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Competencies of Teachers in Game-based Pedagogy

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Abstract

Learning in the twenty-first century is becoming more dependent on the use of digital tools and interactive media. Teachers play a crucial role in creating game-based learning procedures and enhancing learning and motivation. The aim of this article is to determine what kinds of expertise educators could require to effectively use game-based education (GBP). This study was done with 14 schools in East Java and their partner schools that took part in the GBP network initiative from 2017 to 2020. Two or three instructors at each school serve as the "core participants" who disseminate their knowledge to their colleagues. After collecting data via teacher documentation, theme interviews, and questionnaires, this research used qualitative content analysis to draw conclusions. The fields of pedagogy, technology, collaboration, and creativity were defined as the four key domains of competency. Researchers found that teachers' collaborative skills (whether intra-school or inter-school collaborations or networks with other teachers and key actors) were crucial to the success of the GBP's implementation. The findings may be used to improve pre-service and in-service teacher education and training, since teachers' game-based learning abilities will increasingly form an important part of their professional toolkits.

Keywords: game-based pedagogy, teacher competence, educational technology, case study, primary school.

Introduction

In the twenty first century, novel technologies and games play an increasingly important part in the educational process (Mynbayeva, Sadvakassova, & Akshalova, 2018). Teachers play critical roles in game-based learning by improving its learning and motivating elements and by structuring its procedures (Zou, Zhang, Xie, & Wang, 2021).

The pedagogical foundation for using games in the classroom is the subject of a lot of published research. Research on integration of game-based teaching in the classroom has been conducted by Paunova-Hubenova et al. (2018), with a particular emphasis on investigating the perspectives of instructors and students. Other studies have also been discussed by Liu, Shaikh, and Gazizova (2020), the research looked at how students' desire and interest in learning changed as they advanced through school, as well as how it altered their ability to retain new knowledge. There have been other published studies by Ma, Shi, Zhang, and Zhang (2021), the research compare the efficacy of scenario simulation and theme game-based teaching for enhancing disaster nursing competence among students. Lamrani and Abdelwahed (2020) also conducts research using serious games, this research proposes a digital play-based learning technique to augment the Montessori method's pedagogical component. This research proposes a serious game-based digital play-based learning strategy that may be used to supplement the Montessori method's pedagogical components. Tariq and Abonamah (2021) and Damayanti (2022) has conducted research on the importance of game-based learning for creating effective leaders. Three different types of educational games were used across five different classes in the research. From this research, it can be seen that many researchers are interested in the topic of game-based learning. This can be used as a reference material to answer the researcher's questions, but some additions are needed to assess the skills needed by future teachers to use game-based education. Research on the study of abilities needed by teachers in the game-based learning process (GBP) is also still rarely discussed by researchers.

In spite of the growing popularity of game-based learning, educators have been mostly absent from the field's published research, and few studies have taken a holistic approach to assessing teachers' game-based pedagogy (GBP) skills (Cocquyt, Zhu, Diep, De Greef, & Vanwing, 2019; Nagy & Habók, 2018). It is important to study the impact of game-based learning in a way that takes into account instructors' skills and duties, the pedagogical process inherent to using games in the classroom, and the larger environment in which they are used (Brezovszky et al., 2019; Tokarieva, Volkova, &

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Harkusha, 2019). According to previous studies (Al-Marwani, 2018; Halili, 2020; Hébert & Jenson, 2019; Si, 2019; Tardy et al., 2022), competent teachers and well-developed pedagogical models are crucial to the effective implementation of GBP.

The digital and analog classrooms both feature heavily in our research. This paper aims to identify the potential skill sets teachers could need in order to implement game-based learning successfully. In order to achieve this, a question like this is asked "What sort of competences do instructors require in applying various game-based pedagogical approaches?" by analyzing real-world applications of GBP.

One of the benefits of this study for future researchers is the opportunity to go more thoroughly into the expression of different talents via educational games, entertaining games, game creation, and gamification. Since teachers' game-based learning skills will become an increasingly significant element of their professional arsenal, the findings may be used to enhance pre-service and in-service teacher education and training.

Theoretical Background

The two guiding ideas of the study are game-based pedagogy and teacher competency, which provide the context for the investigation.

Game-based pedagogy

Based on our research, we propose the term "game-based pedagogy," or GBP, to describe a pedagogy that incorporates elements of four distinct game-based perspectives (Easa & Blonder, 2022; Mutmainah & Mahfida, 2021; Nurdiana & Suryanto, 2021) These approaches are the use of games for learning, entertainment, the creation of games, and the application of game elements to non-game settings (i.e. gamification). Both digital and analog uses of GBP are included in the definition. While the first three methods all stem from the definition of game-based learning provided by Lamrani & Abdelwahed (2020) and Nugraheni (2021), gamification has emerged as a distinct trend in recent years (Ong, Haw, & Ng, 2019; Wünderlich, Gustafsson, Hamari, Parvinen, & Haff, 2020). The term "playful- ness" is used to describe a way of thinking and acting that is common to all game-based methods (see Figure 1).

It is common for multiple GBP strategies to exist side by side and even overlap in practice. For instance, a learning project may be based on a fictitious story, and the tasks might include, among other things, playing an educational game to demonstrate a certain ability, solving a mystery in a fun game, and designing a tiny game as a challenge for peers.

The most accessible method of incorporating GBP into teachers' practices is via educational games, which are tailored to suit certain learning objectives and aid the student in achieving particular results (Ge & Ifenthaler, 2018; Zhonggen, 2019). In addition, the efficacy of these tools may be studied; several studies have examined the impact of various educational games on student learning. Some studies have found positive results in the subjects of science (Makransky, Terkildsen, & Mayer, 2019; Regmi & Jones, 2020), mathematics (Lopes & Soares, 2018; Tokac, Novak, & Thompson, 2019), literacy (Horntvedt, Nordsteien, Fermann, & Severinsson, 2018), collaboration (Le, Janssen, & Wubbels, 2018; Rahmat et al., 2021) and the self and identity (Ryan & Deci, 2020). Although games are sometimes used in the classroom to pique students' interest, studies have shown that their motivation waned as the novelty wore off (Van Roy & Zaman, 2018). The amount to which the game helps the player concentrate on what's most important in the learning process is another obstacle (Su'aidah Hanur & Sari, 2021). Thus, Harvey, Pill, and Almond (2018) argue that so long as instructors have a sufficient understanding of games and their pedagogical relevance, efforts to promote game-based learning in the classroom may be maintained.

An alternative strategy makes use of the intrinsic motivational qualities of entertainment games that were not designed with education in mind, necessitating more work on the part of the teacher due to the absence of pre-programmed pedagogical content and the possibility of incorrect or misleading information (Bryan, Campbell, & Mangina, 2018). But because of their adaptability, entertainment games might be valuable if we find new methods to use and integrate them with other disciplines (Bryan et al., 2018). Educators have a responsibility to help students focus on what matters most during gameplay and to encourage their growth as players beyond the confines of the game itself (Earle, 2022). Additional content outside of the core game allows for greater immersion in the game's environment and story(Belyaev & Belyaeva, 2019; Dishon & Kafai, 2022). In larger fun or gamified activities, entertainment games have been employed to give a narrative backdrop, challenge, or mystery for the learners to participate with (Whitton, 2018).

The third strategy for applying GBP is to teach via game design(Meng & Khushi, 2019; Singh, Sengupta, & Lakshminarayanan, 2020; Stojanovska, 2021). Since one objective is to improve students' comprehension of course material, it follows that the best way for a student to acquire new information is to actively participate in creating a game rather than just playing them (Madani, 2019). Students learn to problem-solve and broaden their perspectives via game creation (Kalmpourtzis, 2018; Solinska-Nowak et al., 2018). As a result, it's becoming more linked to the cultivation of important abilities in students, such critical reasoning, ICT mastery, communicative fluency, and imaginative expression (Brilingaitė, Bukauskas, & Juškevičienė, 2018; Deng, Wu, Chen, Wang, & Peng, 2022; Hoogland & Tout, 2018;

Kwangmuang, Jarutkamolpong, Sangboonraung, & Daungtod, 2021; McDougall, Zezulkova, Van Driel, & Sternadel, 2018; Steffe & Ulrich, 2020). There is a major change in education right now toward what are called "key competencies" (Care & Kim, 2018; Lourie, 2020), which are the overarching skills and knowledge students will need to succeed in today's dynamic and complex environment (Morris, 2019).

As a fourth strategy, "gamification" uses game mechanics to enhance a non-game activity's appeal and motivation (Boudadi & Gutiérrez-Colón, n.d.; Kyewski & Krämer, 2018; Rubenstein, Ridgley, Callan, Karami, & Ehlinger, 2018). Educational games that use game theory tend to be more successful (Aldemir, Celik, & Kaplan, 2018; Ge & Ifenthaler, 2018) and to more successfully extend studying(Kalogiannakis, Papadakis, & Zourmpakis, 2021). These games benefit students in a variety of ways, including their cognitive, emotional, and social development (Goldstein & Lerner, 2018)(Näykki, Laru, Vuopala, Siklander, & Järvelä, 2019). From simple 'pointification' to activities with a variety of game-like, narrative, and playful elements, gamification can take on many shapes in the classroom, and it frequently transcends traditional subject and grade boundaries (Pfeiffer, Bezzina, König, & Kriglstein, 2020; Woodcock & Johnson, 2018). Example gamification elements include points, badges, and leaderboards (Chou, 2019; Huang et al., 2020). However, it is difficult to utilize gamification in an educational setting simply as a reward system or to understand it only from a mechanical point of view, as this would overlook other components that are more important to learner engagement, experience, and motivation (examples like as narrative, character development, challenging situations, and successful resolutions) (Aldemir et al., 2018; Mystakidis, 2021). Consequently, it is reasonable to question whether it is more effective to use game mechanics to pique students' attention and keep them actively involved in the learning process (Nicholson, 2015) or to use enjoyable features to make easy tasks rewarding.

Intrinsically motivating games include an emphasis on *playfulness*, which is key in ensuring that the activity is enjoyed and valued in and of itself. (Román-Oyola et al., 2018; Whitton & Moseley, 2019a). Students' satisfaction with their learning environment is increased, and the possibility of creative output is increased (Shelley, Ooi, & Brown, 2019; Whitton & Moseley, 2019b), and common ground for collaborative learning is created (Yang & Lerch, 2020). Learning that incorporates fun interaction and imaginative game design and gaming in technology-enhanced classrooms has been dubbed "playful learning" (S.-Y. Wang, Chang, Hwang, & Chen, 2018) (Figure 1).

Teachers' competencies

Teachers' competency is broken down into its constituent parts in this investigation, including their knowledge, abilities, attitudes, values, and ethical (Kangas, Vuojärvi, & Siklander, 2018; Kaur, Shri, & Mital, 2018; Spante, Hashemi, Lundin, & Algers, 2018). Individuals should have a theoretical foundation in each area of study, the capacity to put their knowledge into practice, and a certain mindset (include characteristics like being receptive, open, persistent, and able to see failures as instructive) (Ugli, 2020). The instructor in a game-based learning (GBP) environment must be well-versed not just in the subject matter but also in various teaching strategies and the many game-based techniques that may be used to enhance student learning (cf. AlNatour & Hijazi, 2018).

Teacher competency is also characterized as a process-oriented term and context-bound in this research (Järvenoja et al., 2018), meaning that it varies from one learning setting to the next and is influenced by elements including students' needs, the school's culture, and available technology. This implies that teachers need to have the professional qualities, as well as the personal qualities, knowledge, abilities, and attitudes, appropriate for teaching in a variety of circumstances(Caena & Redecker, 2019; Thibaut, Knipprath, Dehaene, & Depaepe, 2018). It is anticipated that educators would also have the

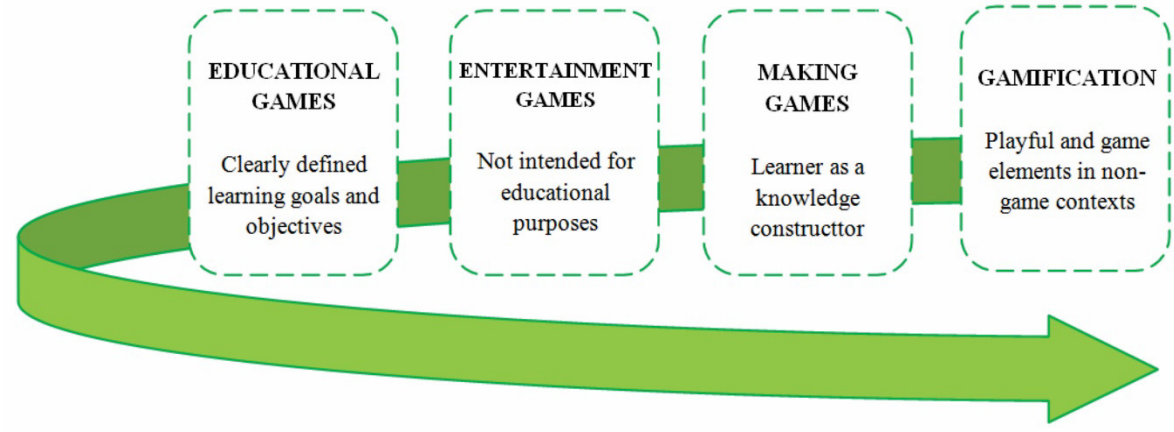

Fig. 1: Approaches of Game-based pedagogical

necessary digital skills (Benali, Kaddouri, & Azzimani, 2018; Zabolotska, Zhyliak, Hevchuk, Petrenko, & Alieko, 2021).

The GBP framework for teaching competences includes a wide range of methods for using games in the classroom, both online and off. Researchers have so far concentrated on determining the factors that encourage or discourage educators from using digital games in the classroom(Gao, Li, & Sun, 2020; Nieland, Fehrenbach, Marowsky, & Burfeind, 2021; Pynnönen, 2019; Zou, Huang, & Xie, 2021). For example, (Assaf, Spil, & Bruinsma, 2021; Sánchez-Mena, Martí-Parreño, & Miquel-Romero, 2019) identify a lack of openness to new technologies as a barrier to using digital game-based techniques in the classroom. Game-based learning is affected and predicted by factors including instructors' motivation, confidence, understanding of game usage in general, knowledge of how games can be used to implement various teaching techniques, and knowledge of how games can be used to apply pedagogical approaches to teaching content areas (Hsu, Liang, & Tsai, 2020).

They are aware that their jobs have shifted with the introduction of new technologies and digital games but they lack the skills and training to effectively incorporate these innovations into their classrooms(Hosseini, Hartt, & Mostafapour, 2019). Instructing, creating, guiding, and assessing are the four GBP-related responsibilities that Whitton and Moseley (Whitton & Moseley, 2019b) identify for educators. Playmaker implies proficiency in explaining duties, responsibilities, objectives, and the present game's dynamics to the team. While playing, students are supported or scaffolded by the guide, and their experiences are understood, explored, and responded to in depth via dialogue by the evaluator (Bressler, Bodzin, Eagan, & Tabatabai, 2019; Vanhorn et al., 2019). In addition to these traditionally understood functions, today's teachers are also expected to play roles such as tutor, coach, leader, facilitator, and learning partner, as discussed in the literature (Kaufman, 2018). It's also important for educators to have some background with games and to understand how they connect to lessons (Jesmin & Ley, 2020). Calvo-Morata, Alonso-Fernández, Freire-Morán, Martnez-Ortiz, and Fernández-Manjón (2019) and Mitchell, Mitchell, Oslin, and Griffin (2020) note that educators need expertise in games to evaluate their educational value.

Methods

This research used a case study approach to investigate educators' competencies in relevant, real-world settings. Case study is the best method to use when the lines between a phenomena and the surrounding environment are hazy (Palupi, Subiyantoro, Triyanto, & Rukayah, 2020). The capacity to supply and manage a variety of data, including but not limited to documents, interviews, and observational data is a major advantage of this method (Cypress, 2018; Mohajan, 2018). Throughout the research, both qualitative and quantitative data were gathered; we analyze the qualitative data from the viewpoint of the teachers involved. (Table 1).

Sample, Participant and Place of Research

Participants in this study were 14 schools and their partner schools in East Java that participated in the GBP network initiative from 2017 to 2020. There were 14 schools where student aged 7-12 received their primary education, and 6 schools where students aged 12-16 received their lower secondary education. The numbers of siswa attending each school varied from under 200 to well over 600. Each school has a core participant of two or three teachers who share what they learn with other teachers in the school and their professional network. Thirty active teachers took part on average, but this number fluctuated as teachers changed schools during the study. Participants were recruited because of their enthusiasm for GBP; however, this study did not prioritize the participants' digital literacy exploration or gaming experience. Most of the participants (75% or more) were primary school teachers, while the remainder were secondary school teachers teaching in specific areas such as language, mathematics, and technology.

Table 1: Data description

Type	*Description*
Documents	Teacher-created content such as weblogs, digital portfolios, and descriptions of activities (2018-2021)
Interviews	Debriefing with teachers (T-6) were conducted in 2018. School A: Teacher 1 (teaching grades 1 to 2 for all subjects) and Teacher 2 (teaching grades 3-5 for all subjects) School B: Teacher 3 and 4 (both teach grades 1 to 5 for all subjects) School C: Teacher 5 (teaching up to grade 6 for all subjects) School D: Teacher 6 (teaching grades 7-9 Mathematics and Technology)
Questionnaires	Answers to the teachers' open-ended questions administered in 2020 (T-19) and 2021 (T-12)

In order to better use GBP in their classrooms, teachers and principals developed individualized strategies to meet the needs of their students. In a first step, they determine the GBP competency profile of the school by rating it with a score of 1 to 10 the school's existing knowledge and skill levels regarding various GBP methods and then indicate which approach they would like to focus on during the project. With this information in hand, educators developed strategies for using GBP in classroom practice. The initiative supplied electronic gadgets and gaming software, instruction in game-based tools and methodologies, and meeting places for face-to-face and online collaboration. Individual schools might also request specialists to educate their teachers on issues that are of particular interest or relevance to them, in addition to participating in regular joint training activities (including, but not limited to, role-playing and game development, game programming, and game applications for commercial).

Data collection

The researchers in this study employed observation (document), interviews, and questionnaires to compile their findings. The teacher document summarizes all school-wide gaming events and includes the teacher's thoughts on each event. To learn more about the initiatives and practices of these six educators and to inquire about the perspectives of both educators and students on GBP activities in the classroom, we conducted in-depth interviews with them (see Table 1). Subjects for the interviews were chosen according to two primary factors. Interviews were conducted with educators from kindergarten through ninth grade at three different elementary and one secondary schools. This was done on purpose to ensure that the sample was representative of the population. We conducted an interview with a teacher at a language school in Malang and conducted a focus group with five teachers at a Surabaya language school. Second, we aimed to conduct in-depth interviews with educators who had used a variety of GBP strategies, from adapting pre-existing games for educational or recreational purposes to more systemic gamification initiatives and game development projects. Together with the network project organizer, we were able to zero down on a diverse set of schools and educators, each with a little unique character in terms of the GBP approach they prioritize. The paper and the interview were accompanied by the questionnaire issued to all participating instructors, which focused on the same subject as the interview. Questions were both open-ended and rated on a Likert scale for difficulty. Our usage of the latter is exclusive to this work.

Validity and Reliability of the Study

According to the literature (Abdalla, Oliveira, Azevedo, & Gonzalez, 2018; Müller, Dosovitskiy, Ghanem, & Koltun, 2018), validity in qualitative research is achieved by the transfer of results to similar settings rather than the generalization of findings to new contexts. The authors opted for a detailed description and selective sample to guarantee the study's external validity.

The conclusions of a qualitative study may only be trusted if they have been independently verified by the researcher (O'Connor & Joffe, 2020). In this study, quick confirmation was employed to create credibility in the outside world.

Data analysis

Researchers transcribed the interviews and analyzed the whole dataset iteratively using qualitative content analysis. We started with a high-level review of the data, during which we found all instances where competences were mentioned without yet distinguishing them based on additional fine-grained criteria. A total of 232 quotes and descriptions of behavior, emotion, or thought were deemed to be relevant to teacher skills. We utilized quotations ranging from a single phrase to many paragraphs as our basic analytical unit.

Next, we used a data-driven methodology and an open coding technique to categorize the quotes according to content areas, without imposing a priori classifications on the data. Some quotes had to be thrown out because they were too confusing or unspecific. Seven categories were generated during the first iteration of this phase, and they were subsequently organized into four more generalized categories, sometimes known as competency areas. We reevaluated the subcategories and further subdivided some of them until we had a total of 10 subcategories falling under 4overarching categories (in Section 4, see Table 2).

This research also categorized quotes by GBP method and stage of the instructional process. To examine the GBP methods shown in Fig. 1, we first created a theoretical and instructional blueprint for gaming as learning (Fig. 2). Both creative and playful learning (Whitton, 2018) and participatory game pedagogy (Arnseth, Hanghøj, & Silseth, 2018) served as inspirations for this framework.

Initial preparation, instruction, and evaluation make up the teaching and learning process (in Fig. 2 labeled #1). The student-driven, game-based process of learning (#2) has four stages: introduction, invention, play, and elaboration. Throughout the many domains of expertise, we tracked down learning activities that match to the various stages of the process. Thirdly, we were able to map skills to various game-based educational strategies (as much as the data would allow). The framework aids in analysis and provide resources for developing GBP-based pedagogical content. Teachers might potentially engage pupils in the creative creation and evaluation of game-based activity by asking questions (Fig. 2) throughout the introduction and elaboration stages.

Table 2: Subject of Competence in Game-Based Learning

1. Pedagogic	*2. Technology*	*3. Collaborative*	*4. Creative*
Constructing Curriculum	Analysis of digital games and technologies	Collaboration and development within the school	Playful Stance
Providing Tutoring	Technology-related obstacles being overcome.	Abilities for interacting with others outside of a school	Exploration and improvisational ability
Assessing Student Competence			Creative focus on one's own development

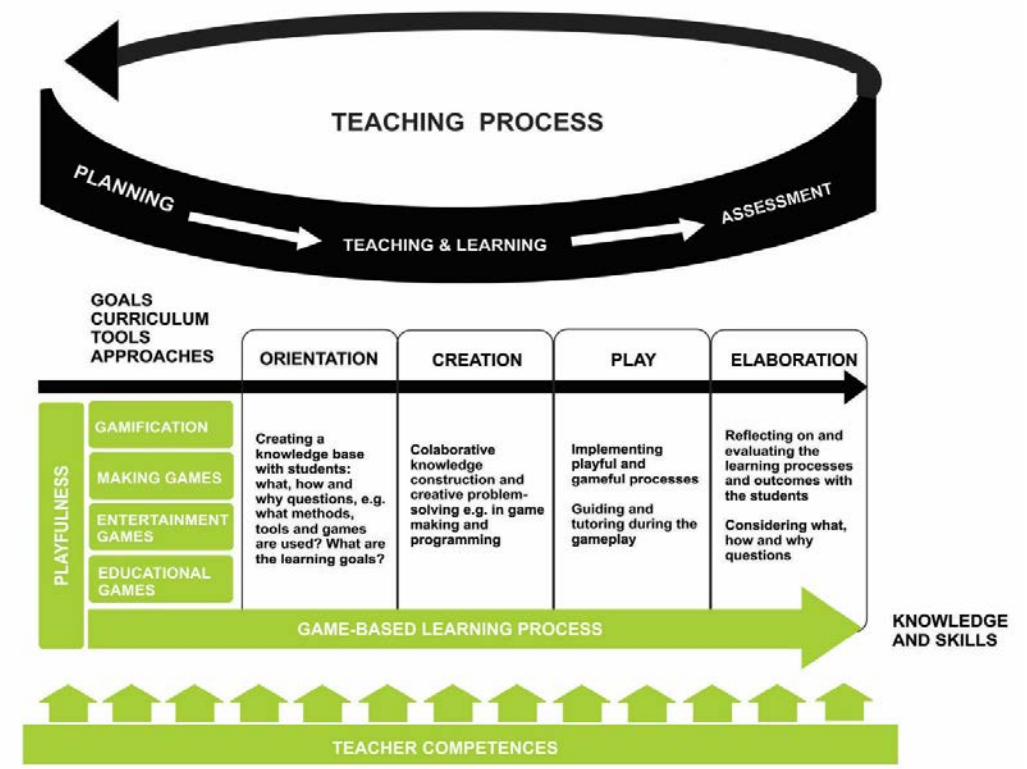

Fig. 2: Pedagogical framework and conceptual for game-based learning

Ethical consideration

Because of their enthusiasm for GBP, all of the volunteers agreed to take part in the study. Official authorization was secured from local authorities, the teacher, and the student all gave their blessing before this study began. All participants were given all relevant information in advance of the study. Pseudonyms such as "Teacher 1, Teacher 2," were given to each participating kid to keep their identities hidden.

Finding

In order to put GBP into practice in a broad variety of contexts, several skill sets are needed. Teachers reported using all four GBP strategies (Fig. 1), with the majority using instructional games. Almost 60% of the educators reported sometimes or often engaging in game design activities with their students, and over 80% reported using educational games in some capacity (Hamari & Nousiainen, 2015). More than a third of educators (40%) have used some kind of gamification or entertaining games with their pupils. (Hamari & Nousiainen, 2015). We found that role-playing games and the awarding of points and badges were the most prominent gamification elements. There was a wide range of GBP implementations, from focusing on subject-specific activities to gamifying almost everything that happened in the classroom. Some learning techniques used more broadly entertaining components to motivate pupils, rather than following rigid game-like rules and frameworks. According to our findings, there are 10 different types of teaching expertise, broken down into four primary categories (Table 2): pedagogy, technology, collaboration, and creativity.

Pedagogical area

Teachers placed a premium on acquiring sufficient pedagogical competences to effectively use a variety of game-based pedagogies in the classroom. Based on their own experiences in the classroom, educators identified three domains that pertain to the skills necessary for making decisions about teaching and learning strategies: Those who are competent in 1) constructing curriculum, 2) providing tutoring, and 3) assessing student competence.

Constructing Curriculum

First, educators must possess skills necessary for preparing meaningful curricular games. One key competency that emerged from their introspections was the capacity to use GBP to support the curriculum, which was examined in the context of the significance of GBP's implementation. To do so required an appreciation of the potential and constraints of various game-based methods of imparting pedagogical material. As indicated in Excerpt 1 about gamifying the content of 6th grade history, for instance, extended role-playing works may involve learner in comprehending larger learning objectives from multiple viewpoints but may not be appropriate for studying particular subject information. When utilizing or having students produce play-based tests or comparable items, however, the situation may be reversed.

(1) And of course, the curriculum, as usual, serves as the beginning point for game design or gamification. These are the origins of the contents. The thing is... This information has been converted into a gaming environment.... There's virtually no way pupils will recall precise dates [in history]. yet it isn't the point either. [Educator at the primary school]

Involving students in identifying and articulating curriculum-related objectives and guiding them toward these goals is another facet of curriculum-based planning (i.e. orientation in Figure 2). Teachers, for instance, set overarching objectives for students' work while giving them agency over the details of how and what they learn. In the second excerpt, we see fifth students working with second graders to create a game-based activity. The learning process was framed as an interplanetary journey, and it contained both game design and gamification elements. This snippet exemplifies how educators may promote student agency in game-based learning by giving students the opportunity to reflect on and synthesize curricular knowledge within a narrative framework.

(2) After [the student] completed their training as space agent cadets, many dangers were posed to our planet/ galaxy, and in order to counter them, we often referred to the curriculum to determine what topics were being covered in second grade. Fifth graders have organized several action points around these themes, providing a framework for the tale they have written. [Educator at the primary school]

Planning game-based activities to supplement students' scholastic learning and more general essential abilities was also seen as crucial by educators. In the third excerpt, we learn about the instructor's plans to use gamification and video games in order to foster specific goals and group solving problems abilities.

(3) At the very least, I believe that the experiential nature of [games and gamification] and collaboration, teamwork, and solving problems would make the material approachable and the education... more profound. [Educator at the primary school]

Providing Tutoring

Next, educators acknowledged the need for tutoring skills. The ability to motivate students, tailor assignments to their specific needs, and adapt to varying levels of independence are all examples of tutoring talents that may be put to use in a gaming environment. One key competency that emerged from the data was encouraging learner institution and self management, which was emphasized most often in larger-scale game projects and game design. In Excerpt 4, an educator reflects on the process of designing games with her kids and how she learned to delegate more responsibility and power to them.

(4) Responsibility and independence have been emphasized heavily for [the pupils]. As a corollary, you get experience in delegating tasks to others. The instructor has a lot of leeway in determining the students' level of accountability. [Educator at the primary level]

Excerpt 5 comes from a different instructor, who discusses how his students used role-playing activities to learn about geography and history, focusing on topics such as other nations and medieval life. Students worked independently on game-based assignments and created a finished product to showcase her knowledge in these gamified activities. The instructor offered many strategies, and the students selected one that best fit their needs.

(5) Quite a bit of creative leeway has been given to [students] in terms of how they want their game-based projects to culminate. The actual result has never really been important to us. Is it a movie, a slide show, a computer game, or a book? They've had time to consider their own talents.... We have been showing all children how to create final outputs using Kodu, Minecraft, and a few iPad applications, and the results have covered a wide range of topics. [Educator at the primary level]

The teacher's tutoring function in a self-directed learning environment included monitoring student progress, answering questions from students who got stuck, and making sure everyone was following the activity's broad pedagogical guidelines. It was vital for educators to recognize instructional moments (Chen & Mensah, 2018) and respond accordingly, for as by supplying necessary context or data. Students spontaneously began exchanging products and services with one another in the history project, which prompted a meaningful conversation on the economic and social dynamics of medieval societies. Still, in a few instances, a more formalized procedure was called for due to regulations regarding the allocation of responsibilities. This problem mainly arose when using preexisting games or game-creation components; teachers had to know when to put limits on students' game time to prevent them from losing focus and getting bored, and when to add more structure to channel students' enthusiasm toward the most important aspects of the educational process.

The results show that instructors must be able to support unique teaching paths and customized teaching in game-based pendagody, which necessitates a comprehension of the features and affordances of various game-based learning strategies. Data suggests that educational games, which allow the most proficient students to advance on their own while encouraging the least proficient ones to put in additional practice time, may be an effective tool for fostering individualized instruction. However, instructors believed that, based on the learning outcomes, they might better assist students' unique learning trajectories when using gamification to design more comprehensive projects.

Assessing Student Competence

Evaluation skills come up at number three and include the ability to evaluate student progress and to facilitate student reflection on the evaluation process. One skill that was highlighted by the data was the capacity to efficiently evaluate students using significant evidence gathered during game-based activities. In Excerpt 6, a teacher provides further context for this idea by discussing her experience with the educational math game Sumdog and how it may give her with a wealth of data to enhance assessment, but only if she has the skills to make good use of that data.

(6) I find that simpler methods, like Sumdog, which informs you exactly what a pupil understands and where they need more practice, are the most fruitful when assessing their progress. How often they make the proper choice, how often they are correct, etc. [Educator at the primary level]

It was particularly clear in the use of gaming elements in educational settings that evaluation is a difficult task. Two educators, whose fifth-graders have taken part in and occasionally organized gamified events for younger children, address this topic in Excerpt 7. Teachers discuss how important it is to keep a close eye on their students throughout the exercise, not only for the sake of identifying how much students have learned, but also so that they can watch the process as a whole, encompassing both subject-specific knowledge and students' critical abilities. The necessity to find strategies for giving students who are less involved a chance to showcase their abilities was also brought up.

(7) Teacherr 1: Perhaps it's possible to get a sense of the kids' level of engagement and interest, as well as their capacity for social interaction, [during the procedure]. Skills of a more generic kind. On the other side, some students may demonstrate abilities that aren't brought out in a typical classroom setting, and this may of course also have an impact on how they are evaluated. I mean, why not give someone a chance if it turns out they're more capable than they [appear to be]?

Teacher 2: It may be helpful if someone could come up with a decent, kind of, set of evaluation criteria in certain scenarios. Such example, how to monitor student progress in a game-based learning environment.... When do these types of positions often emerge? Moreover, do some [students] not participate? How should one evaluate someone who doesn't actively take part in everything?

Researcher: Hm, you make a really valid argument.

Teacher 2: The instructor may, for instance, assign those pupils... tasks as an observer or other types of duties.... In addition, it is not inferior to [more active] participants.

Researcher: So can everyone play to the best of their abilities?

Teacher 2: I agree that it requires a lot of hard work to come up with that evaluation. Of course, there are things like items and jobs that may be examined, and they are straightforward to rate. To evaluate the procedure, however, you need a more in-depth familiarity with it, since there are several factors to consider.

The discussion demonstrates the significance of collecting data on the process involved in a wide gamification method when the activity spans a long time or even the full school year. The educator must have the foresight to know what evidence would be required for evaluation and how to make that happen in the game-based activity. In order to personalize the assessment process, it is necessary to have a firm grasp on the big picture and understand the learners' responsibilities in game-based procedures. For example, instructors emphasized setting interim checkpoints or milestones so that students wouldn't have to look back on the whole procedure at once. Assessment is also tied to skills that let pupils take initiative. Teachers emphasize the need to assess student activity and

reflect on the educational process with students (i.e., the elaboration in Fig. 2), such as debating whether students think they learn as much through game-based activities as is gained when understanding book content.

Area of Technology

These results further emphasize the relevance of technological area competencies for putting GBP into action. Competencies in two areas connected to technology were identified: 1) analysis of digital games and technologies, and 2) technology-related obstacles being overcome.

Analysis of digital games and technologies

Issues with analyzing games and technology tools for selection and combination with nondigital tools were raised by the educators. Teachers may need to consider options beyond those that are immediately available to them. In turn, this calls for an understanding of current resources and how to get access to more information. It is important to be ready to regularly analyze and reassess tools since often the best answers are discovered only after many unsuccessful attempts. In Excerpt 8, a educator evaluates the decisions he's made so far and, using the knowledge he's gotten from this gaming-based initiative, thinks about what sorts of games might be good for teaching mathematics.

(8) Obviously, in the past I haven't been as careful in selecting games that are conducive to learning. If you want your pupils to perform well in arithmetic, you need to provide them with engaging, educational activities. It is possible to [done] certain drills on the laptop, albeit doing so may be boring; however, if they are presented in the form of a gaming, they may be slightly more [interesting]. [Instructor at the Junior and Senior High School]

Technology-related obstacles being overcome.

When asked about their own technological proficiency, teachers said that they felt they had a lot to learn. Therefore, adaptability in the face of technological setbacks has become a crucial skill. Teachers sometimes have to go through repeated cycles of trial and error before they find a way to prepare tools and programs that will ensure a trouble-free learning environment.

A teacher's ability to swiftly come up with an alternate plan in the event that certain game-based activities can't be completed as planned is essential, even if the instructor has prepared as thoroughly as possible to employ technological resources. While it's helpful to have a backup plan in place ahead of time, you'll likely need to wing it and make adjustments to your objectives and methods as you go. The fewer times a teacher's lesson is sidetracked by a glitch in the technology, the more effective that teacher's instruction will be. One obstacle was the difficulty of knowing whether or not an issue could be solved by the instructor immediately (such as interference from other devices, a faulty antenna, or a SIM card that isn't installed). Yet, as is made clear in Excerpt 9, a single educator is not enough to address all of a school's needs.

(9) Students soon get dissatisfied when they are unable to complete [their responsibilities] due to technical difficulties with the network or their devices. Every issue that arises in the classroom requires a quick response from the instructor, and it's not always possible for just one person to accomplish both that and think of alternatives in case they need to be implemented. [Educator at the primary shcool]

Knowing how to find solutions and who to consult when facing technological challenges is, thus, essential for resolving such issues competently. It was thought that part of this competency included knowing where to find helpful online resources (such video tutorials and online forums), trying out a variety of solutions despite doubts about their viability, and enlisting the help of peers and students as needed. Teachers spoke about how they resist using new tools because they don't feel confident in their ability to use them, but they also shared examples of how practical cooperation amongst educators increased their competency and confidence in using GBP. Clearly, the fields of collaboration and creativity are intrinsically tied to the area of technical proficiency.

Collaborative area

Collaborative abilities within the context of GBP were the third theme to emerge from the data. In this respect, we're talking about how willing and able instructors are to disseminate knowledge and information on curriculum materials, pedagogical strategies, and technology resources. To successfully integrate GBP into the culture of a school and ensure its long-term viability, teamwork is essential. Our findings showed that this region was significant on two different levels. It was mentioned that, first, the school's backing is necessary for implementing GBP, and, second, that working with people outside of one's own institution is also an option.

Collaboration and development within the school

Our research shows that educators still have a lot to gain from one another's expertise when it comes to sharing effective classroom strategies and innovative lesson plans. They spoke about the steps that need to be taken and various roadblocks that might prevent sharing from becoming habitual. There was a recognition that even though they were performing more and more collaboration, they could still do better at sharing what they had learned. Teachers emphasized collaborative methods such as mutual aid, collaborative idea generation, and practice demonstration to boost students' collaboration skills (Excerpt 10).

(10) To get other educators interested in GBP, I'd suggest saying something like, " Come up with something with me and we'll see what happens" The other educator can feel neglected if you only lecture them on your accomplishments. [Educator at the primary level]

Openness to new ways, hands-on cooperation by co-creating something with experienced teachers, finding untapped expertise among teachers, and coming up with new ways and conventions to share ideas and resources were all mentioned as important ways to improve these skills (e.g. for instance using digital tools).

Abilities for interacting with others outside of a school

Teachers also spoke about working together with colleagues from different institutions and developing their professional skills in tandem (see Excerpt 11). Collaborating with other schools requires embracing a more open and accepting attitude toward new experiences and ideas. Communication between educators in different institutions may take many forms, just as cooperation inside a school might. It was felt that working together on a tangible project or via participant observation at another school was more beneficial in terms of gaining new skills than just reading about or hearing about the experiences of others.

(11) We connected, and now [four schools] are playing a combined game. What we might do jointly in the future to attract more students' attention is something we've been considering. The faculty is on a field trip to see students and colleagues at other institutions. [Educator at the primary level]

During the course of the project, the usage of gamification in education grew from a handful of pioneering educators to their peers both within and outside the schools (Hamari & Nousiainen, 2015). Our research found that schools' participation in a collaborative networking project was the most effective way for educators to work together and share best practices, but that online professional communities also provided a rich resource for discovering new ideas and potential collaboration partners.

Creative Domain

The last sub-heading of competence is the imaginative one. Our findings indicate that this competency materialized in the form of a teacher's imaginative orientation toward their own growth and development, as well as their capacity to adopt a more exploratory and improvisational approach.

Playful stance

Taking a playful posture materialized as an openness to finding fun in almost any educational setting. Instructors spoke on how to motivate their students using game mechanics and the mindset that everything can be made into a game. This was cited most often by educators who also shared a passion for gaming, role acting, or narrative and found inspiration in the challenge of developing novel game-based components to include into their own lessons. Teachers have pointed out that there are already many elements of school that might be termed gamification, even if they are not seen as such, and that by expanding on these features, they can make their learning more enjoyable and foster gamified thinking. A teacher suggests putting pupils in a lighthearted mood by setting the stage for their work with a humorous role play, In Excerpt 12.

(12) You have the ability to make a tale out of anything. I guess you simply... since games are usually based on a narrative. Start a class by saying something like, " I'm not your [teacher's name]; I'm a neuroscientist who's completely blanked on the material I was supposed to cover with you." To do this, just enter the room after using red face paint or some comparable substance. Therefore, each of you must do your own investigation! That's kind of a game too. You're faced with difficulty, and there's a story, tension, etc. , and the temporary educators next to me are giving me the side eye like I've lost it. [laughing] The next 45 minutes are dedicated to students getting down to business. [Educator at the primary level]

In and of itself, the assignment (requiring students to do independent study) was not novel; it was what all educators do. But if the instructor adopts a lighthearted attitude toward his or her own pedagogical methods, even this serious job may be transformed into a game.

Exploration and improvisational ability

Relatedly, educators must be willing to iterative manner explore and improvise in order to find activities that come naturally and motivating for both teachers and students. This includes trying out new methods and tools without fear of failure, "jumping into the unknown" with students, and making adjustments as they go. Educators are sometimes quoted as saying, "It's interesting and stimulating to try new ideas and see where they go," and if the experiments pan out, the new techniques and strategies are adopted systemically. Some educators' intrinsic curiosity about the world gave them an edge in developing exploration-related skills (Excerpt 13). Some people created them all at once, while others took their time and experimented with each phase.

(13) It seems natural to me to start investigating, creating, and seeking for engaging methods to educate, and I suppose that's because I was the class nerd as a kid and loved making things like role-playing games. [Educator at the primary school]

Finally, the educators detailed instances when the initial strategy did not provide the desired results, necessitating quick thinking and adaptations to the educational concept of the exercise as it unfolded. There was a need for improvising abilities in this situation.

Creative focus on one's own development

It was also noted that teachers are open to rethinking their professional identities and continually expanding their GBP skills. Self-improvement with a creative focus is what we mean by this. Teachers said that GBP prompted them to reflect on and improve their methods in search of more meaningful applications of gaming in the classroom. This was seen to be encouraging as well. In Excerpt 14, a teacher explains how he benefited from using role-play-based gamification in the classroom.

(14) It's been exciting to try my hand at something more expansive... hmm... experimental? And it's very influential on the job, you also want to develop yourself and advance your own expert knowledge, and then, in some way, put your mainstay abilities to work in the interests of the children. [Educator at the primary school]

Next, we will summarize by describing how a teacher acts during game-based learning in schools that reflect the four skill categories.

Discussion

Expertise instructors deemed important for adopting GBP was the subject of this research. The research highlights four domains of competence (pedagogical, technical, collaborative, and creative) as they are seen in game-based pendagogies processes. In this part, we will talk about the findings in the context of our theoretical and instructional framework, and consider how those findings may be used to help educators build skills that align with course goals. We will also talk about the study's shortcomings, as well as the implications the findings have for teacher education and directions for further study.

The findings demonstrate that adopting GBP calls for a wide range of teaching competences since game-based learning demands the careful synchronization of many types of knowledge (Gris & Bengtson, 2021). Figure 3 provides a concise overview of how our conceptual and instructional framework places a focus on the four competency categories highlighted in this research at various points (presented in Figure 2).

Playful, game-based learning encompasses all stages of the learning process, as seen in Fig. 3. The findings imply that any GBP strategy may be used to successfully develop, execute, and evaluate game-based learning activities that make meaningful connections to the curriculum by a teacher with sufficient pedagogical competence (cf. Halili, 2020). Both the initial process design by the instructor and the subsequent orientation of the activities by the teacher and students put a focus on planning skills. Teachers who have mastered the art of pedagogy might, for instance, have their pupils participate in the development of future games and educational strategies and (technological) instruments. Skills as a guide correlate with what's needed during live gameplay (i.e. creation and play). These skills might include things like being able to recognize "teachable moments," or interactive scenarios in which the instructor guides the students' learning process to go deeper into the subject and advance in the game (Ramos, Meek, Simard, Suh, & Ghorashi, 2020). Assessment abilities include both the ability to evaluate the results of students' learning and the skill of encouraging them to reflect on their own assessment practices (i.e. elaboration).

Prior to and at the start of the process, it is important to have technical competences linked to analyzing games and technological instruments, while throughout the activity, competences connected to overcoming technological difficulties become more apparent (Fig. 3). Competencies in technology in the real world include things like knowing how to choose the right games and tools for the job (Ovcharuk, Ivaniuk, Soroko, Gritsenchuk, & Kravchyna, 2020) and being able to draw on the knowledge of peers and teachers as a means of navigating technical challenges(Borup & Evmenova, 2019). Teachers who are fluent in technology are also aware of the potential of some digital tools and games as adaptive educational settings that may be tailored to the varying levels of knowledge and expertise of their students. These findings are consistent with previous empirical findings that show educators, both within and outside of the classroom, require technology skills to employ digital games (Spiteri & Chang Rundgren, 2020) and other fun, game-based learning techniques effectively. The question of whether or not educators see technological issues and difficulties as opportunities, barriers, or non-issues is crucial. Tsybulsky and Muchnik-Rozanov (2019) and Rapanta, Botturi, Goodyear, Guàrdia, and Koole (2020) found that instructors who used this educational technique felt more confident and were better able to tackle novel difficulties in the classroom. In the digital environment, openness to technology and digital self-efficacy positively influence the usage of game-based teaching tools (Hamari & Nousiainen, 2015), and when instructors are comfortable and competent, they may begin devising new, innovative, student-centered uses for technological knowledge (Uerz, Volman, & Kral, 2018).

The findings show that teachers implement GBP more effectively when they have a variety of collaborative skills at their disposal. These skills may include connecting with other actors involved or working in teams within the same school. Fewer connections can be made between specific GBP steps and collaborative competences, which may be called

for during collaborative lesson design, project execution, or reflection (Fig. 3). New strategies for addressing GBP may be fostered via collaboration. Innovative teaching thrives in environments where instructors are directly involved in using innovative teaching techniques, there is a shared vision to promote unique approaches, and there is peer support and sharing (Jesmin & Ley, 2020). How beneficial educators see games as a professional tool is also influenced by cultural norms and the support they get in their immediate surroundings (Baabdullah, 2018; Rodela, Ligtenberg, & Bosma, 2019). Our findings reflected this in descriptions of how more experienced instructors shared their pedagogical practices, knowledge of games, and technical expertise with less experienced ones, notably via the implementation of a real project. Teachers at different schools might collaborate on the design, implementation, and evaluation of a gamified learning initiative, for instance. Sharing and collaborating in the creation of new materials may help educators discover and make connections between previously unrecognized sources of tacit knowledge (Campbell, 2018).

Finally, the instructors' responses revealed a focus on the creative skill area. According to the results, for GBP to be effective, instructors need to take on an attitude of playfulness in their exploration, improvisation, and innovation; they also need to be highly driven to learn and willing to go beyond their comfort zones. The process as a whole benefits from a lighthearted approach, but learning activities, both in terms of preparation and execution, place a premium on playfulness, as does a willingness to experiment and improvise (Fig. 3). When considering how the game-based activity may have impacted instructors' understanding of their own skills and their sense of professional identity, it's important to focus on the three main sub, an innovative approach to self-development (Fig.

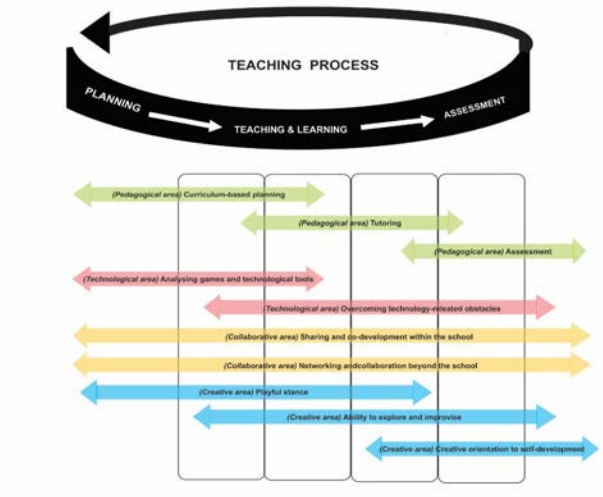

Fig. 3: Mapping between competencies with conceptual and pedagogic frameworks

3). Teachers that demonstrate pedagogical and emotional involvement are more likely to use play - based creativity and display personal entrepreneurial abilities (Lamrani & Abdelwahed, 2020), and as a result, they are often curious about the efficacy of innovative pedagogical approaches (Windschitl, Thompson, & Braaten, 2020).

The GBP competences may also be analyzed in terms of one's level of education, experience, and outlook (Graber et al., 2018; Holmboe, 2019). Theoretical understanding of how to organize, implement, and evaluate a lesson's effectiveness forms the basis for pedagogical abilities; they become transferable skills when applied to a game-based learning environment. On the other hand, although technical competences also need background knowledge, they often begin within the practical skills dimension and are acquired primarily via hands-on activities. Additionally, the attitude component is highlighted in the fields of collaboration and creativity. Our findings suggest that educators think individuality plays a major role in shaping how these two domains materialize in their work (Efendi, Imardi, Muzawi, & Syaifullah, 2021; Rissanen, Kuusisto, Tuominen, & Tirri, 2019). This includes traits like being receptive to new ideas, persistent in the face of setbacks, and willing to learn from one's own and others' mistakes. As a result, having the right set of facts and abilities is just the beginning (Schuppli & van Schaik, 2019). Educators might be disinterested in incorporating digital tools and games into their lessons even if they have access to the latest devices, resources, and information(Kaimara, Fokides, Oikonomou, & Deliyannis, 2021). Thus, technology and gaming are not independent of other factors (Venkatraman, MK Cheung, Lee, D. Davis, & Venkatesh, 2018).

Many relevant projects are presently underway, indicating the growing importance and interest in the study of teacher competences and the implementation of associated policies. This research found many game-based instructional competences that also appear in the DigCompEdu framework. As a result, it is essential to think about how various frameworks and technologies could complement one another. In order to encourage instructors to reflect on their own competence, they may use preexisting assessment frameworks in a variety of contexts, including GBP.

Teachers in the twenty-first century are tasked with using contemporary strategies and digital resources to motivate students and develop essential skills (Shidiq & Yamtinah, 2019). In Finland, for instance, the new core curriculum is focusing less on what to teach and more on how to teach, with the aim of tying together the aims of key competences with more concrete learning objectives (Y. Wang, Lavonen, & Tirri, 2018). The curriculum also emphasizes the use of play, games, and playfulness in the classroom in a variety of settings and contexts, highlighting the importance of these elements for student learning. To ensure that their lessons are

in accordance with school education curriculum and the needs of the digitalized societal structure, instructors may find the game-based techniques and concept and pedagogic approach given in the research useful.

Conclusion

The use of technology and interactive media in education is on the rise in the twenty-first century. Teachers have a pivotal part to play in developing game-based learning processes and boosting student learning and enthusiasm. This article aims to identify the potential skill sets teachers could need in order to implement game-based learning successfully (GBP).

The study addresses pedagogical, technical, collaborative, and creative realms of competency in the context of GBP processes at educational institutions. Since game-based learning requires the precise synchronization of various kinds of information, our results show that adopting GBP requires a broad variety of teaching abilities.

Findings indicate that various forms of educator collaboration (including both intra-school and inter-school cooperation, as well as networking with educators from other schools and other key players) are advantageous to the effective introduction of GBP. While collaborative lesson planning, project management, and debriefing all need various forms of GBP, there is less of a bridge between the individual phases of GBP and the collaborative competencies that are required (Fig. 3). Working together might help generate innovative approaches to tackling GBP. Our results echoed this in accounts of how more seasoned educators taught those with less experience best methods in teaching, gaming knowledge, and technical skills, most notably via the execution of a real-world project. A gamified learning program, for example, can include collaboration amongst teachers from various schools in its planning, rollout, and assessment.

Instructors' replies centered on the need of developing creative abilities. The findings suggest that successful GBP requires teachers to adopt a spirit of fun in their own exploration, improvisation, and creativity, as well as a strong desire to learn and a willingness to push themselves beyond their comfort zones. A lively attitude and a willingness to try new things and improvise are invaluable throughout the process, but they are especially important while planning and carrying out learning activities (Fig. 3). The curriculum places an emphasis on the value of games, and a lighthearted attitude toward learning in the classroom, and it does so in a variety of ways and circumstances. This research offers a theoretical and pedagogical approach, as well as game-based tactics, that educators may use to better adapt their lessons to the needs of today's digital culture.

It is to be anticipated that every study will have certain limitations, and this one is no exception. Teacher participants were limited to those in East Java, and the reliability of the data depended on their honesty and consistency when remembering and reporting their own classroom experiences and pedagogies including games. Although the findings of this research may be generalized to secondary and tertiary educational contexts, it is likely that the study's starting context influenced the emphasis put on certain components within the sections, given that elementary school was the major focus of the study.

Since the capacity to support game-based learning is quickly becoming an important element of a teacher's professional arsenal, the findings of this study may be used to define the domains of competence required in GBP and to develop teaching profession and in-service training. We also suggest that new curriculum be developed in tandem with discussions on teachers' skills, with an emphasis on broadening teachers' knowledge of GBP. The findings of this study were used to rank the relative value of various skill sets. It could be worthwhile to do further research on the potential overlap between skill sets and the use of game-based learning techniques. Since this research was conducted throughout the course of an ongoing networking project, more research into the development of game-based pedagogical abilities, taking into account variables such as teachers' perspectives of what has helped or hindered the growth of these competences, is warranted.

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