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TEACHERS' COMPETENCIES IN DIGITAL GAME-BASED LEARNING IN FINNISH HIGHER EDUCATION:

A CASE STUDY OF THE EUROPEAN BIO-INDUSTRY NETWORK GAME

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Summary: The current study investigates teachers' competencies and practices in the integration process of digital game-based learning (D.G.B.L.) in the context of higher education in Finland. Based on the predefined pedagogical framework of teachers' competencies in game-based learning, which includes: 1) *pedagogical area of competence*, 2) *technological area of competence*, 3) *collaborative area of competence*, and 4) *creative area of competence*, this study aims at 'testing' and possibly 'tailoring' the framework for the higher education context and D.G.B.L. A case study approach was employed to examine teachers' competencies in the real-life context where teachers used the *European Bio-Industry Network* (EBIN) game in the higher education bio-economy studies. The data included documents, physical artifacts, and interviews (n=3) with the teachers who used the game in teaching during the academic year of 2019-2020. Thematic analysis was used to analyze the data. The results showed that all the four areas of competence apply to the context of higher education and D.G.B.L.; nevertheless, the areas of competence had different levels of significance with the pedagogical and technological areas of competence as the most critical. In addition, another significant finding of this study is the *online teaching area of competence*, which refers to the ability of teachers to integrate digital games in online courses meaningfully. Teachers should carefully plan and consider different practices for the meaningful integration of digital games in teaching. Teachers should also consider new ways of using digital games in online courses.

Keywords: teachers' competencies, digital game-based learning, higher education, case study, game-based pedagogy, thematic analysis, the pedagogical framework, online teaching competence

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ABBREVIATIONS

DGBL – Digital Game-Based Learning

GBP – Game-Based Pedagogy

E.B.I.N – European Bio-Industry Network

UAS – University of Applied Sciences

1. INTRODUCTION

In a rapidly growing digitalized society, educational institutions – especially in western societies – are constantly embracing digital tools and games as contemporary and future teaching practices. Prensky (2007, 91) argues that as we now have entered the era of which communication technologies are changing rapidly, and where most of the communication is happening in a digital environment, it is appropriate that the educational methods change correspondingly. Davies et al. (2011) suggest that future employees should be competent to work virtually with connective technologies, which makes it easier to work and cooperate with colleagues despite physical separation. Thus, the digitalization of the educational practices would prepare for entering a technology-oriented working life. In order to fulfil that, teachers and scholars have acknowledged the potential of game-based learning as an innovative approach to engage students as well as bring new technologies in the classroom. To simply put, game-based learning is a way of learning while simultaneously having fun. In their review, Plass et al. (2015, 260-261) summarize some of the critical positive indicators of game-based learning: *motivation* (Prensky, 2007) to learn and entertain through playing games*, engagement* (Prensky, 2007; Egenfeldt-Nielsen et al., 2011; Hämäläinen, 2011; Hamari et al. 2016; Sabourin & Lester, 2014) as the ability of games to engage the learner in multiple ways*, adaptivity* (Presnky, 2003, Nousiainen et al. 2018) refers to the capability of the game to provide a personalized learning experience for each learner*, and graceful failure* (Hämäläinen, 2011) which allows the learner to make mistakes in the game and eventually learn from them. Despite the recognized potential of game-based learning to enhance the learning experience and engage the learner, most of the studies assume that the effectiveness of game-based learning depends only on the effects of the game (Foster et al. 2015, Young et al. 2012 as cited in Nousiainen et al. 2018) and little on teachers' role. Previous research has shown that while the effects of digital games are partly responsible for students' learning outcomes, support and guidance from the teacher are also significant for the successful integration of digital games in teaching (Mayer & Bekebreka 2006, Shaffer 2006, Kangas, 2010; Egenfeldt-Nielsen et al., 2011, Ruten et al. 2012; Nousiainen et al. 2018).

Furthermore, teachers play an essential role in fostering the learning and motivational components in game-based learning (Kangas et al. 2016). Nevertheless, few studies have examined teachers' role in game-based learning, primarily focusing on the competencies they need in for a meaningful implementation of game-based learning. Silseth (2012) concluded

that teachers performed multiple roles during digital-game based learning: a) guiding students during and making connections with the learning goals, b) using several pedagogical approaches, c) supporting the students to understand the knowledge beyond the course. Hämäläinen and Oksanen (2014, 81) discuss the vital role that teachers have to connect the game operations with the theoretical knowledge of the subject. Shah and Foster (2015) showed that the integration of games in teaching requires thoughtful planning and analysis from the teacher. Kangas et al. (2017) show that teachers' pedagogical and emotional engagement in playful learning can influence student's satisfaction with playful-learning environments. In a recent study conducted in the context of lower primary and secondary education in Finland, Nousiainen and colleagues (2018) found four main areas of competence that teachers need to meaningfully implement game-based pedagogy: the pedagogical area of competence, the technological area of competence, the collaborative area of competence, and the creative area of competence.

Despite prior research investigating the teachers' competencies and roles in the process of integrating games in teaching, it remains unclear whether the same the role and competencies apply in game-based learning in the higher education context. The previous studies focus mostly on elementary education and consider the wide range of game-based pedagogy. Furthermore, considering the rapid development of digital tools and games, the previous studies are based on games and practices which might already be considered outdated.

The current study aims at investigating teachers' competencies and practices for implementing digital game-based learning (DGBL) in the context of higher education in Finland. Based on the literature review, there is no existing evidence that focuses on the same angle. Based on the 'Pedagogical Framework of Teachers' Competencies in GBP,' the goal of this study is to 'test' and possibly tailor the framework mentioned above to be suitable for the context of higher education and DGBL. In this case, a concrete example of a digital game will be introduced in practice through the *European Bio-Industry Network* (E.B.I.N) game, which is designed and created to enhance teaching and learning processes in the bio-economy studies in higher education in Finland. The current study is based on a case study approach and focuses on teachers' perspectives about their competencies and practices in DGBL.

2. THEORETICAL FRAMEWORK

In the following chapter, a comprehensive introduction of digital game-based learning will be provided, followed by teachers' competencies in game-based pedagogy. In relation to teachers' competencies in GBP, an extensive description of the 'Pedagogical Framework of Teachers' Competencies in Game-Based Pedagogy' by Nousiainen, Kangas, Rikala & Vesisenaho, (2018, 89-93), which serves as the backbone of this study or the investigated phenomenon will be provided. Finally, the literature review delves and discusses several studies that have investigated teachers' competences in GBP from different perspectives in the past ten years. To sum up, the theoretical framework of this study is based on two main pillars: DGBL and teachers' competencies in game-based pedagogy.

2.1. Digital Game-Based Learning

In the quest to promote digitalization into the educational context and keep up with the current technological trends, teachers, educators, and researchers have shifted their attention towards the potential of DGBL. As Prensky (2007, 91) argues, in an era of radical technological changes, the educational methods and policies should follow the same path. Similarly, Shaffer et al. (2005, 110) suggest that "to understand the future of learning, we should be looking beyond schools to the emerging arena of video games." Despite the obvious gap between the level of digitalization in the contemporary workplace and digitalization in schools and universities, DGBL is more and more employed by teachers and instructors to enhance the learning experience (Prensky, 2007, 196). For instance, Laurillard et al. (2009, 290) claim that the role of these forms of technology-enhanced learning and teaching is to "enable new types of learning experiences and to enrich existing learning scenarios." The great potential of games in teaching is the ability to integrate them in a way that supports the curriculum goals or subject-specific goals. Such an approach would provide students safe learning and practicing environment where failure is part of the learning process.

The term 'digital-game based learning' was initially mentioned by Gee (2003, 1) and Prensky (2001) and has continuously increased attention since then. DGBL has been defined in different ways and often interchangeably used with 'serious game,' 'educational games' or 'edutainment' (Egenfeldt-Nielsen et al., 2011, 9; Rodriguez-Aflecht, 2018, 13). One of the pioneers of DGBL, Prensky (2007, 145) defines it as any learning game on a computer or online, combined with a wide variety of educational content or, as he simply puts it, "DGBL is

any marriage of educational content and computer games." Furthermore, it should feel like a computer game all the way through; however, the content or context should be created in a way that puts the user in a learning situation about a specific topic or area (Prensky 2007, 146). Although the terms 'serious games' and 'education games' have similar meanings with DGBL referring to the application of games in the educational context and enabling the learners to participate and engage in situations that would be impossible otherwise (Corti, 2006; Ypsilanti et al., 2014, 525), throughout this paper the term DGBL is manly used. DGBL offers huge possibilities for teachers and students to enhance learning and have hands-on experiences.

Regarding the effects of DGBL in teaching and learning, Ryan et al. (2006) argue that digital games are so varied and complex, which may lead to both negative and positive effects. While there is a need for research to better understand how games are used at home and for learning, general trends show that serious games and simulations are more and more used to support the curriculum goals (de Freitas & Oliver, 2006, 250; Guillén-Nieto & Aleson-Carbonell, 2012). For instance, Egenfeldt-Nielsen et al. (2011), Shute and Ke. (2012, 1) and Guillén-Nieto and Aleson-Carbonell (2012) claim that digital and serious games have a tremendous capacity to capture the students' attention and engage them in curricular content compared to traditional teaching. Indeed, the learning practices should bring almost the same, if not the same, level of engagement to students as the entertainment devices they use in their everyday lives. As Prensky (2007, 47) points out, the difference between 'diginatives' and older generations is their active participation in learning, rather than being only passive listeners and recipients of the information. The natural playfulness of the games allows students to input elements of themselves into the gameplay. According to Prensky (2007, 147), there are three main reasons why digital game-based learning is efficient. Firstly, *engagement* puts the learner in the game context. Second, an *interactive* learning process should be employed in which the instructor uses different forms and practices combined with the game and third, *the way* that the game is merged with the educational content and practices. Gros (2007, 23) states that digital games can be a suitable way to improve learning because they are user-centered; thus, they promote challenges, co-operation, engagement, and the development of problem-solving. Despite the majority of the research data supporting the effectiveness and the benefits of the integration of DGBL in the classroom, research has also shown that digital games are often perceived only as entertainment. There exists a feeling that, in some worse cases, "games give way to empty banter, ineffective use of time, and little learning" (Hämäläinen & Oksanen, 2014). Indeed, when games are not well-aligned with the specific subject goals, it gives the feeling that

students are just playing it for entertainment, and teachers are just observing them. It can be argued that in cases when the game is not designed in accordance with the subject objectives and curriculum goals, there isn't much learning.

Even though the main focus in DGBL is in the game itself, and especially the user experience, the integration process, which includes the relevant pedagogical approach is complex and as important as the game itself. It is crucial that games are used as a supplement and combined with the relevant pedagogies, and not as standalone applications (Shaffer 2006; Egenfeldt-Nielsen et al., 2011, 29). Teachers and instructors play a key role in the entire process, where their support and guidance are important for the effective integration of digital games in teaching (Mayer & Bekebreka 2006). Considering the importance of appropriate pedagogical planning and the key role that the teachers have in the entire process, the current study examines teachers' integration process of the E.B.I.N game in teaching bio-economy courses in the Finnish higher education context. Thus, as Prensky (2007) claims, in complex topics and subjects, training and education will become even more learner-centered as learners demand it. Similarly, the E.B.I.N game was designed to be an adjunct to the bio-economy courses in order to provide the students with the opportunity to understand the complex topics of bio-economy and value chains in a practical manner. Digital games enable demonstrations of concepts and materials that are difficult to be explained through traditional means; for example, practicing authentic electrical hazard situations (Hämäläinen, 2011). Therefore, digital-game based learning provides practical solutions in teaching complex topics and enable students to connect with the real operational world.

2.2. Teachers' Competencies in Game-Based Pedagogy

As mentioned earlier, the integration and effectiveness of DGBL are highly dependent on teachers' competencies and skills. Thus, research has shown that while the structure of an educational video game plays a role for students' learning achievements and motivation, teachers play an even more important role in the successful integration of DGBL (Shaffer 2006; Egenfeldt-Nielsen et al., 2011; Kangas, Koskinen, & Kokfors, 2016; Shah & Foster, 2015). Indeed, teachers act as a connecting 'bridge' between the game, the curriculum objectives of a specific subject and the students, where competencies play a key role for effective integration. Throughout this study, teachers' competence is understood as a multi-layered concept that encompasses cognitive, skill-based, and affective components, such as knowledge, skills, attitudes, values, and ethics (European Commission, 2018; Nousiainen et al., 2018). Adequate

pedagogical planning is not sufficient for the effective integration of digital games into teaching; hence, teachers should also, for example, have a positive attitude towards games. Multiple competencies during different stages of the integration are important to get the best out of each stage: before, during, and after the course. Egenfeldt-Nielsen and colleagues (2011, 29) point out some key actions for teachers in the process of integrating DGBL in teaching, such as identifying suitable games for the classrooms, testing, and making sure that the content is suitable to students' knowledge and cognitive development. Furthermore, teachers should explain the game and the purpose of the class to students, assist them during the game, and organize a debriefing session where links can be established between learning objectives and the game (Egenfeldt-Nielsen and colleagues, 2011, 29; Kangas et al., 2016). For example, the debriefing session is crucial to bring the game operations into the context of learning outcomes. Despite research showing the important role of the teachers in this process, most approaches that are used to integrate games in teaching still presume that the game effect is the main factor (Nousiainen et al., 2018). Furthermore, Nousiainen et al. (2018, 86) and Hämäläinen and Oksanen (2014) explain that the role of the teachers is not adequately acknowledged in game-based learning literature and comprehensive approaches to teachers' competencies in game-based pedagogy are rare.

Therefore, considering the lack of literature about teachers' competencies in game-based learning, this paper aims to help to reduce this research gap. This study is strongly based on the *'Pedagogical framework of teachers' competencies in game-based learning*' by Nousiainen et al. (2018), which serves as the backbone of this study or the investigated phenomenon since the research interest and questions were mainly inspired from it. In their study, Nousiainen et al. (2018, 86) investigated the possible competence areas that teachers need in game-based pedagogy by conducting case study research in the primary and lower secondary school context in Finland and considering teacher competencies in a broad pedagogical perspective. The data consisting of teachers' documents, interviews, and questionnaires were collected with 15 schools in Southern Finland during 2013-2016 (Nousiainen, Kangas, Rikala & Vesisenaho, 2018, 87). In order to investigate teachers' competence areas, Nousiainen et al. (2018) combine the pedagogical model of creative and playful learning (Kangas, 2010) with four games-based approaches by Nousiainen et al. (2015).

As a result of data analysis, Nousiainen and colleagues (2018, 89) found four main areas and ten sub-areas of competence that teachers need to have when applying game-based pedagogy

in teaching as following *pedagogical area, technological area, collaborative area,* and *creative area.*

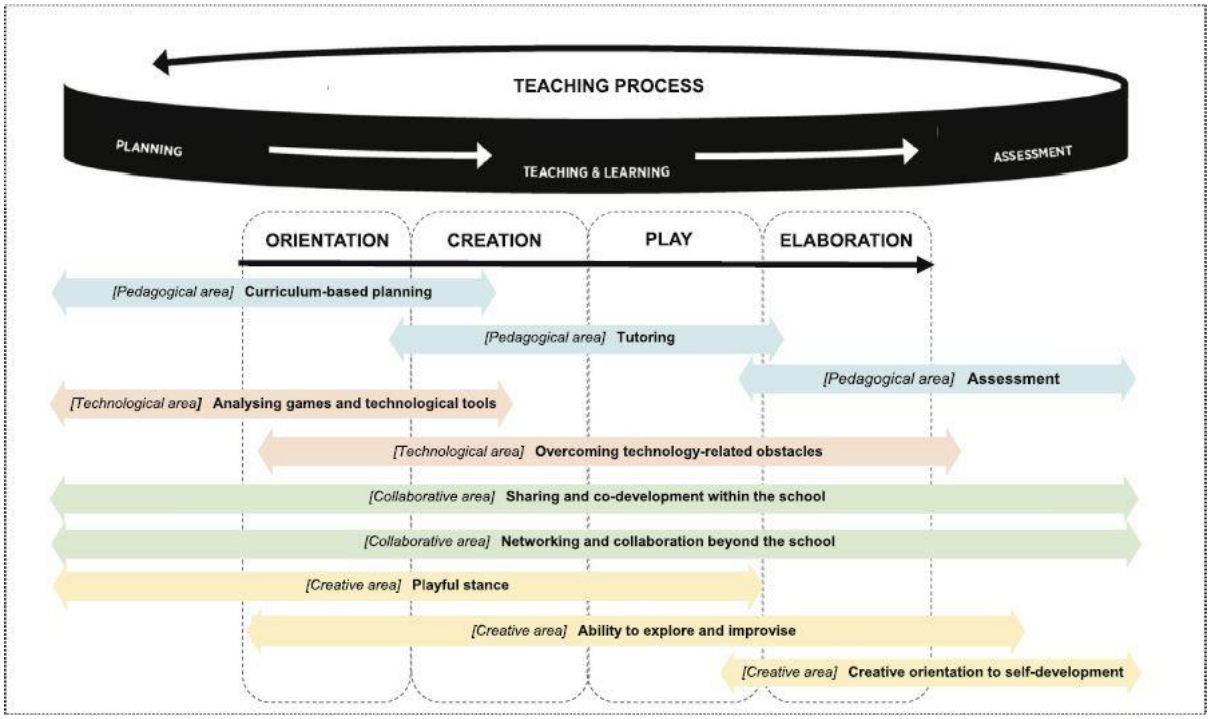

Figure 1: Pedagogical Framework of teachers' competencies in game-based pedagogy (Nousiainen et al., 2018, 94)

As shown in *Figure 3,* the four main areas and ten sub-areas of competencies that teachers need to effectively integrate are distributed in different stages of the timeline of the teaching process. Some of the competencies are mainly needed during a specific phase – for example, curriculum-based planning - whereas the other competencies overlap with each other and often necessary during the entire teaching process (see *Figure 3*).

Initially, the *pedagogical area* was identified where teachers indicate that it is crucial to have pedagogical competencies to integrate game-based approaches in teaching. The pedagogical area is accompanied by three sub-areas of competence *1) curriculum-based planning, 2) tutoring,* and *3) assessment.* According to the findings by Nousiainen and colleagues (2018, 89), curriculum-based planning is a key competence that teachers need to effectively apply game-based learning aligned with the curriculum goals. Moreover, tutoring, which referred to assisting the learning process during the game-based activities was found to be important during the process and, finally, assessment competence, which referred to evaluating students' learning and reflecting with them about the process (Nousiainen et al., 2018, 90).

Second, the *technological area* was found to be an important competence for teachers in order to effectively integrate games in teaching, supported by two sub-areas of competences *1)*

analyzing games and technological trends and *2) overcoming technology-related obstacles*. The teachers consider the competence of analyzing games and technological trends as the ability to select a suitable digital tool and integrate it in a non-digital context in a pedagogically meaningful way. In addition, teachers also acknowledged the fact that they need to be prepared to carefully overcome technology-related obstacles as they emerge during teaching. Indeed, technological disruptions and malfunctions are a major obstacle when using digital games in teaching, sometimes as a result of teachers' lack of technological know-how and sometimes to the game functionalities. This often leads to a lack of concentration from students and disbelief towards game-based learning (Nousiainen et al., 2018, 91).

Third, a *collaborative area* of competence referred to the teachers' ability to share and communicate content, ideas, and practices in order to promote game-based pedagogy in the school culture. The collaborative area was created by two sub-areas in different levels of collaboration *1) sharing and co-development within the school* and 2) *competencies for networking and collaboration beyond the school.* It was concluded that teachers need to improve in sharing ideas and practices within the school and sharing experiences and practices with teachers from other schools in order to continuously improve the game-based pedagogy practices and learn from each other's experiences (Nousiainen et al., 2018, 92).

Finally, the *creative area* was found to be the fourth area of competence that teachers need to effectively integrate games in teaching where teachers take a *1) playful stance*, *2) explore and improvise*, and *3) creative orientation to self-development*. According to the findings by Nousiainen and colleagues (2018, 92), playful stance demonstrated the ability to see playfulness in almost every learning activity. Moreover, the ability to explore and improvise is understood as "to experiment with new tools and methods without worrying about failure." The last sub-competence of creative orientation to self-development indicates that teachers need to continuously improve their competencies in game-based pedagogy in order to meaningfully integrate games in teaching (Nousiainen et al., 2018, 92).

The outcomes of the study conducted by Nousiainen and colleagues (2018) emphasize four key areas of competence that teachers need in order to meaningfully implement game-based pedagogy into teaching. In addition, the research results contribute to narrow the research gap and enhance teachers' role in game-based learning. The four key areas of competence that emerged from the teacher's perspective representing 15 different primary and lower secondary schools in Finland, should be taken into consideration by teachers and instructors who are

planning to integrate games in teaching. Thus, teachers can ensure that the game is aligned with the curriculum goals – and the most important – have a smooth and rewarding experience with the integration of games in teaching. The data which determined the competencies which teachers need to effectively integrate game-based pedagogy emerged from the teachers in a primary education context and encompassing the broad field of educational games, entertainment games, gamification, and making games; therefore, it can be argued whether the same competencies apply to the integration of digital educational games in the context of higher education in Finland. As Nousiainen, Kangas, Rikala, Vesisenaho (2018) point out in the limitations of the study, "the original context is likely to have influenced the emphasis of some aspects within the areas." Consequently, based on the '*Pedagogical Framework of Teachers' Competencies in Game-Based Learning*' by Nousiainen et al. (2018), this study aims to investigate whether the above-mentioned framework applies in the context of higher education in Finland by focusing solely on the digital educational games. Hence, the goal is to 'test' the framework Nousiainen et al., (2018) and possibly identify additional areas of competence in order to tailor and make it suitable for the higher education context when applying DGBL.

2.3. Literature Review on Teachers' Competencies in Game-Based Learning

The potential of DGBL to enhance the learning experience of the students has been widely discussed by scholars and teachers in recent years. Nevertheless, researchers have mainly focused on the game and the students as key indicators for the successful integration of games into teaching. Although some studies (Eastwood & Sadler, 2013; Hämäläinen & Oksanen, 2014; Shah & Foster 2015; Kangas, 2016; Nousiainen et al., 2018) have considered teachers' competencies in game-based learning, further research is required for a comprehensive understanding of teachers' role in different contexts of game-based learning. In the following section, an overview of the studies which investigate teachers' competencies in game-based learning in higher education will be provided.

Regarding the ICT competencies in web-based teaching and learning in higher education, Löfström and Nevgi (2007) used questionnaire survey data to investigate (n=333) institutional leaders, ICT support staff, teachers, and students at the University of Helsinki. Among others, the findings showed that teachers identified two basic functions of ICT in teaching: 1) sharing of the course material through the web, and 2) the developments of interactive and collaborative

learning opportunities. Furthermore, according to the results, teachers indicated that the available ICT training was suitable to meet their needs; however, their lack of time was the main barrier in joining the training. Another finding described that the main problems of ICT integration in teaching came as a result of students' ability to manage time and their technology usage skills Löfström and Nevgi (2007, 312) effectively.

In a study conducted in the United States, Watson, Mong, and Harris (2011, 466) investigate the usage and integration of the *Making History* educational video game, which was used to teach high school students about World War II. In their qualitative case study research, multiple data were gathered through observations, focus groups, and individual interviews, and documents from four of the teacher's classes and a total of 98 students — the authors aimed at understanding students' experience and teacher's perspective with educational video games learning. The findings related to the teachers' role in the meaningful integration of educational video games in teaching indicated that 1) a teacher who is looking to integrate an educational game in a public school must ensure that the content of the game fits with the goals of the curriculum, 2) the teacher needs significant support from the school's administration in order to have the games and the hardware to implement it, and 3) the teachers need to justify what the game is used for and how does it resemble with the learning goals (Watson et al., 2011, 47). The findings clearly emphasize the role of the teacher in the meaningful integration of the games in teaching. Furthermore, the teachers should ensure that the specific chosen game to be used in teaching should be well aligned with the school curriculum goals and learning objectives of the subject.

In a similar case study research, Eastwood and Sadler (2013, 11) examine three science teachers' implementation of the game *Mission Biotech* in their classes. Teachers were provided with a curriculum unit that would allow them to decided and modify the learning and supporting materials (besides the game) according to their specific classroom goals. The results of this study indicate that teachers employed similar practices into their teaching, such as adapting activities to classroom norms and practices, high consideration for quality curricular resources and support, using the game to provide experiences that the students cannot normally access and regards about the effective use of time. Furthermore, another interesting finding show that needs support to integrate and connect the game with the supporting curriculum material (Eastwood & Sadler, 2013). As a matter of fact, effective alignment of the games with the curriculum goals is rather complex and requires the right knowledge, skills, and competencies.

In an experimental study, Barzilai and Blau (2014) examine the effect of augmenting a business simulation game with an external conceptual scaffold – which provides formal knowledge - on learner skills to solve financial-mathematical word problems within a business simulation game. The results showed that the learners who study with the scaffold before the game showed a better performance in the post-game assessment. Moreover, the external scaffold did not have any negative effect on learners' flow and enjoyment (Barzilai & Blau 2014). Thus, the findings support the fact that pedagogical frameworks and design are necessary for the meaningful integration of games in teaching.

Additionally, Hämäläinen and Oksanen (2014, 81) conducted a research in the context of vocational education in Finland with the aim of understanding the impact of teachers' real-time instructional activities in collaborative shared knowledge using 3D learning games. The authors found that the teacher plays an important role in fostering collaborative knowledge construction in the 3D learning games context (Hämäläinen and Oksanen, 2014, 81). Consequently, the results of this paper highlight the crucial role that teachers have to connect the game operations with the learning material and goals. The teachers' role is to highlight the teaching goals and to connect it with the operations during the gameplay.

Another study conducted in the United States by Shah and Foster (2015) focuses on teachers' competences in game-based learning. In their mixed-method study, 14 pre-service teachers undertook a methods course that trains them in-game analysis, game integration, and ecological conditions impacting game use in school contexts using the Game Network Analysis framework. As a result of data analysis, Shah and Foster (2015) found that after completing the course, the teachers had a better understanding of the game analysis and integration. Teachers highlighted the fact that they could support students in making and generating connections between content and the game through curricular planning and debriefing. Moreover, teachers indicated that the integration of the game requires thoughtful planning and analysis, and the potential of a game relied on the context of its use. Teachers also reported that the ones who are competent with game-based learning could help other teachers to the successful integration by employing and instructional approach Shah and Foster (2015, 260).

Nousiainen, Vesisenaho, and Eskelinen (2015) conducted another study with comprehensive schools in Finland with the aim of understanding 1) the types of game-based practices which are used by teachers in school and 2) the teachers' perspectives on the role and importance of game-based pedagogy in the school culture. In a similar study design with Nousiainen et al.

(2018, see above), data from 15 comprehensive schools, 32 teachers, and approximately 700 pupils were collected during a project (2013-2016) in Helsinki, Finland. The results show that game-based pedagogy plays a crucial in the process of the transition of traditional practices in schools. In regards to the teachers' experiences with the role game-based pedagogy in teaching and learning, the findings which emerged from questionnaire analysis and interviews indicated five main roles 1) supporting differentiated learning, 2) games can motivate students and meet their specific learning needs, 3) the role of games in testing and reshaping classroom practices, 4) games provide new opportunities for student' evaluation, and 5) obstacles of employing game-based pedagogy in teaching (Nousiainen et al. 2015, 1-7).

A more recent mixed-method research that aims to shed light on teachers' role in game-based learning is conducted by Kangas et al. (2017) with two elementary schools in Finland and one in the Netherlands. The results related to teachers' engagement in the learning process suggest that student's satisfaction eventually depends on the teacher's engagement and her decision (Kangas et al. 2017). An additional outcome of the study shows that in order to promote student satisfaction in a technology-enriched environment, it is important for the teacher to be motivated and engaged in embracing these pedagogical approaches (Kangas et al. 2017).

In conclusion, the literature review emphasizes the complex process of integrating the games into teaching and the key role that teachers play in the process. Foster and Shah (2015) argue that teachers' key actions for a successful game integration are 1) to learn to use the game to complement their pedagogical practices and extend their technological pedagogical and content knowledge, and 2) utilizing the game as a way to support social affective, motivational, and cognitive learning experience for students. Despite these studies giving valuable insights about teachers' competencies in game-based learning, a number of questions regarding teachers' competencies with DGBL in higher education context remain to be addressed. Thus, this research seeks to bridge this gap by examining teachers' competencies from their own perspective in DGBL in the context of higher education in Finland and focusing on a specific digital educational game. By employing a case study design, the current study seeks to reveal practices and actions that teachers consider important when using DGBL.

3. METHODOLOGY

3.2. Aims and Research Questions

There have been numerous studies to investigate the effects of game-based learning; however, as shown in the literature review, future research should focus more on teachers' competencies in game-based learning, considering their key role for the meaningful integration of games in teaching. Therefore, this study has multiple objectives. First, this paper seeks to examine teachers' competencies in DGBL in higher education in Finland with the goal of providing valuable insights that may help to better understand the competencies and skills that they need for effective integration of games in teaching. Second, based on the 'Pedagogical Framework Teachers' Competencies in Game-Based Learning' by Nousiainen et al. (2018, 89-93), this study aims to build-on the above-mentioned pedagogical framework by tailoring it for higher education and DGBL environments.

Consequently, the following research questions have been examined in this study:

1. ***How do teachers use the E.B.I.N game in teaching the bio-economy courses?***
2. *What competencies do teachers need to effectively integrate the E.B.I.N game in teaching bio-economy courses?*
3. *What do teachers consider as useful practices when using the E.B.I.N game in teaching bio-economy courses?*

3.2. Qualitative Case Study Research

In order to investigate teachers' competencies and the E.B.I.N. game integration in the real-life context, a qualitative case study approach was used. Yin (2014, 4, 31) argues that no matter the field of interest the researcher has, the need for case study research emerges out of the desire to understand complex social phenomena, for example, small groups, communities, decisions, programs, organizational change, and specific events.

In addition, a case study allows researchers to concentrate on a 'case' and maintain a realistic and real-world perspective. Similarly, in this research, teachers' integration process of the E.B.I.N game form the 'case'; whereas, the realistic and real-world perspective is maintained by taking into consideration the current state-of-the-art in game-based pedagogy. Yin (2014,

16-17), who is one of the main contributors in case study research, has defined it as an empirical inquiry that examines a current phenomenon (or the 'case') in-depth and within its real-world context when the boundaries between phenomenon and context are not clearly evident. Thus, the first reason for employing a case study approach emerges from the goal of this study – which aims to - delve into teachers' experience with the integration process of the E.B.I.N. game into the bio-economy studies at Häme UAS. In addition, a case study research relies on multiple sources of data, which allows that the 'case' is explored from different lenses; therefore, several aspects of the phenomenon can be revealed and understood (Baxter & Jack, 2008, 555; Yin, 2014, 17). The second reason to use case study research comes from the aim to utilize multiple data sources that provide a comprehensive understanding of teachers' experience with the integration process of the E.B.I.N. game in teaching. Third, this study seeks to understand 'how' do teachers' integrate the E.B.I.N. game in teaching and 'why' do they do it in a specific way. By the same token, Yin (2014, 29) states that case study research is most likely to be suitable for 'how and 'why' research questions. To sum up, Yin (2014, 9-12) defines three conditions which determine when to use a case study approach: a) the type of research question posed, b) the extent of control that research has over actual behavioral events, and c) the degree of focus on contemporary phenomenon. This study complies with the above-mentioned conditions since a) the research question posed '*How do teachers' use the E.B.I.N. game in teaching the bio-economy courses?*' aims to understand the 'how' and 'why' of a phenomenon, b) the data collection began after the game was used in teaching in two different semesters, which indicates that there was not any major control over the actual behaviors of the teachers, and c) this research focus on a contemporary phenomenon by investigating teachers' activities on the timeframe November 2019 until June 2020. Yin (2014, 31-33) argues that bounding the case or distinguishing what is outside the context of the study is similarly important as defining the case itself. This will lead to a clear focus on the determined case within a reasonable scope. According to Baxter and Jack (2008), there are a few suggestions how to bind the case a) by time and place (Creswell, 2003 as cited in Baxter & Jack, 2008), b) time and activity (Stake as cited in Baxter & Jack, 2008) c) definition and context (Miles & Huberman, 1994 as cited in Baxter & Jack, 2008). Therefore, as illustrated in *Figure 2*, the case in this study is defined as teachers' competencies in DGBL; whereas, the context is defined as using the E.B.I.N. game in teaching bio-economy studies during the academic year 2019-2020 or more precisely, during the timeframe November 2019 until June 2020. This statement takes into account the above-mentioned suggestions on how to bind the case and have a reasonable scope of a case study.

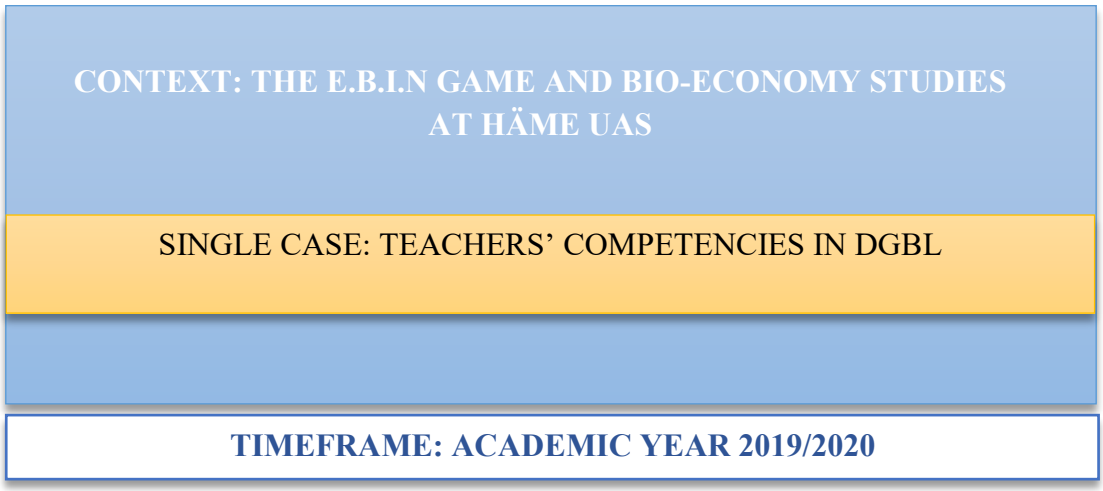

Figure 2: The case and the context illustrated.

The definition of the 'case' of this study indicates that a single case study is employed. Single case studies are beneficial when selecting a specific case would be critical to the theory or theoretical propositions. Thus, the theory should have specified a clear set of circumstances within which its propositions are believed to be true. As a result, the single case serves as a way to define whether the propositions of the theory are correct or some alternative explanations might emerge (Yin, 2014, 51-56). A single case study is suitable for this research paper since the aim is to 'test' and/or build-on the aforementioned 'Pedagogical Framework of Teachers' Competencies in Game-Based Learning' by Nousiainen and colleagues (2018, 89-93). The pedagogical framework includes four main areas of competence that teachers need to meaningfully apply game-based pedagogy in the context of primary and lower-secondary education in Finland (Nousiainen et al. 2018). Consequently, the single case study is employed in order to investigate whether those theoretical propositions of the framework are applicable in the context of higher education or whether additional competencies will emerge. It is important that this case study contributes to the previous knowledge of teachers' competences but also allows to compare the results with other cases.

The empirical data of this study consist of documents, interviews, and physical artifacts. Yin (2014, 1) and Gillham (2000, 20-21) explain that a case study needs multiple sources of evidence such as documents, records, interviews, 'detached' observations, participant observations, physical artifacts. In this way, multiple data sources foster data credibility (Baxter & Jack, 2008, 554) and help to get the best possible answers to the research questions (Yin, 2014, 1). Likewise, documents and presentations from the planning phase of the E.B.I.N. game were collected, the E.B.I.N. game itself served as a physical artifact, and thematic interviews with the teachers who used the E.B.I.N. game in teaching were conducted. Yin (2014, 110-

117) states that interviews are one of the most important data sources of case studies, whereas physical artifacts can be an important component in the overall case. A database was designed to organize the data as Baxter, and Jack (2008, 554) recommend that it improves the reliability of the case study.

3.3. Research Context

The context of the current research entails the integration of the E.B.I.N. game into the bio-economy studies at Häme UAS during the academic year 2019-2020. Thus, the context creates an ideal basis for investigating teachers' competencies and integration practices in higher education, including a specific digital game. Below, the bio-economy studies at Häme UAS will be discussed in general, whereas the course structure where the game was used will be described more specifically. Moreover, the E.B.I.N. game learning goals, operations, and functionalities will be explained below.

3.3.1. Bio-Economy Studies at Häme UAS

The E.B.I.N. game was designed and planned specifically for the bio-economy studies at Häme UAS and other UAS's in Finland. Initially, when the game was almost finished in April 2019, teachers at Häme UAS started to plan how to integrate the game in the bio-economy courses for the upcoming academic year (2019-2020). The initial aim of the project during which the game was designed was to utilize the game in the curriculum of all universities of applied sciences, which were part of the 'Digitalization of Natural Resources for the Bio-economy' project. However, teachers at Häme UAS were the first ones to integrate the game in bio-economy studies. First of all, teachers planned a 5 ECTS compulsory online course named 'Bio-economy value chains' in which they integrated theoretical background about value chains in bio-economy and circular economy. Furthermore, besides the theoretical information, the online course included the E.B.I.N. game, which students were supposed to download and play in their own computers. The online course was in Finnish and English. Finally, teachers also included a final exam in the online course. Thus, students needed to pass the exam in order to complete the course and gain 5 ECTS. Then, the course was uploaded on the CampusOnline platform, and it became available for the first-time during November-December 2019. The course was intended for different units under the bio-economy studies; however, since the course was on CampusOnline, students from different universities and study degrees could register for the online course. Therefore, a total of 450 students registered for the course, where

250 students were from different units of the bio-economy studies at Häme UAS, such as sustainable development, agriculture, gardening, and landscape planning. The goal was to create an online course that blends all the bio-economy units together to work under the same 'project.' Additionally, 200 students from other universities joined the online course during the autumn semester of 2019. Since it was an online course, students could proceed with the course according to their preferred pace. They could choose whether they played the game first, studied the theoretical part, or did the exam. The main aim of the course was that the students would learn about value chains in the bio-economy, circular economy, and making sustainable solutions through a combination of theoretical materials and the operations in the E.B.I.N. game. One of the teachers who participated in this study was responsible for the 'Bio-economy and value chains' online course. Teachers were able to track students' progress and the completion of the assignments in the game since every student had a specific username, which they used to log in to the game. Finally, students had to complete a final exam that was graded with a pass or fail. In the end, students could also give feedback about the course.

In the spring semester 2020, besides the online course, which was used again, teachers planned another course around the E.B.I.N. game. The course was named 'Bio-economy, value chains, and network,' it was intended for direct teaching and to be used with bio-economy engineering students. There was an English and Finnish version of the course. Similarly, the course had 5 ECTS, and the goals of the course were to teach bio-economy engineering students about value chains in bio-economy, circular economy, and sustainable decision-making. In the direct teaching course 'Bio-economy, value chains, and networks,' one of the teachers who has participated in this study was responsible for the course. In this case, an introductory lecture was held by the responsible teachers. Furthermore, the teacher was giving guidance and monitoring students' progress during the course. The course included theoretical materials about value chains, the E.B.I.N gameplay, and a final assignment that students had to complete.

On the other hand, the online course 'Bio-economy and value chain' was used again during the Spring semester with the same; however, it was intended for bio-economy engineering students, and another teacher was responsible for the course.

To sum up, the E.B.I.N. game was used in online and direct teaching courses during the Autumn and Spring semesters 2019-2020 with bio-economy and bio-economy engineering students at Häme UAS. In total, three teachers were responsible for the courses, and three of them participated in this study.

3.3.2. The *'European Bio-Industry Network'* Game (E.B.I.N)

The E.B.I.N. game was planned and designed to teach students about bio-economy in general and, more specifically, about value chains, networks, circular economy, waste management, etc. The game is designed in a way that students would learn about the above-mentioned topics by completing different tasks, assignments, and operations in the game. It was planned to support bio-economy studies and engage students in decision-making in a practical manner. The E.B.I.N. game, which serves as the context of this research, has been the backbone of the project named 'Digitalization of Natural Resources for the Bio-economy' (HAMK, 2019; Karinen, J, 2019). The project lasted for a period of three years, from 1st of February 2017 until 30th of June 2020, and included a consortium of eleven universities of applied sciences all over Finland: Häme University of Applied Sciences (UAS), Lapland UAS, Oulu UAS, Karelia UAS, Seinajoki UAS, Jyvaskyla UAS, Savonia UAS, Turku UAS, Tampere UAS, South-Eastern Finland UAS, Novia UAS and the Natural Resources Center (HAMK, 2019; Karinen, J, 2019). In general, the aims of the project were to create a common e-Learning environment, design virtual courses, and create pedagogical methods for implementing e-Learning to enhance teaching and learning in the bio-economy. Therefore, through data collection, a virtual learning environment (digital game) was modeled, which represents a virtual Finland operating through the principles of the circular economy. The game was created at the FrostBit Software Lab at the Lapland UAS.

Initially, teachers and students need to download the game in their computers to be able to play it; then, the game offers you the option to choose the language (Finnish, English) and take you through a tutorial. At the start of the game, the player has a drone view of the environment, which is covered in pollution since the owners of the production facilities are not aware of how to manage raw materials and make a profit out of them. Hence, in order to make the 'village' operate in a sustainable way, the player acts as a consultant for the *'European Bio-Industry Network'* with the objective of advising the 'local' production facilities to act in the most sustainable way as possible as shown in *Figure 3.* According to Prensky (2007, 131), *strategy games* are mainly about being responsible for something important and big – and making it evolve the way you want, either on your own or against opponents. Therefore, the E.B.I.N game falls into the category of strategic games.

Figure 3: Overview of the production facilities and raw materials (HAMK, 2019; Karinen, J, 2019)

In the game, the operating area is divided into multiple areas, and the goal of the player is to make each area as ecological as possible, for example, by controlling the production of a specific material and reusing waste materials. There are different production facilities that produce different material flows. Consequently, the player can control a decision through data and parameters; for instance, how much meat or grain is produced in the farms. In case that the stocks are full of materials, then the waste is generated, which leads to the reductions of the ecology of a specific area. Critical-thinking and decision-making are crucial to achieving a sustainable balance between production and waste management. Through the right decisions, the player can expand the network of facilities under management and progress further in the game. The player is often faced with difficult decision-making where he/she has to decide whether to choose a more ecological option of production, which is less efficient or a less ecological option, which leads to more production, thus better income, as illustrated in Figure 4. To simply explain, cutting the forest and using only the logs from the trees to produce furniture would generate high income; however, the area is less ecological, and the waste which is not utilized has to be thrown into the environment again. A sustainable decision would allow the forest to grow and focus more on utilizing waste in different means. At the start of the game, it is challenging to operate on a large scale, but as the game progress, more and more operations become available. As mentioned earlier, the game was designed to provide a virtual Finland which operates through bio-economy; thus, students can apply their knowledge to make sustainable solutions that foster a circular economy.

Figure 4: Production facility operations (HAMK, 2019; Karinen, J, 2019)

The game teaches students to implement circular economy principles in their decisions since advancing on the game requires managing the material flows and making sustainable choices. Overall, the game aims to promote critical thinking and decision making among students, which in turn might influence to make their everyday and work-related choices more sustainable.

The game can be downloaded online and played anywhere. Students should create their profiles, but it is also possible to access the game without a profile. On the other hand, teachers are able to monitor students' progress and complete tasks within the game. The game was initially implemented in teaching in November 2019 in the 'Bio-economy and value chain' online course. Then, the game was used again during the Spring semester 2020, starting from February through online and direct teaching.

3.4. Data Collection

The data were collected from January until July 2020, and it was done in several phases due to multiple sets of data since when doing case study research, evidence from multiple sources is important for the validity of the study. Yin (2014, 105) suggests six sources of evidence when doing case study research: documentation, archival records, interviews, direct observations, participant-observations, and physical artifacts. The sources of evidence can be combined and

intertwined by the researcher according to the specific case study; however, it is important to have more than one source of data.

Thus, in this study, there are three main sources of data: 1) *documents* from the E.B.I.N. game planning and design, 2) the E.B.I.N. game which served as a *physical artifact*, and 3) three (n=3) *thematic interviews* with the teachers who used the E.B.I.N. game in teaching during the academic year. Utilizing several data sources enabled a more comprehensive understanding of the case from different perspectives. The four principles of data collection mentioned by Yin (2014, 118-129), 1) using multiple sources of evidence, 2) create a case study database, 3) maintaining a chain of evidence, 4) exercise case when using the data from the electronic sources were taken into consideration during the data collection process. By the same token, the same principles were employed in this study as three sources of evidence are used, a database of evidence was used to cauterize the data from the beginning of the data process. Moreover, the chain of evidence helps to increase the reliability of the research and go backward to the beginning of data collection; consequently, it makes it easier to relate the research questions to the findings. On the other hand, the last principle does not largely affect this study since the case was not online.

The data were collected in two phases; initially, the documents (n=3) from the game design were collected from the project managers, and the E.B.I.N. game was downloaded in the personal computer, and then the interviews (n=3) were conducted with the teachers from Häme UAS. In a case study research, documents are mostly used to enlarge evidence from other sources and help with correct spelling that might not be recognized during the interview; nevertheless, attention should be paid to the accuracy and bias (Yin, 2014, 107). Consequently, the documents helped to create a better initial understanding of the case.

Similarly, the E.B.I.N game served as a digital tool to familiarize with the case and delve into the research problem as Yin (2014, 117) points out that physical artifacts can be a technological tool which helps to understand the overall case—utilizing the documents and the E.B.I.N. game led to thematic interviews which were the final part of the data collection process.

Thematic interviews (Appendix 2) with the teachers (n=3) at Häme UAS were conducted online during June-July 2020 using Microsoft Teams. Participants included three (n=3) teachers who were the only ones to use the E.B.I.N. game in teaching. According to Yin (2014, 110), interviews are one of the most important sources of evidence in case study research. The interview included open-ended questions and was structured in three main parts. The thematic

focus of an interview affects which aspects of a specific subject the questions focus on and which remains in the background (Brinkmann & Kvale, 2015, 133). Therefore, the interview questions emerged from the research questions and from the 'Pedagogical Framework of Teachers' Competencies in GBP' by Nousiainene et al. (2018).

Initially, before starting with the questions, given consent was discussed with the participants, and an overall view of the goals of this study was described. Then, the first part of the interview included practical information about teachers' academic background, their inclusion in the project, the E.B.I.N. game, and the structure of the bio-economy studies at Häme UAS. The second part of the interview focused on teachers' integration processes and practices of the E.B.I.N. game in the bio-economy courses. The third part of the interview delved into the user-experience in the E.B.I.N. game and possible suggestions to improve it in order to be aligned with the learning goals. The duration of the interview was planned to be approximately 45 minutes; however, all of them exceeded that time, with one of the interviews lasting for almost two hours. Finally, the recorded interviews were transcribed manually by the researcher.

By following this order, the information from the game planning documents and the ability to play the game helped to create a better understanding of the case before interviewing the teachers. Furthermore, this procedure allowed a database to be created and maintaining the chain of evidence.

3.5. Data Analysis

Thematic analysis was used to analyze the data since it enables the researcher to examine themes and patterns of meanings from the dataset (Guest et al., 2012, 15; Crewell, 2009, 184). In this case, thematic analysis was suitable because the emerging patterns from the data should be related to the predefined theoretical propositions. According to Joffe (2011, 1), the main goal of thematic analysis is to identify key elements from the dataset. Despite the fact that thematic analysis is often used to investigate the data for emerging patterns employing an inductive approach, in this analysis, a combination of inductive and deductive approaches is employed. Yin (2014, 136) recommends that one possible way to analyze the case study data is to follow the theoretical propositions, which led to the study. The deductive approach was used to connect the themes from the data to the theoretical propositions, in this case, 'Pedagogical Framework of Teachers' Competencies in Game-Based Pedagogy.' The primary goal was to 'test' whether the same pedagogical framework applies in the case of higher

education and digital-game-based learning. On the other hand, in line with the research questions, the inductive analysis was used to identify new themes that might emerge, which are different from the theoretical propositions. The thematic analysis process included multiple key steps such as transcribing the interviews, creating a codebook, coding the materials using qualitative analysis software Atlas.ti, looking for emerging themes and categories and distributing them into the framework. An iterative approach was used in order to understand the data in-depth.

In the first step of the analysis, a code list was created included a total of six codes. Guest et al. (2012, 50) define code as a textual description of a component of a theme. The following codes were linked to the theoretical framework*: code 1) pedagogical area of competence, code 2) technological area of competence, code 3) collaborative area of competence, code 4) creative area of competence.* Whereas, the following code emerged from the research questions: *code 1) possible emerging areas of competence.*

Second, all the materials from the dataset were uploaded into Atlas.ti qualitative analysis software since it was easier to work with multiple data sources. As Yin (2014, 134) points out that the real value of the analysis software in two words: 'assisted and tools', meaning that although the analysis software can assist in the process, it is the responsibility of the researcher to make meaning out of the data. The materials were coded according to the predefined codes while also investigating emerging patterns. *Figure 5* below indicates the number of quotations for each specific code and the number of files used to generate those quotations. The pedagogical area of competence was quoted 80 times in 5 different files, the technological area was quoted 30 times in 5 files, the collaborative area was quoted 9 times in 3 files, the creative area was quoted 3 times in 3 files, and emerging areas was quoted 40 in 4 files. The graph shows an imbalanced distribution of the quotations; however, none of the predefined codes was without quotations.

In the third step, all the quotations under a specific code were moved to specific documents. For example, all the quotations linked with the pedagogical area of competence were copied to the 'pedagogical area' document. Consequently, it was easier to focus on certain areas in a large set of data. Each document representing a specific code was examined to find themes and sub-themes. The online working board named 'MIRO app' was used to facilitate the process

since it offers the possibility to use virtual sticky notes. Using sticky notes is a great way to have an overview of the patterns emerging from the data and making meaning out of them.

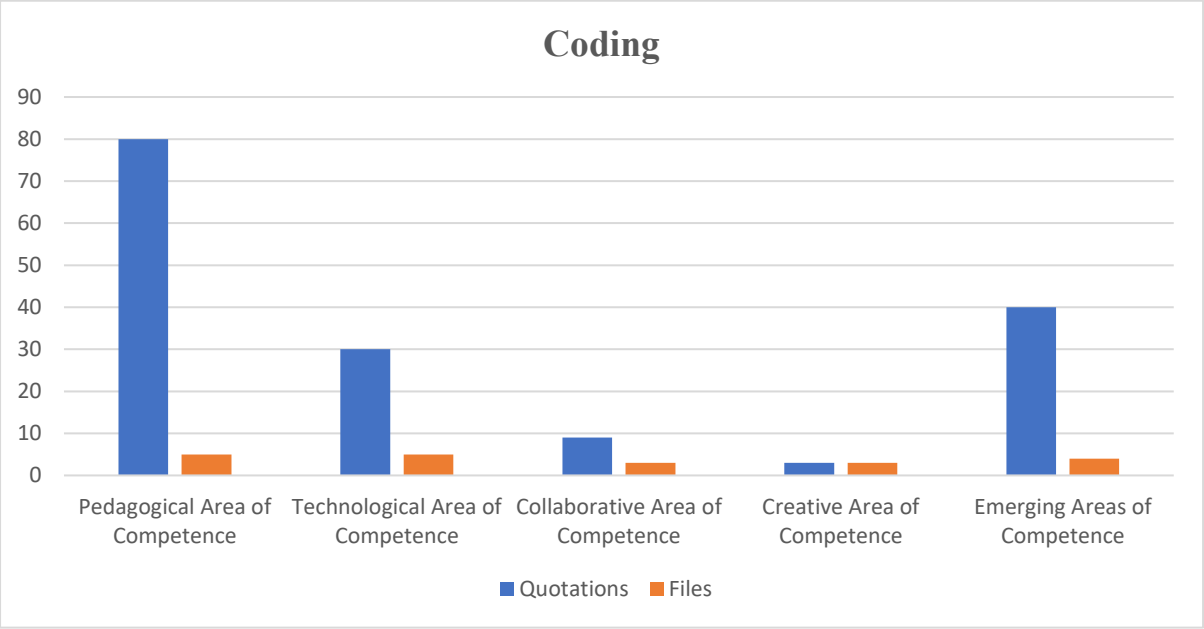

Figure 5: The distribution of quotations and files

Practically, while examining each specific document, practices, and key actions supporting the four areas of competence started to emerge. The practices and key actions were noted down ad added to the board according to their theoretical proposition, as illustrated below in *Figure 6*.

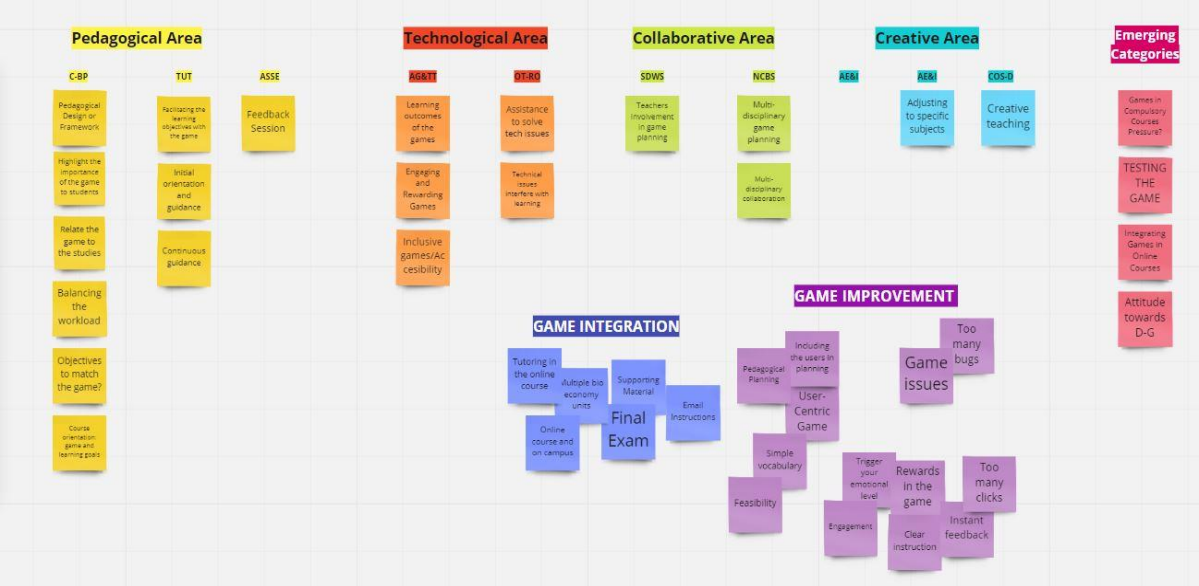

Figure 6:Preliminary distribution of themes

The board was reviewed several times in order to better understand the practices and transform them into concrete activities, and finally distribute them accordingly in the framework map. Special attention was paid to the quotations corresponding to the research questions, such as the emerging areas of competence. The final sketch of the board shown in *Figure 7*, shows the predefined themes according to the pedagogical framework: pedagogical area, technological area, collaborative area, and creative area. In each of the sub-areas which belong to one of the four main areas of competence, concrete practices and actions that supported the framework emerged.

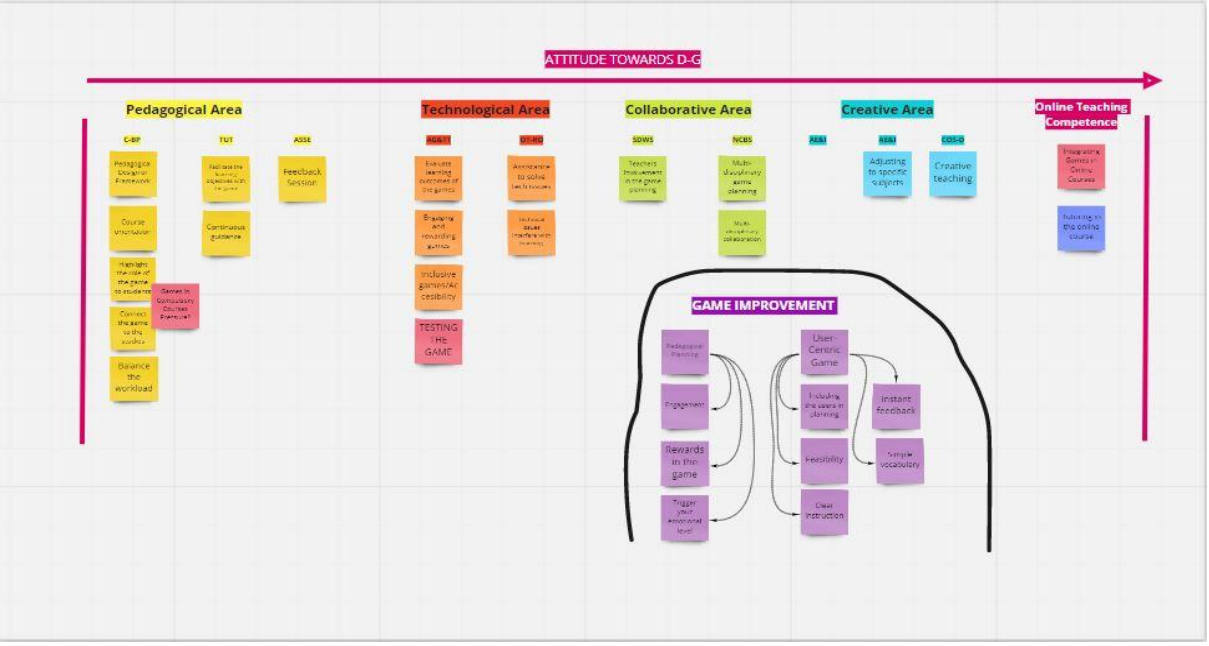

Figure 7: The final sketch of the board.

For example, as shown in *Figure 8* below, in the pedagogical area of competence, seven key actions distributed in the three sub-areas were determined. The sub-area of curriculum-based planning included four key actions: 1) *pedagogical framework*, 2) *course orientation*, 3*) highlight the role of the game to students*, and 4) *balance the workload for students*. The sub-area of tutoring included two key actions: 1) *continuous guidance*, and 2*) associate the learning objectives with the game*. The sub-area of assessment included: 1) *feedback session*.

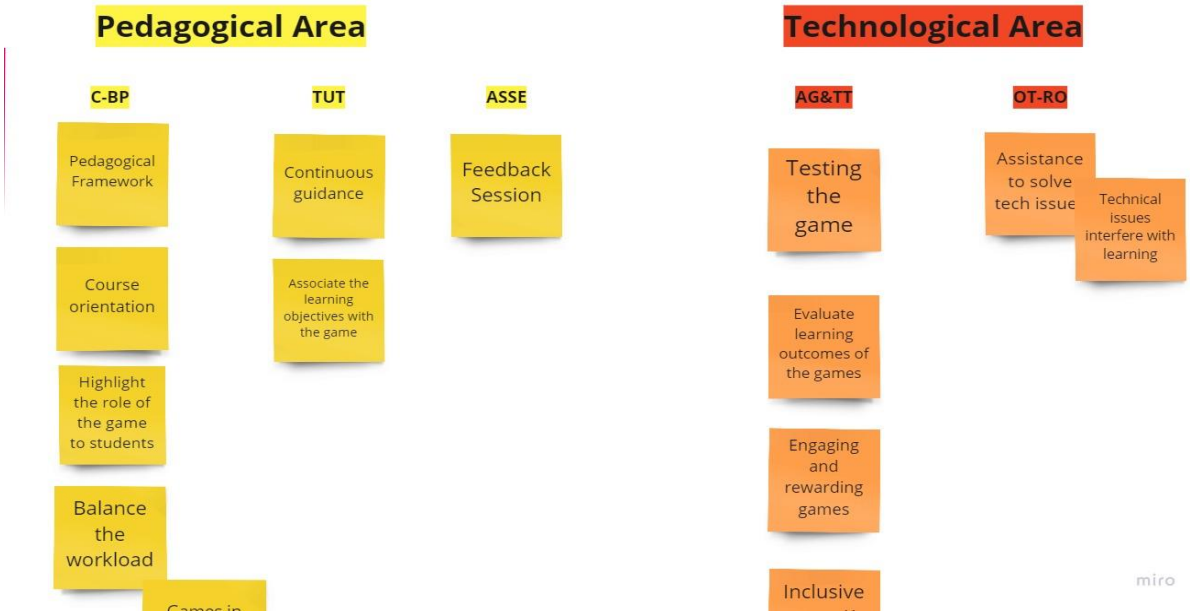

Figure 8: The key actions applied in the pedagogical framework

In the technological area of competence, six key actions emerged in two sub-areas. The sub-area of analyzing games and digital tools included four key actions: 1) *testing the game*, 2) *evaluate learning outcomes of the game*, 3) *selecting engaging and rewarding games*, 4) *selecting accessible and inclusive games*. The second sub-area overcoming technology-related obstacles included: 1) *assistance to solve technical issues* and 2) *technical issues interfere with learning*.

In the collaborative area, three key actions were found. The sub-area of sharing and co-developing with the school included: 1) *multi-disciplinary collaboration* and *2) teachers' involvement in-game planning,* whereas the sub-area of competencies for networking and collaboration beyond schools, one key action emerged: 1) *multi-disciplinary game planning.*

The creative area of competence had only two key actions distributed in 3 sub-areas of competence. The sub-area of playful stance was the only one without any key action, whereas the sub-area of ability to explore and improvise included one key action: 1) *adjusting to specific teaching subjects*. Moreover, the sub-area of creative-orientation to self-development had one key action as well: 1) *creative teaching*.

In addition to the key actions which supported the four main areas of competence of the pedagogical framework or the theoretical propositions, a new area of competence emerged,

namely: 1) *online teaching competence*. The online teaching competence relates to the ability of teachers to integrate digital games in online courses, which was not part of the original pedagogical framework.
Lastly, the attitude towards DGBL was found to be an important component for the effective integration of digital games in teaching. The attitude cannot be considered as a competence; however, it is a crucial part of the entire process, as shown in *Figure 7* above.

3.6. Ethical Considerations

The ethical issues have been carefully considered in this study, even though none of the participants were minor, and the collected data did not involve information about participants' private life. The ethical issues have been considered in accordance with the Finish National Board of Research Integrity (TENK, 2019, 50), who point out three general principles for ethical research: 1) the researcher respects the autonomy of research participants, 2) the researcher respects the research material, and 3) the research conducts research in a way that it doesn't harm the participants or the subjects related to the research.

Initially, permission to conduct this study was asked by the project manager, who led the game development project. Creswell (2009, 90) indicates that one possible ethical issue during the data collection involves the agreement with decision-makers who can give access to the research site and context. Thus, asking permission from the project manager was the first step regarding the ethical considerations.

Secondly, permission to access the game, documents, and presentations was asked by the other people involved with the project. The General Data Protection Regulation (GDPR) was also taken into consideration since the documents and files included confidential and personal information. Therefore, the documents were used in a way which the information was not shared with the third-parties.

This study involves human participants, and their participation in the project was based on their will. The Finnish National Board of Research Integrity (TENK, 2019, 51) states that participants have the right to voluntarily admit or refuse to participate in research.

Consequently, a general email indicating the aims of the study and participants' involvement in the research was sent to all the participants. An email confirmation was received from all the participants indicating their willingness to be part of the study. According to the Finnish National Board of Research Integrity (TENK, 2019, 51), participants should have the right to discontinue their participation without any negative consequence. Similarly, the participants in this study had the opportunity to terminate their involvement at any time.

A consent form (Appendix 2) was sent to the participants before the interviews to read, sign, and send it back; consequently, all the participants signed the consent form. The signed consent then becomes a guarantee that the participants are informed about the research and consent to participate (Silverman, 2011, 428). In addition, Israel (2015, 79) point out that participants should clearly understand the reason for giving consent and decide whether they want to give the consent and withdraw their consent participation at any time (TENK, 2019, 51). Before the interviews, several factors were considered to make the experience as relaxing as possible and gain the trust of the participants. For example, participants could decide whether they want to keep the camera open or not during the video interview. Creswell (2009, 90) suggests that one point to consider is how an interview will improve the human situation and the possibilities to cause stressful moments for participants. In many cases, people do not prefer to use a camera when interacting with digital devices. Furthermore, looking at the camera requires extra effort for participants, which might lead to a lack of concentration on the conversation.

At the beginning of the interviews, participants were asked for permission to record the interviews for data analysis. Then, the informed consent was mentioned again, highlighting the fact that their statement will remain confidential internally as well. Creswell (2009, 91) point out that the research should find ensure the protection of anonymity of individuals; however, in some cases, the confidentiality cannot be guaranteed since the number of participants is low and they might be recognized by people who are in the same context (TENK, 2019, 57). Additionally, a general overview of the objectives of the study was provided to participants, and the possible timeline of receiving the results. The Finnish National Board of Research Integrity (2019, 52) inform that the participants have the right to receive information on what the participation in research means in practice, the timeline for processing and preserving the research data. Moreover, the participants have the right to be informed about the potential effects and benefits of the research. In this case, participants were informed that the results of this study might provide useful information that could be employed in their future practices on integrating the games in teaching.

Finally, the accuracy and transparency of data were taken into consideration and discussed with the participants. In the case of this study, the results are only based on the outcomes of data and do not intent to neither support of harm different parties that were part of the project. Similarly, Creswell (2009, 92) mentions that a possible ethical issue on scientific research might arise from the potential of suppressing, falsifying, or inventing findings to meet the researcher's or audience's needs. Thus, extra attention was considered to the statements which might criticize the parties involved in the project.

4. FINDINGS

Integrating digital games in teaching requires a set of competencies; therefore, specific practices and key actions should be considered in different stages of the process. The preliminary goal of this study was to 'test' the 'Pedagogical Framework of Teacher' Competencies in Game-Based Pedagogy' by Nousiainen et al. (2018) and possibly identify additional areas of competence that teachers need to meaningfully integrate digital games in the higher education context.

The analysis identified practices and key actions that support the existing areas and sub-areas of competence in the above-mentioned framework. Consequently, the findings of this study confirm that the areas of competence of the pedagogical framework apply to the context of higher education and digital-game based learning; however, the areas of competence had a different level of significance, and new area of competence emerged. According to the results, pedagogical and technological areas of competence were highlighted more than the collaborative and creative area. In the pedagogical area of competence, seven practices and key actions were found to support each of the three sub-areas where the sub-area of curriculum-based planning to be the most highlighted competence that teachers need for meaningful integration of DGBL. In curriculum-based planning, teachers indicate that: pedagogical frameworks, course orientation, highlighting the role of the game to the students, and balancing the workload are important practices to be considered when integrating digital games in teaching. Tutoring sub-area of competence was found to play a crucial role in the process where teachers point out that: continuous guidance and associating the learning goals with the game should be taken into account when implementing DGBL. In the assessment sub-area, teachers mentioned feedback sessions as a way to evaluate the course' performance and students' experience.

The technological area of competence was found to be the second most emphasized area where six practices and key actions emerged in two sub-areas of competence. In the sub-area of ability to analyze games and digital tools, teachers suggest four key actions be employed, which will determine the degree of meaningful integration of games in teaching: testing the games, evaluating the learning outcomes of the games, choosing engaging and accessible games. Furthermore, in order to overcome technology-related obstacles, the findings show that: technical issues interfere with learning, and teachers need assistance to solve the technical issues.

The collaborative area of competence included three key actions distributed in two sub-areas of competence. In the sub-area of sharing and co-developing within the schools, teachers should participate in the planning phase of the game, and multi-disciplinary collaboration should be utilized. In contrast, in the sub-area of networking and collaboration beyond the school, multi-disciplinary game planning was found to be an important practice to foster collaboration in DGBL. Lastly, the creative area of competence had only two key actions in three sub-areas of competence. The sub-area of playful stance was the only one without any key actions determined. On the other hand, in the sub-area of the ability to explore and improvise, teachers indicate that adjusting to specific teaching subjects is important for students to embrace digital-game based learning. The sub-area of creative orientation to self-development had the key action of creative thinking.
The results also show that teachers need online teaching competence – which is classified as an additional area of competence in the framework – in order to meaningfully integrate digital games in online courses. Tutoring in digital- game-based online courses was found to be the sub-area of competence under the online teacher area of competence.

Another finding shows teachers' attitude towards digital games is a key factor for DGBL. It cannot be classified as a competence; nonetheless, attitude is present during the whole teaching process, and it's a strong factor for the meaningful integration of DGBL.

The main and sub-areas of competence, together with the practices, will be further elaborated below.

3.1. Pedagogical Area of Competences

As results show, teachers manifested that they need pedagogical competencies as the main skill to meaningfully integrate DGBL. Teachers highlighted the importance of pedagogical competencies in multiple phases of digital game-based teaching, for example, when making the game, when planning the course, and during teaching. Pedagogical competencies are the basis for implementing games in teaching, and arguably, the lack of pedagogical competencies can influence the entire teaching process. As illustrated in Figure 9 below, multiple practices were highlighted by the teachers.

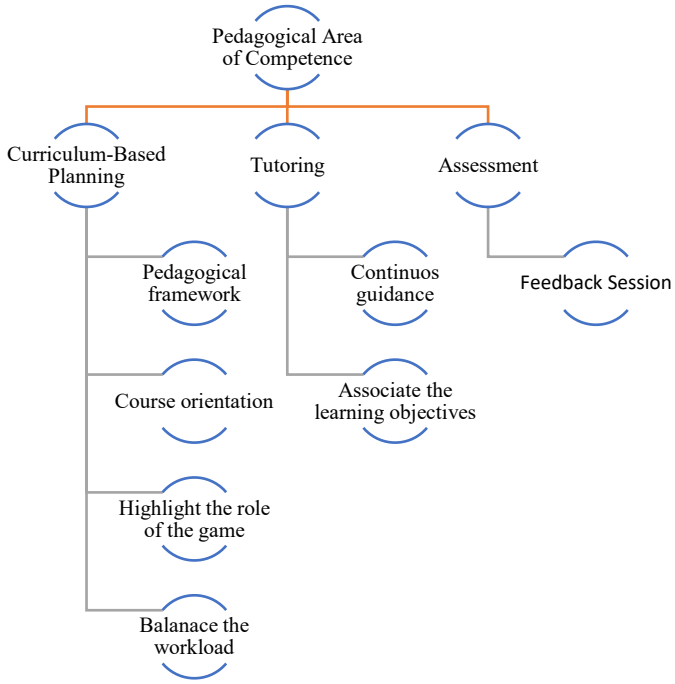

Figure 9: Findings in the pedagogical area of competence.

Curriculum-Based Planning

As the most emphasized sub-area of competence, curriculum-based planning has a strong influence on the course layout, experience, and learning outcomes. Teachers need to ensure that the game to be integrated will accomplish the learning goals of the course. Similarly, Nousiainen et al. (2018, 89) found that on main competence in regards to curriculum-based planning is the ability to apply game-based pedagogy to support the curriculum. A set of practices were determined by the teachers who could be considered during the curriculum-based planning.

First, teachers suggest that a pedagogical framework should be taken into account when using digital games in teaching since it increases the chances for a proper implementation. In Excerpt 1, one of the teachers discusses about the importance of pedagogical planning before the beginning of the course.

(1) *Of course, it would be great if it would have been in the beginning and we would have thought about it (pedagogical framework) … That should be something that pedagogical professionals should point out… that kind of stuff which you should even have in your course, whatever kind of course you have there are always some kind of pedagogical issues.*

Pedagogical models are important for the successful integration of games in teaching. For instance, Kangas (2010, 67) designed the pedagogical model of 'Creative and Playful Learning' (CPL), which includes four main stages during the teaching process: orientation, creation, play, and elaboration. Such models should be followed by teachers when implementing games in teaching in order to achieve the learning goals in practice.

Second, teachers point out that course orientation plays a crucial role in the learning outcomes of the course. The game is not sufficient to solely meet the learning goals of the course; therefore, teachers should explain the course structure to the students and ensure that they understand where does the learning come from in the game. The course orientation helps the students to recognize the learning goals in the game throughout the whole course. When the course orientation is not done well, it might influence the learning outcomes of the students as described by one teacher in Excerpt 2 below.

(2) *Well, I think there should be still on lecture, kind of telling to students, why are these two things together (game and value chains). Somehow, they did not understand the things we were talking about in videos, materials and exams. You are doing them (learning goals, materials) yourself in the game so…very many of them actually never did get that…(learning goals and materials are embedded in the game).*
I don't know what they think that bio-economy is but I guess it should have been explained better. That is absolutely one thing that we have learned from this…that we should have had one recording…doing more this integration.

During the course orientation, teachers should clearly explain the learning objectives of the game and supporting materials in the course, such as books, videos, presentations. Consequently, students follow a logical schedule when reading the materials or completing the assignments. In Excerpt 3 one teacher discusses the importance of connecting the theoretical material with the game.

(3) *I didn't realize it, like no one did before but now I realize that we still should do one short description…telling how is this all combined as 5 ECTS… that*

you play the game and you do this. This is the same thing you do yourself in the game (meaning value chains, bio economy). That's it!

In the case of the E.B.I.N. game and value chains in bio-economy, students should have been introduced with the concept of value chains in a practical manner or illustrate them with examples from the game. Introducing only theoretical concepts created difficulties for students to grasp value chains in the game context. In the same way as curriculum-based planning, course orientation creates a 'learning map' where students should navigate to reach the learning goals in DGBL.

Third, teachers suggest that highlighting the role of the game to the students and connecting the game to the subject should happen at the beginning of the course in order to make them committed to meaningfully engage with the game. Conversely, from pupils in primary or secondary school who are more interested in the entertainment part of the games, students in higher education need to understand the reason and benefits of completing specific tasks in the courses, which include game-play. Teachers discuss that students need to understand how specific assignments will foster their learning. In the case of games, teachers should emphasize to students how the game and the course would be beneficial in their future working life. In Excerpt 4, one teacher explains that ensuring that the students understand the role of the game influences in their commitment during the course.

(4) *Amm, the first thing, like I said, you have to think how you are going to make it feel that it (the game) is important for the students because they always need a reason for everything that I do during the course. If I give them an assignment, they will ask me why it's important…They are going to question my entire course so I have to interpret why that game is important to them and what they should learn from the game.*

If I tell that from the beginning, then they focus more on what I said during the course and they try to figure out from that game what they have to learn from the course. But if I just tell them…they are just going to play it and that's it. To get the credits?

When students do not clearly understand how the game connects with the subject, they cannot define their learning outcomes, which in turn results in a minimal commitment in the course or, as teachers point out, ‘to just get the credits.’

Fourth, teachers recommend that balancing the workload for students in DGBL courses influences the learning outcomes as well as students’ engagement. Teachers referred to the workload as the theoretical and practical tasks and assignments that students need to complete in order to pass the course. One interesting outcome is related to the effects of making DGBL courses compulsory for students. Teachers were not sure whether making the course compulsory had positive or negative effects on students’ performance in the course; however, compulsory courses might create pressure to complete the course (see Excerpt 5). Consequently, students might focus more on completing the assignments for the sake of the grade and credits rather than the actual learning outcomes.

(5) *Of course, I can tell them that the course has this much credits and you won't get them, you will fail the course...but I am just creating pressure, I am not encouraging them to play.*

Well, with the integration part, I guess I have to think how are you going to balance the workload you have for students. So, now I have to think what kind of assignments I have to give for the course if they are playing the game at the same time. So, I cannot make them work too much for a 5 credits course. That is also another challenge I guess, with the integration…

Well, the approach is more like… I don't know if it's motivating or more pressure to them but in my course, if it was 5 credits, I had set 2 credits for the game. So, they had to do it, no matter what.

Furthermore, another challenge for the teachers was determining the number of credits that the students would earn after completing the course. Interestingly, teachers had different perspectives on how many credits the course should have. Different teachers structure the course in different ways, which leads to a different perspective to define the credit value of the course. Additionally, teachers found it difficult to convert the assignments in the game in actual credits. In Excerpt (6), teachers explain that students cannot get credits for just playing the game but complete assignments in compliance with the subject learning goals.

(6) *Also, actually, there are almost 200 assignments inside the game… so we decided that… this is actually crucial too… "How do you define how many ECTS this is and how do you prove it?" It cannot be just that: "Okay, I did play!" You cannot give any ECTS based on that!*

When teachers make digital game-based learning courses compulsory, it might lead to positive and negative consequences. On the one hand, students might take the course and the game very seriously. On the other hand, if the course and the game are not designed well, or technical issues often occur during the course, students might want to complete the course only to get the credits. This applies especially to online courses, which include digital games since tutoring is present compared to face-to-face teaching.

Tutoring

Teachers referred to tutoring as facilitating the learning process between the course materials, the game, and the students. Guidance from the teachers is essential during the entire course timeline to ensure that students meet the learning goals. Nousiainen, Kangas, Rikala, and Vesisenaho (2018, 90) point out that teachers should be able to support personalized learning in game-based pedagogy, which in practice means that teachers need to understand the features of different game-based approaches to facilitate learning.

First, continuous guidance during the course was found to be an important practice highlighted by the teachers. By providing continuous guidance, teachers should assist students, for example, with basic instructions, technical issues, or giving hints during the game-play. Similarly, the findings of Nousiainen et al. (2018, 90) suggest that when students were working independently, the role of the teacher was to observe, nobody got stuck in the game and students' work stayed within the pre-determined pedagogical frames. In Excerpt (7), one teacher describes her steps in giving guidance about the E.B.I.N. game.

(7) *So, in my first lecture I go and tell them that they can find these (instructions) here and you do this with the game. I kind of helped them to download (the game) and some of them were not even able to open it so...because some of them don't really play games so it is kind of difficult for them, of course! So, I kind of assist them at the same time during my first lecture so when they are ready with the*

game and then I ask them to...but I usually tell them to start with the tutorial first and then go to the game.

Prensky (2007, 352) argues that the most effective model for learning is the tutor. Therefore, tutoring throughout the course enhances the learning experience for students. Another teacher acknowledged the fact that more guidance was needed when using the E.B.I.N. game in teaching (see Excerpt 8). Additionally, she suggested encouraging students to collaborate and learn from each other.

(8) *I think more guidance when the students are playing the game if they still need it. Also encourage them to work together and ask help from each other also when they are in the same level of the game.*

Second, teachers recommended that the role of the teacher as a tutor is to associate learning objectives with the game during the game-play. Teachers should be alert during the gameplay and ask students to elaborate further on specific operations in the game, which are connected with the learning goals of the course. In Excerpt 9 below describes her practices of connecting the subjects' learning goals with the operations in the E.B.I.N. game.

(9) *In the game, there are a lot of value chains which they (students) can link to so they had the bio economy value chains lectures and when they played the game, I had to ask them: "What kind of value chains were they able to find out from the game and did they really find any circular economy value chains or any new perspective through the game...that would at to bio economy or circular economy. I tell them: "Okay, this thing, you can also consider during the gameplay. When you are in this area maybe there is something that you can think of." So, when I talk about value chains or bio economy value chains during the course I try to ask them: "Have you come through this kind of value chain in the game?". They tend to remember what they have done and try to link it to the course. That's how I did it.*

In order to do that, the teacher should have sufficient knowledge of game functionalities and operations.

Assessment

Teachers emphasized the importance of feedback sessions at the end of the course, evaluating students' performance through assignments within the game and the final exam. Reflecting on the course' experience and the learning goals with the students should be part of the course schedule in order to assess the course and receive feedback on how to improve it (see Excerpt 10).

(10) *Teacher 2: In my course, we always had this feedback session at the end of the course, the last lecture is always about the feedback session. Since this game has been introduced into my course we end up talking about it (the game) more than the actual course.*

Teacher 1: now we have this feeling that it didn't work out too well from the point of teaching… like the students gave the feedback so kind of… also listen to the feedback and then think of it (the game) again, like how to arrange this teaching next time because this was not very satisfying as in a way of learning.

Feedback sessions help teachers to improve the course structure by considering students' wishes. Resembling with Nousiainen and colleague's (2018, 90-91) finding, teachers brought up the challenge of evaluating students' performance based on their game-play and also discussed that teachers should assess students' performance within and without the game. For example, in addition to the assignments related to value chains and circular economy within the game, students had to take an exam at the end of the course to assess their learning. In these cases, teachers find it challenging to effectively assess students' performance considering different components.

3.2. Technological Area of Competence

The data analysis showed that the technological area of competence is the second most important competence that teachers need to effectively integrate DGBL, as shown in *Figure 10*. Teachers emphasized that testing and being familiar with the game is of great importance to decide suitable games for specific subjects as well as to be able to solve technical issues that may occur during the course. Especially in the case of digital games, teachers suggest that

attention should be paid to testing the game prior to the integration in the course since technical issues might influence learning and students' commitment to the course.

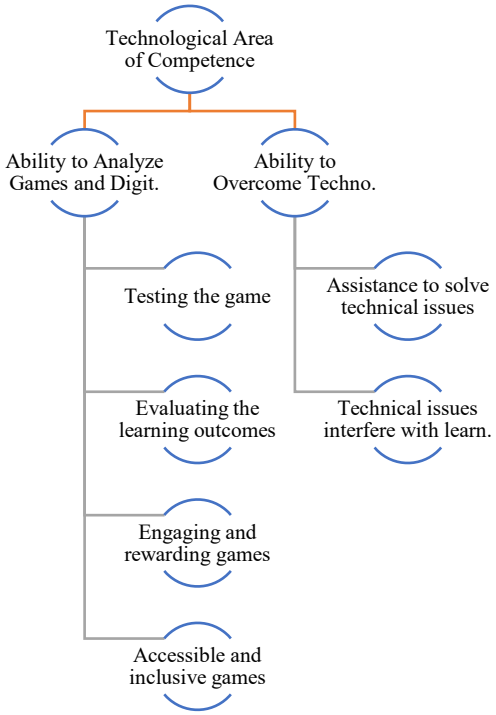

Figure 10: Findings in the technological area of competence.

Ability to Analyze Games and Digital Tools

According to the teachers, analyzing digital games prior to integrating them in teaching will influence on the students' experiences and learning outcomes. There are several practices that teachers should consider when planning to implement a new digital game in a specific course, such as testing the game, evaluating the learning outcomes of the game, choosing engaging and rewarding games, and making sure that the chosen game will be accessible for all students.

First, testing the game would provide the teacher with extensive knowledge about the game operations; thus, the teacher is able to plan the course content based on those operations. Testing applies especially to new digital games that are designed for a specific subject. For instance, the E.B.I.N. game was designed specifically for the bio-economy studies, but testing was not done properly, which led to the exposure of the technical issues during the first try-out. Teachers argue that testing the game would give a comprehensive understanding of game performance.

(11) *Teacher 1: If I have some kind of game and I could test it beforehand then it would be more…I need to be more sure of what I am doing.*

Teacher 2: …for that I had to play the game. I cannot just tell them to play the game unless I know it myself. So, that was the biggest challenge for me.

Researcher: I see, I see! But in reality, the testing part was not done well?

Teacher 1: No, it has failed! I don't know why we couldn't play it beforehand…and I don't know if they meant that they (game developers) had themselves played it through.

Second, the findings suggest that teachers need to be able to evaluate the learning outcomes of the game to ensure whether the game matches the learning goals of the subject. The ability to evaluate the learning goals can help them to prepare the supporting materials for the course. In Excerpt 12 below, one teacher reflects on her thoughts about the way the E.B.I.N. game operations would relate to the learning goals of the bio-economy course. Sometimes, instead of choosing the game to match the learning goals, teachers should design the learning goals according to the game operations (see Excerpt 12).

(12) *I think it was that the students would learn about the value chains, side products, how the other factories can utilize the side products and they would understand the network there.*

Researcher: How did you ensure that the game was aligned with the course learning goals in the case of bio economy engineering?

Teacher 3: I am not sure how we ensured or was it vice-versa… we decided the goals to match the game.

Third, according to the teachers, choosing engaging and rewarding games is critical to keep the students motivated and committed to interact with the digital learning environments during the course. Despite being educational digital games, entertainment should not be missing during

the gameplay since students link games with fun. When the fun is missing in DGBL, students will lack motivation and engagement to commit to the game. For instance, in Excerpt 13 below, one teacher describes how the E.B.I.N. game was lacking engagement and how rewards could make the game more interesting for students.

(13) *Like I said, it's boring. Something should be done that really engages the player. Something more exciting that the player wants to complete it, not just completing the task but you should have a goal in the game. Maybe I will earn this much money, kind of a goal would also work, you know? Like if you get money for every task, maybe that would help. I don't know, something like that but it's not engaging at all. The engagement part is really missing there!*

Regardless of teachers' wish and ability to choose engaging students in DGBL, often, this is a challenging task since much depends on resources and game producers. However, this is a practice that teachers should think of during the testing part before using a game in teaching: Is the game going to engage students?

Fourth, teachers must ensure that the chosen digital game to be integrated into teaching is accessible and inclusive, especially when students have to play the game on their computers. Considering the versatility of devices and laptops that students use nowadays, teachers should make sure that the chosen digital game is compatible with different devices and versions. For example, when the E.B.I.N. game was initially used in teaching – the Mac version, which is the operating system of Apple devices – was missing, which made it difficult for some students to access the game (see Excerpt 14).

(14) *In the very beginning, there was my mistake that I didn't even realize that. They (the game producers) didn't have this Mac version at all! So, when we started this, we had this course ready and then the first question: "How about the Mac version?". I was like, I don't even know if there is another Mac version. But not one though about that actually! No one from the whole project group. I was like: "That never came to my mind."*

We were like: "Ohh, no!" The computer working (supporting the game) and these different versions are a really crucial part!

In cases when digital games are too 'heavy', and the teacher is not sure whether students' computers will support it, they should consider using the game in a classroom with computer devices that are designed to support 'heavy' digital games.

Overcoming Technology-Related Obstacles

The findings show that teachers need to be able to handle technical issues that might occur with DGBL. Initially, teachers try to solve the technical problems by themselves or with the help of the students; however, often they need the support of professionals. Teachers also highlighted that the technical issues which often occurred in the E.B.I.N. had a great influence on students' engagement and learning. According to the teachers, assistance is often needed from professionals when technical issues happen within the digital games, so they should be able to determine whether they are able to solve the problem themselves of asking for help (see Excerpt 15).

(15) *Every time I or students had some problems, I just clicked the picture and sent it to developers. There was nothing I could do! I don't even know why those problems were happening so… that was the easiest way for me.*

In this case, many technical issues occurred since the E.B.I.N game was not totally finalized when teachers started to use it in teaching

3.3. Collaborative Area of Competence

The data analysis supported the findings of Nousiainen et al. (2018, 92) that teachers consider collaboration within and beyond the school as a main area of competence. In this study, teachers pointed out important practices to be considered to foster DGBL (see *Figure 11*). They also discussed that sharing the experience within the school would generate common knowledge on how to improve the implementation of digital games in teaching.

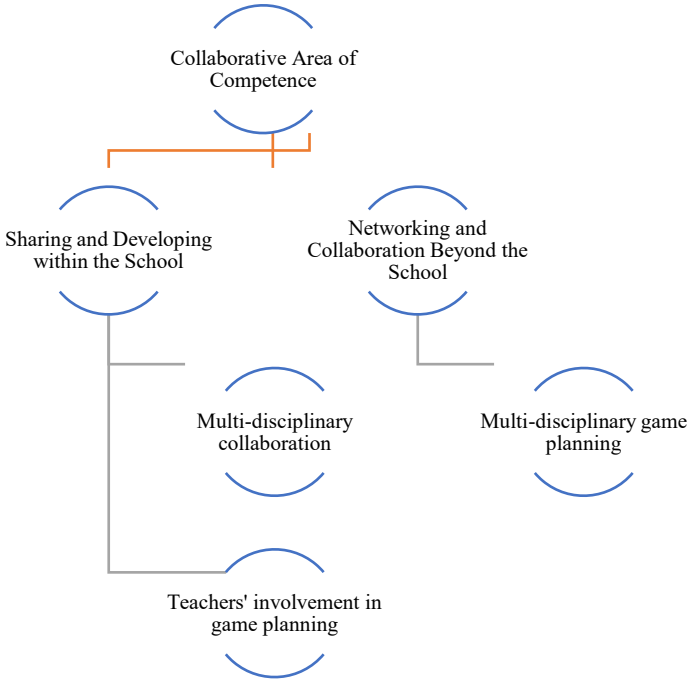

Figure 11: Findings in collaborative area of competence.

Sharing and Co-Development Within the School

First, the data shows that teachers need to be able to facilitate multi-disciplinary collaboration within the school. One of the teachers explains how they have tried to create a common online course worth 15 credits for students who were studying in different units of the bio-economy studies, and it has not been working really well (see Excerpt 16).

> *(16) It has been a struggle and I don't even know where did it (idea) to have something in common came from…They have been thinking that it's a really nice idea but…and we have tried many different ways in previous years, like, how to do that…and there always have been kind of complaints: This didn't work out…and they did nothing…and project was too far…and I don't know. So, it has been like that.*

She explains that students often are focused only on their subject of studies, and it requires extra effort for them to learn something which might be out of the context for them. Nevertheless, teachers should find practices that foster students' collaboration and networking. As students get ready for the workplace after higher education, networks are important for future collaboration.

Second, teachers regarded it important to be involved and contribute to the planning phase of digital games. Teachers' perspectives, when planning digital games, should lead to better game design, especially the teachers who have to use the game in their courses. For instance, one of the teachers who was using the E.B.I.N. game in teaching indicates that she did not participate in the planning phase; hence, she could not contribute to the content with the game (see Excerpt 17).

> *(17) So, I don't even know what were the problems during the development phase because I wasn't really communicated about those. I am always asked when I have to give feedback about what happened during the course because I am using the game, right? But, I was never asked what else should we do with the game, so I cannot just go and tell people what they should do or they shouldn't because I was not among those who were making the decisions (game design and planning) or contributing.*

Being part of the game planning phase is not always possible; nevertheless, teachers recommend that contributing to the layout and features of the game is crucial in order to be aware of the game functionalities and pedagogical input. Furthermore, teachers learned from each other's practices; for instance, teachers who used the E.B.I.N. game in teaching during the second semester learned from the experience of the teacher who used the game in the first semester.

Competencies for Networking and Collaboration Beyond the School

The data showed that teachers consider multi-disciplinary game planning as an important practice to foster collaboration beyond the school. Teachers point out that professionals from different disciplines should collaborate when planning digital game-based learning. Including different perspectives in the planning phase helps to ensure that different components such as pedagogical planning, user-experience of the game, or testing are taken into consideration. In Excerpt 18 below, on teachers how including different perspectives can influence to have the best version of a specific digital game.

> *(18) And also, something would be very important for the future that you just don't include someone like a teacher from… The group who is planning it doesn't have to be only teachers and it doesn't have to be experts from every sector. It can be*

> *me! I am not an expert but I know about games, I have played those. It could be some students who are being involved with the game. Then you get the best version of the game when you have all these different perspectives together. Not that you just get all the experts from the universities and you just put them together and tell: "Let's see what we should do with the game!" And those are people who have never played a game.*

Teachers also emphasize that students should participate in co-developing digital games since their input as users are crucial for the learning outcomes and user-experience of the game.

3.4. Creative Area of Competence

According to the data analysis, the creative area of competence (see *Figure 12*) was the least quoted area by the teachers. Surprisingly, the data did not show any supporting evidence for the sub-area of playful stance, which Nousianinen et al. (2018, 92) defines as the ability to see playfulness in almost every learning activity. However, the results show that teachers need to be able to adjust their teaching style according to specific subjects and be open to new technologies.

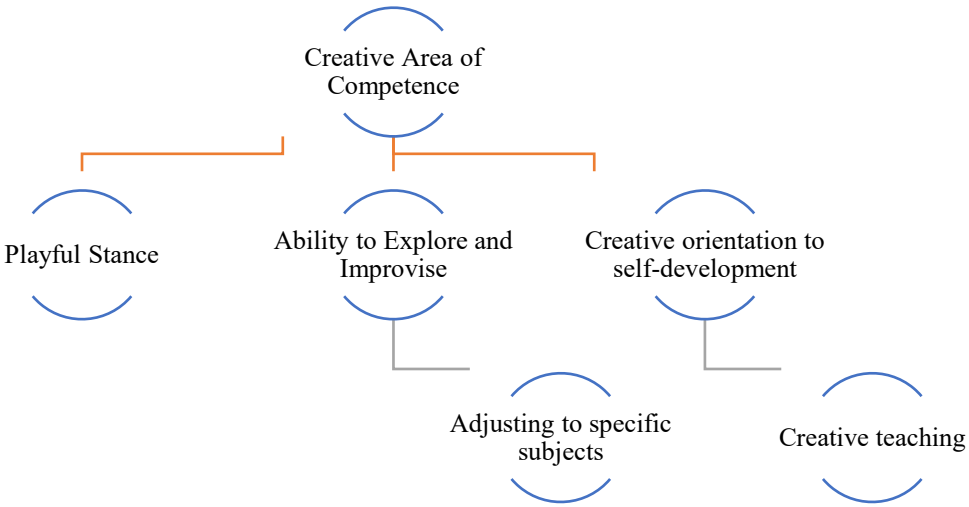

Figure 12: Findings in creative area of competence.

Ability to Explore and Improvise

Teachers discussed the ability to adjust and improvise when implementing DGBL. Different students have different perspectives on DGBL; hence, it is important that the teachers consider that and adjust her teaching according to the specific subject where DGBL is integrated. For example, one teacher explains how she tried to adjust her teaching style when using the E.B.I.N. game according to the students (see Excerpt 19).

> *(19) And the same thing with the sustainable development students… to make it seem more interesting, I have to talk their language...while teaching. I cannot be an engineer teacher when I am with them and talk about that perspective so I have to change it according to the students, like every time.*

Adjusting and improvising is a practice to be considered by the teachers as it may lead to better learning outcomes from students. Furthermore, teachers highlighted their openness to new technologies and new ways of teaching.

> *(20) I think all different ways of doing my teaching and having my different kind of assignments and… I have really different way than others do because I really like to develop the stuff I am teaching. So, I was also thinking the same about the game (E.B.I.N.) that I think it's really good. It's a really interesting idea and I am willing to try.*
> *Teachers are from so many different backgrounds and different ages, you know? There are some who never played games and there are some who do play games and it's kind of 'clashes'...and I think I would never fit in that group because I never talk the same language as the teachers who have been teaching traditionally all the time. I have always learned in the modern(unclear) way let's say,*

In many excerpts, the teachers highlighted their positive attitude towards DGBL. They also mentioned that they had played games themselves. The results indicated that the teachers were excited to enhance their teaching by integrating the E.B.I.N. game in their courses.

3.5. Online Teaching Area of Competence

Based on the data analysis, the online teaching area of competence emerged. Teachers discussed the challenges they had when they integrated the E.B.I.N. game in the online course 'Bio-economy and value chains,' especially during the Autumn semester 2019. Tutoring in online courses was defined as the sub-area of competence, as shown in *Figure 13* below.

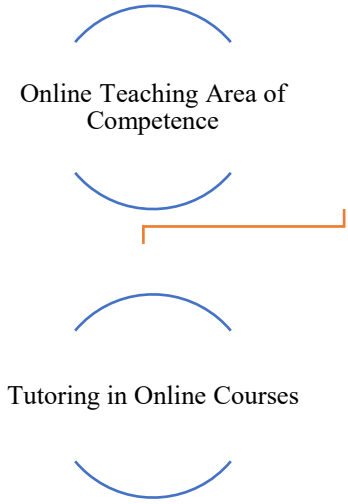

Figure 13: Findings in online teaching area of competence.

Using the E.B.I.N game in the online course did not provide a rewarding experience for either students or the teacher.

First of all, according to the teachers, the challenges for a meaningful integration arose mainly due to the user-experience of the E.B.I.N. game during the online course. Many online students sent emails to the teacher complaining about the technical issues they were experiencing in the game. Moreover, at the end of the online course, some students indicated that they did not learn anything about value chains. Since online courses have many differences with direct teaching courses – the dynamics of digital game integration in the course are different – which in turn requires different pedagogical approaches and a set of new competencies. In Excerpt 21 below, one teacher discussed that the students who joined the online course in the Autumn semester 2019 were not satisfied with the user experience of the game; therefore, they were complaining about the game and the course to the responsible teacher.

> *(21) And, I got those kind of emails (hate mails) from other units, not just from my students…also campus online students and other schools. I got a mail that: "I have played these kinds of games in my life but this is not rewarding, this is frustrating." I don't know so much about the strategy*

games but I think they (the students) are very bored…it should be better… or it shouldn't be just like: click, click, click…

During the online course in the Autumn semester 2019, many students who were interested in the bio-economy and value chains had the chance registered for the course, despite the fact that they did not like to play games. Furthermore, many students were older generations; thus, according to the teachers, they were not open towards digital games in teaching. However, the online course 'Bio-economy and value chains' was designed around the E.B.I.N. game, and additional theoretical materials were created to support the course. Many students registered for the course because it was compulsory, and they were interested in the topic; nevertheless, they had a negative attitude towards DGBL. The negative attitude towards DGBL accompanied by the technical issues in the E.B.I.N. game led to a non-rewarding teaching experience. Teachers explained that the attitude of online students – especially the older students who do not like to play games – was different from the direct teaching students who played the game on campus (see Excerpt 22 below).

(22) *In my understanding all of them who said that: "I am not ever in my life going to play anything!" were online students. I know I had some who said: "I don't like playing!" … but they were in my day group so they had schedules where they had the time to play and the came to the classrooms… but the online students are different!*

In addition, data analysis showed that another reason why the E.B.I.N. game integration in the online course 'Bio-economy and value chains' did not go as expected was due to the online course structure and the supporting materials. The online course had additional theoretical materials about bio-economy and value chains besides the E.B.I.N. game, so students were supposed to read the materials, play the game, and finally complete the exam in order to pass the course. In many Excerpts, teachers indicate that the introduction part and instruction in the online course should have been better. Consequently, this leads to the sub-area of online teaching competence, which is tutoring in digital game-based online courses. The online course structure allowed students to do the tasks and assignments are they preferred. They could, for example, play the game first, then read the theoretical material or do them simultaneously. In contrast with direct teaching, teachers' do not play the same 'tutoring' role in the online courses. This is related to the finding in the tutoring sub-area of competence, which shows that teachers should be able to associate the learning objectives of the course with the game. In this

case, when online students were playing the E.B.I.N. game on their own, no one could ask them to associate the decision to turn off a specific factory in the E.B.I.N. game with the value chain or circular economy. In Excerpt 23 below, one teachers points out that some deeper understanding was missing in the online course.

(23) *Yeah, if you think about the online course (campus online), it doesn't go that deep as it would go during the lessons (direct teaching). I think maybe there is missing some deeper understanding in the online course anyway.*

It was just that we put the students into the course and give the instructions via email for them how to start the course and what things they should do there… and the deadline for the course so they got an information email about that. Then they started to do the course and, in the end…

As discussed earlier in the findings of the pedagogical area of competence, teachers highlighted two important practices during tutoring sub-area of competence: continuous tutoring and associating the learning goals of the subject with the game during DGBL. That applies mainly to direct teaching, where the teacher and students interact with each other and play the game in the same environment. On the other hand, continuous guidance is challenging to be implemented with online students due to the dynamics and restrictions of online teaching. For instance, during the first semester, when the E.B.I.N game was used in teaching, a total of 450 students participated in the course. Thus, it is impossible to provide continuous guidance and associate the operation in the E.B.I.N game with value chains for all of them.

Another issue that arose during the online course was related to the collaboration between the students who participated in the course. Although students had the opportunity to share their experience with the E.B.I.N. game with fellow students in the online discussion forum, they were mostly complaining, and the discussion forum did not serve the purpose it was created (see Excerpt 24).

(24) *When we had this platform (Moodle), we had there a discussion forum where we were thinking beforehand that the students can exchange hints and give ideas…you know, help other students. If you think about it beforehand that they have a*

discussion forum to help others. It was totally… I don't know what word to use but it didn't work out at all because some people…
The other point in the discussion forum is that I thought that they will give the hints. Someone was writing there that: "My problem is this paper bill and I can't get there; can someone help me?" No one did help, mostly no one did help.

Sharing knowledge and reflecting on the E.B.I.N. game with fellow students in the online course had a completely opposite effect than teachers were expecting. As a result, the online course students did not have real-time teacher instructions to promote collaborative knowledge construction, which in turn led to the students writing complaining comments in the discussion forum rather than help and support each other. According to many Excerpts, teachers highlight the fact that the online students were the ones complaining the most and that the direct teaching students were different. Consequently, this emphasizes the important role of tutoring when implementing DGBL, which, if it is considered accordingly, it may lead to a meaningful integration or vice-versa. Considering the dynamics and differences between direct teaching and online courses, teachers need to find new ways of tutoring in a digital game-based online course for a meaningful implementation of DGBL.

3.6. Attitudes Towards DGBL

Another finding shows that attitude towards DGBL is another important factor that influences the effective integration of games in teaching. The attitude towards DGBL entails both teachers and students. In a transitional period where the new curricula are designed around digitalization, teachers claimed that some other teachers are not welcoming towards DGBL and still prefer the old-fashion teaching methods. On the other, students mostly like to play digital games and have a positive attitude towards DGBL; however, some students do not. In multiple Excerpts, teachers underline the effects of the attitude towards DGBL and how teachers' attitude influences on student's willingness to play the E.B.I.N. game.

(25) *So, that's the first point… and if the attitude is against all games played…*
I also heard that in one unit in HAMK, the teacher was against the gameplay, then also the students were against the game.
They (students) think that it's a waste of time. So, it might be that group (who doesn't like to play games) who was complaining. Same groups were maybe not

too used to use computers, maybe they just did not want to use it, maybe that's the reason. And some, they just have that attitude, I don't know why!

In this study, the attitude towards DGBL is defined as an important influence on the entire teaching and learning process, as shown in *Figure 14*.

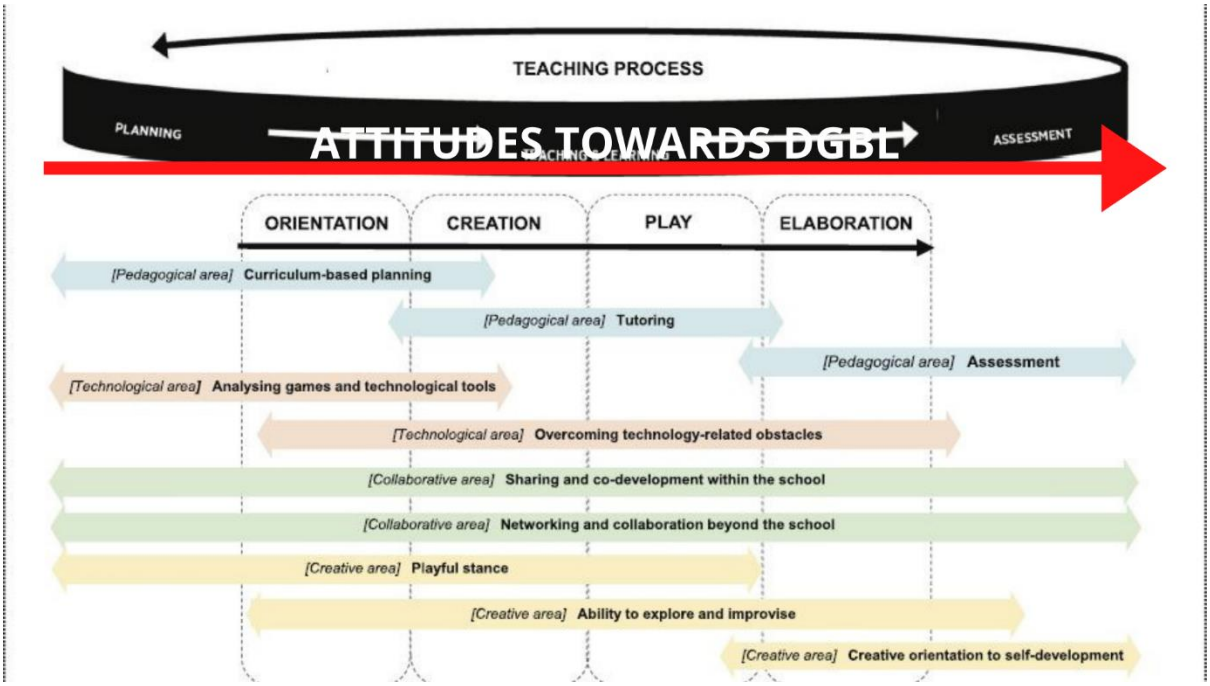

Figure 14: Attitude towards DGBL in the Pedagogical Framework of Teachers' Competencies in GBP

Attitude is not considered a competence; nevertheless, it comes from within the individuals; in this case, teachers. Therefore, the same as the competencies, attitudes towards DGBL influences in the meaningful implementation of digital games in teaching.

5. DISCUSSION AND CONCLUSION

As discussed above, game effectiveness or students' attitude is not enough for meaningfully integrating games in teaching. Teachers' competencies and attitudes play a key role in the process; however, a few studies have focused on teachers' competences in DGBL in higher education. Thus, the current study aimed to investigate teachers' competences in DGBL in the context of higher education in Finland. The pre-defined 'Pedagogical Framework of Teachers' Competencies in GBP' by Nousiainen et al. (2018), who determined four main areas of competence that teachers need to meaningfully implement GBP, served the basis of this study. The goal was to find out and 'test' whether the same pedagogical model applies to the context of higher education in Finland and possibly identify additional emerging areas of competence and practices. The findings of this research will contribute to enlarge the literature on teachers' competencies with GBP and DGBL. Furthermore, the findings which relate to the practices and key actions that the teachers in this study pointed out can be considered when teachers prepare and plan to use DGBL in teaching. Additionally, based on the findings of this study, teachers can evaluate and compare competencies in DGBL.

By using a case study approach, this research examined the experiences of three teachers with the integration process of the E.B.I.N. game in the bio-economy studies at Häme UAS during the academic year of 2019-2020. The findings indicate that the four areas of competence: pedagogical area of competence, technological area of competence, collaborative area of competence, and creative are of competence apply to the context of higher education in Finland when teachers are using DGBL. However, the results showed different areas of competence had a different level of significance when applying DGBL in teaching in higher education. Thus, pedagogical and technological areas of competence were highlighted the most by the teachers – considering their significance for a meaningful implementation of DGBL – compared to the collaborative and creative areas of competence. Another main finding of this study is the online teaching area of competence, which is related to the ability to meaningfully integrate digital games in online courses. The online teaching area of competence was accompanied by the sub-area of tutoring in online courses. The results from each specific area – including practices and key actions suggested by teachers – will be discussed more thoroughly below.

Pedagogical Area of Competence

The results show that teachers need pedagogical competencies for meaningful integration of DGBL, were the most emphasized was the sub-area of curriculum-based planning. Teachers discussed that integrating digital games in teaching means that that DGBL has to be aligned and support the curriculum goals. Similarly, Nousiainen et al. (2018, 89) found that one main competence in regards to curriculum-based planning is the ability to apply game-based pedagogy to support the curriculum. To achieve that, teachers suggested that utilizing a pedagogical framework is a safe way to effectively implement DGBL. Kangas (2010, 68) point out that adopting suitable digital tools and theoretical frameworks is important for applying GBP. The 'Creative and Playful Learning' (CPL) pedagogical by Kangas (2010, 68) includes four main phases that teachers should consider when using games in teaching: orientation, creation, play, and elaboration. Furthermore, Keskitalo and Ruokamo (2015, 81-82), re-designed their earlier pedagogical model of 'Facilitating, Training and Learning' (FTL) to be suitable for simulation-based learning in healthcare. In the re-designed pedagogical model, they define six distinct phases: introduction, simulator and scenario briefing, scenarios, debriefing, and post-activities (Keskitalo & Ruokamo, 2015). DGBL has a different dynamic with simulation-based learning; however, some of the phases of the framework might be suitable for DGBL as well.

Additionally, the results show that course orientation or debriefing has a significant role in the students' experience with DGBL. In this study, the game was used in online and direct teaching. The instructions for the online course were sent to students via email, whereas in the direct teaching course, one teacher was responsible for a debriefing lecture with the students when the course started. According to the teachers, the students who participated in the direct teaching course could make more associations between the learning goals of the subject and the game, compared to the online course students. Kangas (2010, 69) explains that the purpose of the orientation is to form a basis, a script and an outline for the upcoming learning activities. The results of this study expose the weaknesses of giving instruction or debriefing in the online courses; hence, teachers should think of new ways of delivering meaningful debriefing for online courses, especially when digital games are included.

In relation to the course introduction, the findings show that teachers should be able to highlight the role of a specific game to students and relate the game to the learning goals of the subject. According to the teachers, students are willing to complete a task in the lesson if the teacher is

able to demonstrate the reasons why the task is useful for the students. Otherwise, students do not meaningfully engage with the game and the course. Besides emphasizing the role of the game to students, teachers should also point out the benefits in the future. For example, if students play the E.B.I.N. game, they become familiar with digitalized environments, which can help them to integrate easier in their workplaces. Considering the fact that not all the students do not like to play digital games for different reasons, highlighting the role of the game might influence their attitude towards DGBL.

Teachers suggest that balancing the workload for students in DGBL will influence students' performance during the course. Balancing the workload refers to the amount of theoretical material, the game-time, and assignments they had to complete in order to pass the course. For example, if the theoretical material is not sufficient or well-linked with the operations within the game, students might not reach the learning goals of the course. Teachers should ensure that the theoretical material is well-aligned with the subject learning goals, and students should feel that the amount of work they do to pass the course match the credits of the course. Additionally, when implementing DGBL in class, teachers should plan carefully whether the course is compulsory or not. In cases when the game-based courses are not well-designed and compulsory, it might add pressure to the students to complete something which they do not want to.

In the sub-area of tutoring, the results indicate that teachers should be able to provide continuous guidance for students during the course. According to James Lengel (as cited in Prensky, 2007, 352) although the technology is wide-spread, "teachers guide and facilitate learning". Continuous guidance helps students to navigate through DGBL courses. According to the findings, continuous guidance is necessary, especially when technical issues often occur during the gameplay. Nousiainen et al. (2018, 90) suggest that teachers guide and ensure that nobody got stuck in the game and students' work stayed within the pre-determined pedagogical frames.

Another closely-related finding with continuous guidance is the ability of the teachers to make connections and associations between the learning objects or course materials and game operations. In this way, the teacher should facilitate the learning process by highlighting the key learning moments during the gameplay. Nousiainen et al. (2018, 90) point out that it is critical that the teacher recognizes and react to teachable moments when needed. Watson et al. (2011, 473) identify 'teachable moments' when the teachers interrupt the game-play to interact

with the students about what actually happened in the game. The role of the teacher is to be aware of those 'teachable moments' and encourage students to make associations between the subject and the game.

According to the results, effective curriculum-based planning should include a feedback session at the end of the course. The feedback session should provide valuable insight for the teacher to understand whether the learning outcome was met by the students and how the course can be improved in the future. In this study, teachers discussed the role of the feedback session with the entire class, whereas the feedback in the online course was given through feedback questionnaires. Interestingly, the finding by Nousiainen et al. (2018, 91), which indicates that teachers should reflect with the learners individually on the learning process, was not reflected in this study. This can be due to the number of students and the dynamic of higher education. Furthermore, teaching games in online courses do not offer many possibilities for one on one reflections.

Technological Area of Competence

The findings show that the technological area of competence is the second competence that teachers need for effective integration of DGBL, just after the pedagogical area of competence. Technological competencies are significantly important when teachers are using digital games in teaching since testing the game, solving technical issues, and being able to choose accessible game are key competencies which teachers need to implement DGBL. These findings complement the results of Nousiainen et al. (2018, 91), which describe that the ability to analyze games and digital tools is mainly related to combining the game with non-digital tools in a meaningful way.

The results indicate that teachers should test digital games prior to using them in teaching. Hammond et al. (2009) suggest that early preparation is a critical period for teachers' development of technological competencies. Testing the game is important, especially when the teacher is not familiar with it since she needs to have a good understanding of the operations and technical issues within the game. For example, in the E.B.I.N. game case, teachers did not have time to test the game; thus, they were not aware of the technical issues, which led to a negative experience with the DGBL.

Teachers need to be able to also evaluate the learning outcomes of a specific subject and how does it connect all together with the course which the game will be integrated into. The ability to evaluate the learning goals leads to smoother implementation experience. Teachers regard it

as important to be able to evaluate the learning goals of the course in order to support learning with additional resources such as presentations, theoretical materials, or assessment methods. Similarly, Egenfeldt-Nielsen and colleagues (2011, 29) point out that teachers should be able to choose suitable games for the classrooms, testing, and making sure that the content is suitable to students' knowledge and cognitive development. Indeed, the ability to evaluate the learning goals of the game would help teachers to have a clear picture of what they want to achieve in a specific subject.

In relation to the previous finding, teachers should be able to select engaging and rewarding games in DGBL. Students want to interact with engaging and rewarding content, similarly as they do with social media in their everyday life; hence, they expect the same from the digital games in teaching. Prensky (2007, 111) argues that the principal roles of fun in the learning process is to create motivation and relaxation for the learner. An engaging digital game will keep the students committed and concentrated, which arguably may lead to better learning outcomes.

When teachers choose a digital game for DGBL, they should ensure that the chosen game is compatible with different devices and software in case students have to download it on their computers. Nowadays, students have different devices which support different version of the software; consequently, if the chosen game is not accessible by some students, might create a challenging situation for the teacher. For example, in the present case, the teacher realized that the E.B.I.N. game was suitable only for one version of the computer only when she started the course. Therefore, she faced the challenge that some students could not download and play the game on their computers.

Another finding which corroborates with Nousiainen et al. (2018, 91 shows that teachers should be able to flexibly solve the technical issues which might occur during the game. This competence is connected to testing since when testing is done properly; the teacher is aware of the common issues that might occur in that game. Initially, teachers try to solve the technical problems by themselves or with the help of the students; however, often they need the support of professionals. This finding is aligned with the finding of Nousiainen et al. (2018, 91), who discusses that the competence to overcome technical issues is the ability to know where to look for possible answers and whom to ask for assistance. Teachers also pointed out that technical issues and bugs interfere with learning; thus, students do not have an engaging, rewarding, and the learning goals are not met.

Collaborative Area of Competence

Regarding the collaborative area of experience, the results show that teachers should be able to utilize collaboration within and beyond the school in order to promote DGBL. When discussing the collaboration within the school, teachers emphasize the ability to plan digital game-based courses, where different students from different units would participate in the course. Multi-disciplinary collaboration is often challenging to execute since students are concentrated in their subject of study, and they show little interest in topics that are out of their focus. Furthermore, they should be able to participate and contribute to the planning phase of digital games. Their knowledge, especially the pedagogical perspective, is crucial for effective game design. On the other hand, regarding collaboration beyond the school, teachers point out that multi-disciplinary game planning is important to enhance collaboration beyond the school. During the planning phase of a digital game, professionals from different fields should be included, which should lead to a better and well-thought game design.

Creative Area of Competence

The findings show that the creative area of competence was the least necessary competence among the four main competencies. According to the data analysis, there was no evidence that supported the sub-area of a playful stance. That might have happened because of several reasons. First, teachers could not utilize playfulness within the course due to the occurrence of frequent technical issues in the E.B.I.N game. Second, the online course "Bio-economy and value chain," where the E.B.I.N game was used, did not offer the possibility to see playfulness in every learning activity. Third, digital educational games or 'serious games' in the context of higher education provide challenging circumstances to utilize a playful stance.

In addition, when applying DGBL, teachers should be able to adjust and improve according to the specific subject and students. For example, one teacher discussed how she changed her teaching style in the "Bio-economy, value chains, and networks" course between sustainable development students and bio-economy engineers. By the same token as Nousiainen et al. (2018, 92), teachers discussed the ability to explore and improvise as a way to embrace innovation and new technologies as well as improvise in their teaching according to specific subjects and students.

Based on results, teachers should be open to 'creative teaching' which allows them to embrace new tools and technologies in teaching. Creative teaching entails the ability of the teacher to constantly look for new ways of making the lessons interesting and lively.

Online Teaching Area of Competence

The results show that teachers need online teaching competence in order to meaningfully integrate DGBL in online courses. The online teaching area of competence was not part of the investigated pedagogical framework by Nousiainen et al. (2018); consequently, it is defined as an additional area of competence that teachers need when using digital games in online courses. DGBL in online courses creates new challenges for teachers since the dynamic with direct teaching is different. One major challenge which arises when implementing DGBL is related to tutoring and giving instructions since the online courses often have a 'loose' structure compared with the direct teaching courses. Hämäläinen and Oksanen (2014, 89) found that teachers' real-time instructions support collaborative knowledge construction more than groups who were studying without real-time teacher instruction. Considering the importance of tutoring that teaching plays indirect teaching when implementing DGBL, in online courses, teachers should think how-to guide and instruct students in a similar way. The online course instructions have an important role in students' experience; however, associating the learning goals of the subject with the operations in the game in real-time is challenging in online courses. Implementing DGBL in online courses is a new playground that teachers need to explore and experiment with different practices since teaching the digital game in online courses is a new way of creative teaching.

Attitudes Towards DGBL

According to the teachers, attitudes play a crucial role in the meaningful integration of DGBL. Utilizing DGBL in the classroom is especially difficult when students do not have a positive attitude towards digital games. The attitude towards DGBL includes teachers as well since they are not adequately embracing innovation in teaching and still stick with the traditional ways of teaching. Many scholars have studied the effects of attitudes towards DGBL. For example, Gaudelli and Taylor (2011) suggest that many teachers are skeptical of the pedagogical value of DGBL, partly due to the lack of experience with digital games. Teachers mentioned that they were not sure whether the E.B.I.N. game enhanced the learning experience when used in direct teaching in the bio-economy courses. An and Cao (2016, 169) found that when teachers participate in the game planning and design phase, it helped them to create a positive attitude, self-efficacy, and perceptions towards digital games in classroom. This finding corroborates with the collaborative area of competence, where teachers indicate that they find it important to be part of the game planning phase.

In conclusion, as this study shows, teachers' competencies are important for meaningfully integrating DGBL in teaching. Therefore, in order to meet the learning goals and have a rewarding experience with DGBL, teachers need to consider a set of practices when using digital games in teaching. According to the findings, different areas of competence have different significance on the process; however, all of the four areas are important in DGBL. In addition, online courses provide a challenging and interesting playground for the meaningful implementation of DGBL. Teachers should explore and find news ways of tutoring in digital game-based online courses. The findings of this study will help to bridge the gap in the literature regarding teachers' competencies in game-based learning by providing insights into the context of DGBL and higher education in Finland. Finally, this research provides useful practices and key actions that teachers can utilize when using digital games in teaching.

6. LIMITATIONS AND FUTURE RESEARCH

The findings of this study have to be seen in the light of some limitations. First of all, the sample of this study is small, consisting of only three teachers. Additionally, the sample represents only one university of applied sciences in Finland; therefore, the results cannot be generalized for the entire higher education in Finland. Another limitation of this study is due to the lack of previous research which investigates teachers' competencies utilizing DGBL in higher education. Furthermore, the E.B.I.N game, which serves as the context of this study, was not completed when teachers started to use; hence, the technical issues might have influenced teachers' practice and integration process. Game functionalities and technical issues have a strong effect on teachers' and students' experience with DGBL. Finally, time constraint was another limitation. Additional time would have been necessary to investigate teachers' integration of the E.B.I.N game in teaching. For example, examining the integration process during the second academic year would provide new results, since in the first year, the game was used for the first time. Time constraints are also applied to data analysis.

Future studies should investigate teachers' competencies from a sample that represents different universities in Finland. Furthermore, several digital games should be taken into consideration. Lastly, future research should examine the online teaching area of competence since additional knowledge is required for meaningfully integrating digital games in online courses.

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APPENDICES

Appendix A

CONSENT FORM FOR SCIENTIFIC RESEARCH

University of Lapland

Faculty of Education

Master's Degree of Media Education

Supervisor:

Mari Maasilta

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Title of the study

Teachers' Competencies Using Digital Game-Based Learning in Higher Education in Finland: A case study of *European Bio-Industry Network (E.B.I.N)*

Description of the research and your participation:

You are invited to participate in a research study conducted Erson Halili for his Master's Thesis. The aim of this research is to explore teachers' experiences of using virtual game-based learning environments in teaching and the overall user-experience of the *European Bio Engineering Network (E.B.I.N)* game.
Your participation in this research will include online individual interviews with the researcher. The interviews will be recorded and used for data analysis.

Risks and discomforts:

There are no known risks associated with this research.

Potential benefits:

This research may give valuable insights about the process of utilizing virtual-game based environments in teaching. In addition, it may also to improve the user-experience of the E.B.I.N game.

Protection of confidentiality:

The confidentiality of records identifying the participants is of utmost importance. We will do everything we can to protect your privacy. Your identity will not be revealed in any publication resulting from this study.

Voluntary participation:

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information:

If you have any questions or concerns about this study or if any problems arise, please contact Erson Halili at University of Lapland: ehalili@ulapland.fi, +358 40 361 0918

Consent:

I have read this consent from and have been given the opportunity to ask questions.

I give my consent to participate in this study.

____YES ____NO

I agree to be recorded during the interview.

____YES ____NO

Date: _____

Participant's Name: _____

Participant's Signature: _____

A copy of this consent form should be given to you.

Appendix B

Interview Protocol

Q1: Can you tell a bit about your academic role at HAMK?

Q2: Can you tell a bit more about the project?

Q3: How were you involved in the earlier phases of the project?

Q4: How is the E.B.I.N game integrated in teaching at HAMK (which courses, semester, bio-economy engineering)?

Q5: How was your experience of integrating the E.B.I.N game in teaching?

Q6: In a timeline before the start of the course until the end, what new activities did use to integrate the game in teaching?

Q7: How did you ensure that the E.B.I.N game is aligned with the course learning goals?

Q8: What activities do you consider as crucial (key) to effectively integrate the E.B.I.N game in teaching before starting the course, during the course and after the course?

Q9: What do you consider as the essential factors to effectively integrate the E.B.I.N game in teaching circular economy?

Q10: What were your expectations and goals before starting the course using the E.B.I.N game in teaching?

Q11: How was your experience with using the E.B.I.N. game in teaching circular economy compared to prior to the game (without the game)?

Q12: How did the E.B.I.N game enhances the learning experience in the circular economy course?

Q13: How did the E.B.I.N game influenced in your motivation to integrate virtual learning environments in teaching?

Q14: What were the key challenges of integrating the E.B.I.N game in teaching?

Q15: What were the main challenges of using the E.B.I.N game during the course? How was the user-experience?

Q16: How did you tackle the technology obstacles while using the game?

Q17: What elements of the E.B.I.N game should be improved to enhance the user-experience?

Q18: What elements of the game should be improved to better correspond with the learning goals of the course?

Q19: What are you going to do differently in the next time you teach the circular economy course using the E.B.I.N game?

Q20: Is there anything else that you would like to share?