sigurdardottir@nord.no

Abstract: From the perspective of educators, game development has great potential as a teaching method, as it promotes group collaboration, project-based learning and the development of content tailored to a given target group. This paper is based on a study that was carried out through an international project, implementing an educational game development concept called Game Lab into an educational context. The study explored professional development topics such as game-based learning, game development, and game testing, along with the Game Lab method focusing on group dynamics, progression, and creativity. It employed an abductive analysis of written responses from twelve teachers who participated in the Let's Play project, which involved a Game Lab component. The teachers, ranging in age from their thirties to their sixties, represented all levels of education from preschool to upper secondary school. They responded to a survey with open-ended questions and reflection notes, providing insights into their experiences with game development methods as pedagogical tools. Their responses were analyzed to identify key themes and patterns. Findings suggest that this approach has broadened participants' perspectives on utilizing diverse games and game development techniques in education, aligning with prior research on production pedagogy. It underscores the importance of integrating in-game content with real-world contexts as a modern teaching method. Participants also highlighted that effective game-based learning supports a constructivist approach to teaching over behaviorism. The participants emphasized their increased insight and understanding of game development and game systems and how the combined effect of educational game design and the Game Lab method (working in teams) resulted in a more valuable learning outcome than they would have experienced alone. They also reported an improved understanding on how working with the development of a board game made them dig much deeper into the topic at hand. In addition, they found that this increased their motivation for learning, knowing that this was going to be a product that was to be tested and played by others (pupils and teachers). Furthermore, the participants highlighted the role of group dynamics in fostering teamwork and consensus during the collaborative game development process.

Keywords: Educational board Games; Group Dynamics Game-based Learning; Game-development; Motivation; Assets of use Value.

1. Introduction

This paper presents key findings on teachers' experiences with learning to utilize game development processes as methods for teaching and learning. It is based on a year-long process carried out through a project cooperation between a game development bachelor program at a university in Norway and practicing teachers from Poland. The project was titled Let's Play. It was funded by the EEA grants and based on approaches to motivating learners through artifacts production. Rather than the artifact alone being the end goal, the learning process of making a game about a certain, clearly outlined topic, is a key component of the end goal.

Through over a decade of running a bachelor program within game development, as well as several international projects on game development, programming, learning through construction and more, the university partners in the project have seen that game development has great potential. Applying game development as a learning process has turned out to increase the engagement of participants. This study was conducted to further explore this approach.

In the Let's Play project, the group of participating teachers first went through a 2-day on-site seminar, including lectures and workshops, to learn about the basics of educational game development. Through the ensuing Game Lab process, they took part in the development of analog board games. They worked in teams and were given bi-weekly feedback on the progression of the project, through the Game Lab model.

Game Lab is an international concept, describing a development environment linking people with different roles, such as technologists, artists, teachers, students, companies, researchers etc., in a game development process (Munkvold, 2017). In Game Lab, students are offered insight into the basics of professional life. The concept is often organized as a business simulator, where student teams form small, functional game development companies and assume various roles and responsibilities, while supervisors act as clients or investors. This concept has a clear framework and rules for implementation.

Other than optional initial presentations, the Game Lab approach is free of traditional classroom teaching. It begins with the student teams each pitching different game ideas. Then, in collaboration with supervisors, the teams choose one of the project ideas. The teams then work on that concept for the rest of the semester. The teams receive constructive feedback from the supervisors through regular meetings. The game development progress is monitored, guiding teams towards a fully developed game by semester's end.

This study contributes valuable insights into the integration of game development processes as innovative educational tools. By examining teachers' experiences within the Let's Play project, our research expands the understanding of how educational game design, and the Game Lab method, can enhance learning outcomes. Through exploration of these methodologies, this study aims to provide practical implications for educators seeking to engage students through immersive and collaborative learning experiences in both analog and digital realms. Empirical data was gathered a survey with open-ended questions and reflection notes written by participants towards the end of the semester, providing their insights on using game development as an educational approach, working in teams and developing a board game on a given subject. Their responses were analyzed to identify key themes and patterns.

2. Theoretical Background

Constructivism and behaviorism are central learning theories in game-based learning (Hense & Mandl, 2014; Egenfeldt-Nielsen, 2006). Constructivism emphasizes active learning where the student creates knowledge themselves, while behaviorism focuses on reinforcing desired behavior. Motivation is a key concept, with external and internal motivation as important factors (Lei, 2010; Plass et al., 2015; Shaffer et al., 2005). In game-based learning, external motivation can involve external rewards, such as points and prizes, while internal motivation refers to games based on curiosity, excitement, or the joy of solving challenges (Oudeyer, Gottlieb & Lopes, 2016).

Constructivism highlights individual knowledge construction, experiential learning or learning by doing (Mayer, et al., 2002; Molina-Carmona and Llorens-Largo, 2020 and Shaffer et al., 2005). It varies whether, or to what extent, experiential learning is considered independent of constructivism. The term is descriptive; students should learn by construction; working on realistic tasks instead of reading about such tasks or acquiring abstract knowledge. Digital games are often seen as useful options for integrating approaches to experiential learning in the classroom (Mayer, Mautone, and Prothero, 2002; Molina-Carmona and Llorens-Largo, 2020). Previous research has also underscored the positive sides of students as game designers (Slussareff and Bohácková, 2016), and how this benefits knowledge acquisition.

Using game development features (GDFs) as a base for the process of teaching and learning opens a range of possibilities and can help improve students' learning outcomes in classroom teaching (Wu and Wang, 2012). Czauderna and Guardiola (2019) furthermore address the Gameplay Loop Methodology as a Tool for Educational Game Design and how the methods of player-centered design ensure the relevance and quality of the final product.

Navarrete (203) and Thumlert et.al (2018) examined what and how young people learn through game design and critical thinking. They have found this way of learning, through production pedagogies, to be effective, providing deeper understanding through designing artifacts that have use value, and that matter to their makers. This is further supported by Yanes et.al (2019) who also highlight the importance of giving learners the opportunity to participate in processes of inquiry, meaning-making and design work, through action and interaction and by engaging in a process of learning where students' own interests are central.

Munkvold et al. (2017) have tested several interventions and researched the topic of Learning through construction (see also Kolås et.al., 2017; Kolås and Munkvold, 2017 and Sindre et.al., 2018). Munkvold (2017) emphasizes the importance of the making of an artifact/outcome driven development and how testing the game with players (target audience) increases the motivation for working with the project, aligning with the principles of production pedagogies (Thumlert et.al., 2018 and Chamberlin et.al., 2012). There is further support that the process of getting there, working systematically in teams, having regular meetings with the supervisor, observing others testing and playing the game and the fact that one is making a product that is interesting and relevant to a given audience, are mentioned as a combined set of motivational factors (Munkvold, 2017). This is also supported in previous research by Chamberlin et.al (2012) and Li (2010), emphasizing how collaborative work and group dynamics have positive effect regarding understanding and learning the game design process, and how it increases participants' insight on the subject matter and the generic skills.

3. Method

The learning activities were carefully designed, following the steps from the Game Lab concept, the game development process, to ensure progression in each of the teams' projects. The figure below gives an overview of the process, using Game Lab as the educational approach.

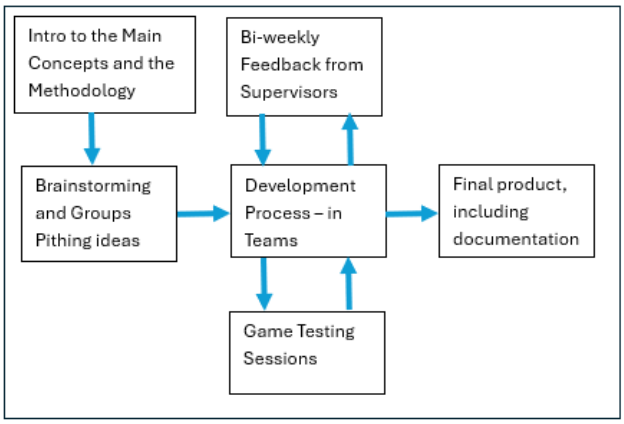

Figure 1: Game Lab as basis for the Game Development Process

To address our exploratory research, we conducted a comprehensive analysis of written in-depth reflection notes provided by the group of teachers who participated in the Let's Play project, which included a Game Lab component. The participants also answered an assignment-survey with open ended questions, where they provided their insights on learning experiences and motivational factors when using games and a game development process as a pedagogical tool for learning activities.

A total of twelve teachers, representing a diverse age group from their thirties to their sixties, with the majority being women and only three men. Their responses captured the participants' insights into learning experiences and motivational factors when utilizing games and a game development process as pedagogical tools in the learning activities. Since many of the responses were initially written in Polish, accurate translations to English were provided by the Polish project coordinators.

The texts provided by the teachers were analyzed using an abductive approach, which aims to explore thematic patterns and emergent insights from the data (Reichertz, 2007). Abduction enables the integration of deductive reasoning based on theory with the outcomes derived from inductive data coding.

Regarding limitations, it is important to acknowledge that the teachers in this study had voluntarily enrolled in the Let's Play project, indicating a potential bias toward an interest in game-based learning approaches. This, and the fact that there were only three men out of twelve participants, may limit the generalizability of our findings beyond this specific population. Furthermore, all the teachers provided their consent to their responses being used for research purposes. They have also received a presentation of the main findings.

It is important to note that both the authors of this paper were involved in the project. However, we do not view this as a conflict of interest, as our focus remains on analyzing the experiences of the teacher participants.

4. Findings & Discussion

Two main themes emerged from the participants' responses, when they were asked about the most useful/inspiring things and the most motivational factors during the game development project. These themes were educational game design on one hand, and the Game Lab method on the other hand. Within each of these categories, their responses further reveal three main sub-categories:

Table 1: Main findings

Educational Game Design	The Game Lab Method
• Game based learning	• Group Dynamics
• Game development	• Progress
• Game testing	• Creativity

The *educational game design* theme evolved around increased professional knowledge and skills regarding these three prominent sub-categories. Within the sub-category of *game-based learning*, participants commented that the project had given them a broader perspective on using diverse games in education, highlighting the importance of connecting in-game content to the real world and how this is a suitably modern approach to teaching. Some also commented that when successful, game-based learning provides precious opportunities to approach teaching from a constructivist angle rather than a behaviorist one.

Regarding the *game development* sub-category, the participants emphasized their increased insight and understanding of game systems. They also reported improved insight into game development.

In the third sub-category the participants highlighted the importance of *game testing* for their professional development and how they had come to discover this as an obvious, yet surprisingly potent approach. They further emphasized the importance of conducting testing sessions with the appropriate target audience (their own pupils in this case) and how the results from this were essential for the further development of their own games.

A quote from one of the participants is a good example on how they felt that the *educational game design* approach in the Let's Play project supported their own professional development:

> *"Already during the lecture, I realized that for more than 13 years of my work as a teacher, what I have really cared about, what I have strived for and what I have learned was to transfer knowledge, to achieve some educational goals 'by the way'. At various stages of our team's work, we returned in our conversations to the fundamental premise of moving towards constructivism rather than behaviorism when developing a game."*

In the *Game Lab method* category, the first sub-category was *group dynamics*, where the participants emphasized teamwork and the ability to negotiate and reach consensus. They appreciated meeting like-minded, passionate people, as well as discussions and reflections during the game development process regarding both motivation and learning outcomes.

In the *progress* sub-category, participants called attention to the key role of experiencing the games' natural, yet structured, development through sequential stages in the development process. They felt that experiencing this with the Game Lab approach was a highly engaging process, resulting in a valuable learning experience.

The sub-category that we call *creativity* puts the spotlight on the significance of creating something and being creative. Being open for "surprise turns" during the development process was emphasized. The respondents felt that this supported the innovation, freshness and novelty of the product and how it increased the participants' motivation for working on the project. In one of the responses that emphasized the focus on creativity, the respondent referred to how one of the lectures in the on-site seminar had inspired them, *"as it encouraged me not to be afraid of my ideas and to experiment with my imagination."*

To summarize and reflect on the findings considering relevant previous research and theories, we can say that the participants valued their increased insights and understanding of game-based learning, game development and game testing as vital elements for educational game design, and their own professional development through the project. This approach was seen as a modern and effective way to foster constructivist learning environments, as also stated in previous research by Munkvold (2017), Thumlert et.al. (2018) and Yanes et.al (2019). The respondents reflected on this in relation to their own professional work situations, accounting for a broad spectrum of relevant factors, ranging from educational theories to the simple reality of helping their pupils understand somewhat abstract ideas related to real world topics, through something as tangible as an analog board game.

The participant's reflections on shifting from a behaviorist approach to a constructivist one aligns with the theoretical emphasis on constructivism in game-based learning (see for example Hense & Mandl, 2014; Egenfeldt-Nielsen, 2006). This transition underscores the value of active, experiential learning, where students construct knowledge through realistic tasks, resonating with the participant's realization of the importance of engaging students in meaningful learning experiences.

When it comes to the other main theme in the participants' feedback, the Game Lab method, the participants highlighted group dynamics, which is in line with Chamberlin et.al (2012) and Li (2010), the observable progression of the game and the creativity that the method both allows for and, at the same time, is dependent on. Their personal experience and motivation were prominent in their responses regarding Game Lab, while their reflections also reveal an understanding of how the elements that made Game Lab valuable for them, can

also be applied to create valuable learning experiences for their own pupils. This is also supported by Thumlert et.al (2018) and their emphasis on the positive motivational effect of producing assets of use value.

5. Conclusion

The research findings reveal two main themes that significantly impacted the participants: educational game design and the Game Lab method – both connected to production pedagogies as a motivating learning approach and further grounded in constructivist learning theories. Each theme comprises several sub-categories that further elucidate the participants' experiences and insights.

In conclusion, the project enabled participants to enhance their professional skills and knowledge in educational game design, particularly through game-based learning, development, and testing. They reflected on how these elements could be integrated into their teaching practices to help pupils grasp complex concepts through both playing and developing tangible analog board games.

The Game Lab method further enriched their experience by emphasizing the importance of group dynamics, structured progress, and creativity. Participants' personal experiences and motivations were deeply influenced by these elements, and they recognized the potential to apply these insights to create valuable learning experiences for their own pupils. The project suggests that educational game design and the Game Lab method may synergistically support professional development and innovative teaching practices.

The following quote, addressing the role and effects of *group dynamics,* provides a fitting conclusion for this paper:

"Alone you go faster, but together you go further."

References

Chamberlin, B; Trespalacios, J and Gallagher, R. (2012) *The Learning Games Design Model: Immersion, Collaboration, and Outcomes-Driven Development*. International Journal of Game-Based Learning 2 (3), 87-110

Czauderna, A and Guardiola, E. (2019) *The Gameplay Loop Methodology as a Tool for Educational Game Design*. Electronic Journal of E-Learning 17 (3), 207-221

Egenfeldt-Nielsen, S. (2006) *Overview of research on the educational use of video games.* Digital Kompetanse 1(3), 184–213.

Hense, J., & Mandl, H. (2014) *Learning in or with games?* In Digital Systems for Open Access to Formal and Informal Learning (pp. 181–193). Springer International Publishing. https://doi.org/10.1007/978-3-319-02264-2_12.

Kolås, L., Munkvold, R. I. and Nygård, S.A. (2017) *Learning through construction in IT courses 2017.* NOKOBIT: Norsk konferanse for organisasjoners bruk av informasjonsteknologi: Volum 25

Kolås, L. and Munkvold, R.I. (2017) *Learning through construction: a roller coaster ride of academic emotions?* CSERC '17 The 6th Computer Science Education Research Conference 2017, ACM Publications: 10-19

Lei, S. A. (2010) *Intrinsic and extrinsic motivation: Evaluating benefits and drawbacks from college instructors' perspectives.* Journal of Instructional Psychology, 37(2), 153–160.

Li, Q. (2010) *Digital game building: learning in a participatory culture*. Educational Research 52 (4) , 427-443

Molina-Carmona, R., & Llorens-Largo, F. (2020) *Gamification and advanced technology to enhance motivation in education.* Informatics (Basel), 7(2), 20. https://doi.org/10.3390/informatics7020020.

Munkvold, R.I. (2017) *Game Lab – a practical learning approach for Game Development*, Proceedings of the European Conference on Games Based Learning (ECGBL), 472-479

Navarrete, CC. (2013) *Creative thinking in digital game design and development: A case study*. Computers & Education 69 , 320-331

Oudeyer, P., Gottlieb, J. and Lopes, M. (2016) *Intrinsic motivation, curiosity, and learning: Theory and applications in educational technologies.* Progress in Brain Research. 229. 10.1016/bs.pbr.2016.05.005.

Plass, J. L., Homer, B. D. and Kinzer, C. K. (2015) *Foundations of Game-Based Learning. Educational Psychologist*, 50(4), 258-283. https://10.1080/00461520.2015.1122533.

Shaffer, D. W. et al. (2005) *Video games and the future of learning.* Phi Delta Kappan, 87(2), 104–111.

Slussareff, M and Bohácková, P. (2016) *Students as Game Designers vs. 'Just' Players: Comparison of Two Different Approaches to Location-Based Games Implementation into School Curricula*. Digital Education Review (29), 284-297

Thumlert, K., de Castell, S. and Jenson, J. (2018) *Learning through Game Design: A Production Pedagogy.* Proceedings of the 12th European Conference on Game-Based Learning ECGBL.

Reichertz, J. (2007) *Abduction: The logic of discovery of grounded theory.* In Bryant, A., and Charmaz, K. (Eds.), The SAGE handbook of grounded theory (pp. 214–228). Los Angeles, CA: Sage.

Sindre, G, et al. (2018) *Project-based learning in IT education: definitions and qualities*, UNIPED: Volum 41, 147-163

Wu, B and Wang, A. I. (2012) *A Guideline for Game Development-Based Learning: A Literature Review.* International Journal of Computer Games Technology. https://doi.org/10.1155/2012/103710.

Yanez, G.A, Thumlert, K., de Castell, S. and Jenson, J. (2019) *Pathways to sustainable futures: A "production pedagogy" model for STEM education,* Futures, Volume 108, 2019, Pages 27-36, ISSN 0016-3287, https://doi.org/10.1016/j.futures.2019.02.021.