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Giving Teachers a Voice: A Study of Actual Game Use in the Classroom

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Abstract: The adoption of games in the classroom has been studied from different angles, such as the readiness of teachers to use games or the barriers encountered. However, actual classroom practices with regard to the use of games have not been examined on a larger scale. With this research, we gave teachers a voice to report on their actual practices. We examined the current practices of a large sample of Estonian teachers (N = 1258, which constitutes almost 9% of the total Estonian teacher population) in primary and secondary education in 2017. We found that most of the teachers use games on a regular basis. Mainly, they use the games for motivation and alternation, but they also use them to consolidate and teach new skills. While awareness and motivation are high and experimentation on using games is widespread, practices appear fragmentary and not widely sustained. As a result of this study, we suggest the creation of an evidence base and a better integration of social support structures into teacher education. This is the first large-scale study to look into Estonian teacher's actual practices, and although Estonian teachers have relatively high autonomy and technical skills, we believe that these results and further investigations are applicable in other contexts as well.

Keywords: teachers game use; games in school; game based learning; GBL; Estonia

1. Introduction

The use of games in the classroom can be seen as an attempt to introduce student-centered and collaborative elements into school education. Games in this context are playful activities that teachers use in their teaching; these can be anything starting from movement games to board games or digital games. There is some evidence that GBL (game-based learning) technologies improve motivation and interest [1]. Some other studies find that using games in the classroom improves learning outcomes [2], and some have proven that with games, students learn and retain more [3]. The immediate feedback in computer games provides players information regarding the correctness of their actions and decisions and thus gives them the opportunity to correct inaccurate information [4]. The findings of Boyle revealed that playing computer games is linked to a range of perceptual, cognitive, behavioral, affective, and motivational impacts and outcomes [5]. A systematic literature review of game-based learning empirical evidence in primary education by Hainey [6] stated that GBL has developed a reputation with educationalists; it is perceived as a potentially engaging form of supplementary learning that could enhance the educational process and has been used at all levels of education including primary, secondary, and tertiary education.

It is likely that teachers have a critical role when introducing games into the classroom. Depending on what kind of teaching and learning practices they introduce around the introduction of a game will determine the success (or failure) of the classroom activity [7,8]. For example, the central role of the teacher as a "change agent" has often been noted when introducing new technologies or new

approaches to teaching and learning [9,10]. For this reason, teachers' views, beliefs, and values with regard to use of games has been a frequent object of research [1].

As the teacher adoption of games was usually found to be low [11], or even faced resistance [12,13], most of the research has therefore focused on teachers' motivation and technology adoption. Teacher resistance has been mostly attributed to insufficient resources in terms of time and technology as well as teachers' lack of competence and self-efficacy with respect to feasible ways of using GBL technologies. The latter point is related to the notion that games are often still merely associated with play and entertainment, while their compatibility with teaching is disregarded—especially by those who have no personal gaming experience and might therefore be less open to experimenting with GBL [14].

The central assumption of the technology adoption research is that the use of games in the classroom is low. For this reason, researchers are focusing on teacher attitudes or "behavioral intention". However, the assumption of low usage has not very often been confirmed. Either the evidence is already somewhat older, or it is based on unsystematic observation [1]. In general, results that are based on large data sets—ones that focus on in-service teachers from across different educational levels—are missing [14].

1.1. Teachers' Use of Games in the Classroom

Several different studies have explored the use of games by teachers from different perspectives: teacher's beliefs [15], concerns [16], adoption intention [17], teacher perception of games [18,19], acceptance of GBL [1], integration into the curriculum [20], institutional and individual factors pertaining to information and communication technology (ICT) readiness [14], teachers' perception of barriers [11], exemplar teachers perceptions, use, and access [21], challenges involved in conducting a game based curriculum [22], and teachers´ attitudes toward game design [23]. The general results of these studies show that the teacher is the key, and their positive experiences with games and/or technology are important. However, all of these also start with general perspectives on resistance, barriers, and non-acceptance that somehow need to be overcome.

There are also papers that discuss the benefits, barriers, and guideline recommendations for the implementation of serious games in education for stakeholders and policymakers [24]. Tsekleves et al. (2016) highlight the importance of understanding the constraints under which teachers work and argue that a better understanding of the contexts in which games are to be used, and the roles teachers play during game-based learning scenarios, is a necessary foundation for improving games' viability as educational tools.

There have been attempts to look into the practices of teachers using games in their classroom. For example, the OECD (The Organisation for Economic Co-operation and Development) report TALIS (Teaching and Learning International Survey) looks into actual classroom practices, but games are not considered [25]. Level Up learning is a thorough national survey in the U.S.A. on teaching with digital games with 694 teachers that found that game integration is hard, and teachers are learning to teach with (digital) games informally [26]. However, this research has not been published in a peer-reviewed source, and it focuses on digital gameplay only. The goal of Dickey's [19] research was to investigate teachers' perceptions and insight into the potential of digital games for teaching and learning to gain insight into methods for integrating digital games in K12 education. They reported that teachers expressed conflicting feelings of optimism and scepticism about the use of games for learning. They found that in order to use games in teaching, teachers need to see the value beyond it. However, this study focused only on the perceptions of only four teachers rather than actual classroom practices. Stieler-Hunt et al. [15] looked into the beliefs of teachers who use games, but they focused only on digital game play. They found that the teachers had a belief that digital game play (DGP) could be beneficial for learning, which stemmed from experiencing their own subjective success from using DGP in the classroom, personal experiences with DGP, or through watching their own children play games. Due to the way this study conceptualized the perceptions and beliefs of teachers, it is not possible to draw any conclusions on actual practices. Using a quite small convenience sample of Singaporean

teachers, Koh et al. [18] found that teachers agree that games can be useful aid in education, but their use is irregular and infrequent. Proctor and Marks [21] found that the adoption of computer-based games for educational use in the classroom by primary teacher populations appeared to be in the Late Majority stage of the Rogers Technology Adoption Curve, while adoption by secondary teacher populations appeared to be in the beginning of the Early Majority stage. However, their research focuses on the practices of exemplary teachers only. All the results of these studies are important for this study because they identify several important practices, such as the frequency of using games, game type or technology, learning from their peers, or personal experience with games, etc., but a more systematic mapping of teachers' practices is still needed.

1.2. Mapping Teacher Practices

Therefore, the first goal of this research is to understand how widespread the adoption of games in classroom teaching in secondary schools in Estonia. While studies using the Technology Acceptance Model (TAM) usually explore intended behaviors, the goal of our research was to explore the actual current practices of game use among teachers. We did this by exploring the teachers' reasons for using games, their motivation, the support and barriers they experience, and the benefits they perceive as consequences. By exploring these issues, we were hoping to get a realistic picture of the situation in Estonia.

With this research, we are focussing on teacher practices that go beyond individual behavior and, instead, consider behavior to be embedded into a wider social context of use. The results of the international Innovative Teaching and Learning Research study show that innovative teaching flourishes in such school environments where there is a collaborative and supportive overall culture particularly in terms of (1) peer support and sharing, (2) teachers' direct involvement in practicing new teaching methods, and (3) a common vision that encourages novel approaches [27]. We needed to include not only the perspective of the teacher but also to understand the context of the teacher as well.

An important question to consider when studying actual game use in schools are the reasons for teacher to do so. By understanding the reasons of game use, it will also be possible to better guide the development of games in the classroom as well as stimulate their adoption.

A better understanding of the current practices around game use in the classroom would allow researchers to understand the actual situation in the real classroom to provide better, targeted support and materials for teachers, to provide better trainings for teachers, and to share the successful and failed practices.

Following this logic, we propose the following research questions:

RQ1: How widespread is the use of games in the classroom in Estonia?

RQ2: What are the motivations of teachers?

RQ3: What are the main barriers they encounter?

RQ4: What are the support mechanisms they use and need?

2. Method

2.1. Study Design

In order to get a more or less representative picture of actual practices of game use in the classroom in Estonian primary and secondary schools, a survey research strategy was followed that asked teachers to report their actual practices in a self-report questionnaire (Detailed in Appendix A). The survey design was descriptive and cross-sectional. The survey used an online survey form in LimeSurvey and collected answers from a large sample of teachers in Estonia. The study followed a mixed method design combining quantitative and qualitative methods. All of the questions in the survey, except for the background information, had an open field were teachers could add their comments.

2.2. Questionnaire Construction

For the design of our questionnaire, we drew on Hamari and Nousianen [14] as they mapped the reasons why teachers use games in Finland. Further sources were Koh et al. [18], who identified push, pull, and demographic factors of game use, and Bourgonjon et al. [1], who proposed a model for teachers' behavioral intention to use games in schools. In addition, we used the research of Tsekleves et al. [24] and Watson et al. [11], who identified the barriers encountered by teachers. The OECD report of pedagogical innovation [28] was also consulted in order to find relevant topics. Finally, the authors' previous research [29] was used to define typical patterns of practice (such as what triggers a certain practice, what are the benefits perceived, etc.)

The questionnaire consisted of the following sections:

Section 1 (Background information, five items, closed format): The first section asked for background information to enable a group comparison on the basis of some of the teachers' main characteristics. This part used closed questions on gender, age, county, years of teaching, and grade of teaching.

Section 2 (Use of games, five items, closed format): The items included closed questions on whether they used games in their teaching, about the frequency of game use, the purpose of game use, the technology used, and the type of games used.

Section 3 (Motivation and perceived benefit, three items, mixed format): This section included three questions: A closed question asked where they got the ideas to (start) using games. With two open answer questions, we asked: "What to you get from using games? What do students get from using games?"

Section 4 (Problems and barriers encountered, one item, open format): One open format item was used to ask what kind of problems they had encountered when using games.

Section 5 (Teachers' needs and support, two items, mixed format): Two closed, with the comment field, items asked for what had been supporting them so far and what support they felt was still missing.

The final section included several further exploratory questions, such as whether teachers had received feedback about their use of games (from students, parents, colleagues, or the school board) and whether they would recommend the use of games to their colleagues. There were further sections that consisted of a scale of concern-based adoption, and one on technology use. The results of these scales is reported elsewhere (see for example Jesmin and Rinde (2016) [30]).

The survey was piloted with 10 educators from different fields, after which minor revisions to the wording were made, and a few values were added to closed questions.

2.3. Sampling Strategy and Inclusion Criteria

In April 2017, an invitation to the survey was sent to all Estonian schools public emails. In Estonia, there is a central public database of all Estonian schools (eesti.ee), and the first round of invitations was sent to all schools to their main contact e-mail. In May, the invitation was sent again to teachers' individual emails available on their school websites. Altogether, almost 15,000 invitations were sent out to all Estonian school teachers. An effort was made to reach all Estonian teachers with this invitation. The invitation letter to the survey asked all the teachers to give their answers regarding game use in schools, whether they used games themselves or not.

In total, there were more than 1800 logins to the survey. A total of 1258 teachers filled in the survey at least partly, while 978 of them filled in the survey completely. For the later analysis, all responses with more than 50% missing answers were deleted from the sample. At the time of the survey, there were 14,581 active teachers, which means the response rate was 8.63%.

2.4. Data Analysis

The approach that we took was mainly descriptive and cross-sectional. Closed questions were analyzed with quantitative methods, and a Chi-square test was used to test the significance of the

differences (with SPSS version 18). For the last three research questions, we used mixed and qualitative methods. As we took the grounded theory approach, we aimed to describe the results as they were given by the teachers. The qualitative analysis of the open questions was done in two ways: thematic analysis or clustering similar answers. The thematic analysis was done by first familiarization by reading the results repeatedly, followed by open coding. Several themes and patterns emerged from open coding, and after reviewing the emerged themes, they were then assigned to categories designated to define related themes and patterns. These three rounds of qualitative analysis were done by one researcher. For the analysis, we conducted a manifested pattern search within the thematic analysis. This technique is especially appropriate for inductive content analysis, as opposed to a deductive approach using standardized content analysis. Our aim was to map the results in conclusive way, not to produce new high-level theories.

2.5. Ethical Aspects

The questionnaire was anonymous, and no information about the school or town/village name was asked, so it is impossible to follow the teacher. Only details regarding gender, age, and county (we have 15 of them in Estonia) were asked of the teacher. The authors declare no conflict of interest; there were no funding sponsors involved in this study. Informed consent was not necessary as participation in this survey was voluntary.

3. Results

3.1. Description of the Sample

A total of 90.8% (1142) of the respondents were female and 9.2% (116) were male; there are less than 14% of male teachers in Estonia. All of the 15 counties of Estonia were represented with the highest percentage in Harjumaa with 32.2% of the sample, and the lowest percentage in Hiiumaa, with 1% of the sample. The average age of the respondents was 47.15 (SD = 11.35), the minimum age was 22, and the maximum age was 77. The average years of teaching experience was 21.31 (SD = 12.33), the minimum was 1, and the maximum was 55 years. Most of the teachers taught in fourth through sixth grades (69.3%), and 30.8% of them taught in high school and 2.5% in applied education. By the overall population of Estonian teachers, it is a representative sample (www.stat.ee and www.haridussilm.ee). See the comparison in Table 1.

Table 1. Sample and population comparison.

	Sample	**Population**
Age Group		
Less than 30	10.5%	9%
31 to 50	47.2%	42%
More than 50	42.3%	49%
Gender		
Female	90.8%	87%
Male	9.2%	13%
Main Grades taught		
1–3	47.4%	20%
4–6	69.3%	33%
7–9	58.4%	31%
High school	30.8%	16%
Other	2.5%	Unknown

3.2. Use of Games

To address the first research question (how widespread the use of games is in Estonian schools), we used simple descriptive statistical analysis to give an overview of teacher's actual practices. A total

of 93.8% (N = 1175) of the respondents used games in their classes, 2.1% (N = 26) used them seldom. Only 4.2% (N = 52) of the respondents claimed not to use games in their teaching. The gender difference can be seen in Table 2, and the age and level differences can be seen in Tables 3 and 4.

Table 2. Game use and gender differences.

		Gender		Total
		Female	**Male**	
Do you use games in your teaching?	Yes	1083 95.3%	92 79.3%	1175 93.8%
	Sometimes	19 1.7%	7 6.0%	26 2.1%
	No	35 3.1%	17 14.7%	52 4.2%
Total		1137 100.0%	116 100.0%	1253 100.0%

Table 3. Age and games.

		Do You Use Games?			Total
		Yes	**Sometimes**	**No**	
Age	Up to 35	214 98.6%	0 .0%	3 1.4%	217 100.0%
	36 to 50	482 94.7%	9 1.8%	18 3.5%	509 100.0%
	51 to 65	445 91.4%	15 3.1%	27 5.5%	487 100.0%
	Over 66	34 85.0%	2 5.0%	4 10.0%	40 100.0%
Total		1175 93.8%	26 2.1%	52 4.2%	1253 100.0%

Table 4. Game use per grade level taught.

		Do You Use Games?					
		Yes		**Sometimes**		**No**	
		Count	**%**	**Count**	**%**	**Count**	**%**
1–3 grade	Yes	586	98.5%	5	0.8%	4	0.7%
4–6 grade	Yes	829	95.4%	16	1.8%	24	2.8%
7–9 grade	Yes	677	92.5%	21	2.9%	34	4.6%
10–12 grade	Yes	345	90.1%	11	2.9%	27	7.0%

Only 20.7% of teachers reported that they use games at least once a day, while 41.2% of respondents use games at least once a week, 22.6% use them once a month, and 5.3% used them seldom or not at all. Among male teachers, there are less teachers who play with students and the differences in gender are significant $Chi^2(2) = 46.504$ ($p < 0.0001$).

We see that in each of the age groups most teachers do play, although the percentage of players decreases when the age goes up. The differences in age groups are significant, although the actual differences are very small ($Chi^2(6) = 20.016$ ($p = 0.003$)).

The game genres teachers reported to have been used are shown in Figure 1. Teachers also named a wide variety of other games; altogether, there are 28 different types, including musical and movement games, cultural heritage games, and mathematical games.

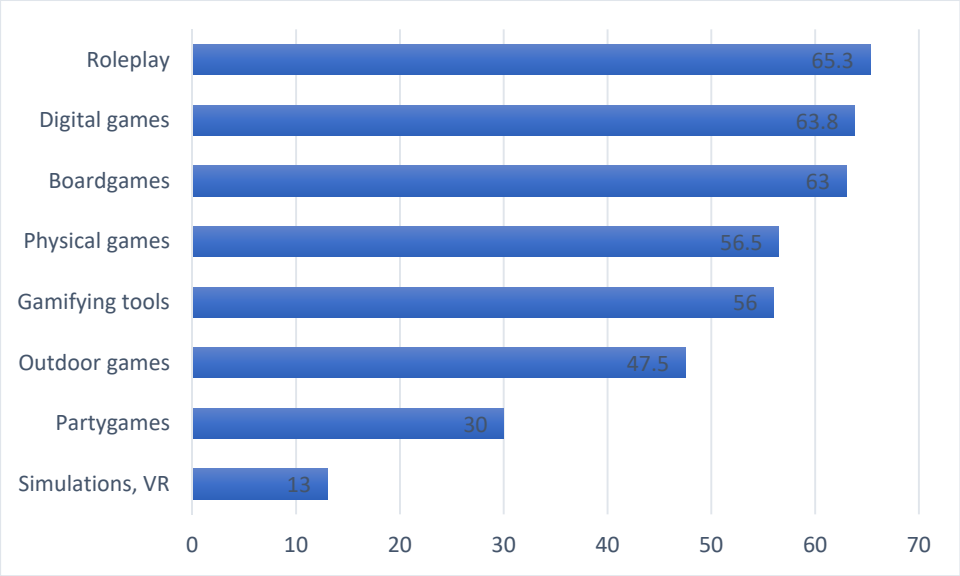

Figure 1. Game genre percentage.

Most teachers use some kind of technology to play, so we asked them about the technology they use with multiple choice question. The results are shown in Figure 2. Most common were personal computers (PCs) (62.3% of teachers) followed by smartphones (60.2%) and tablets (44.6%). None of the mentioned technology was used by 13.2% of the teachers.

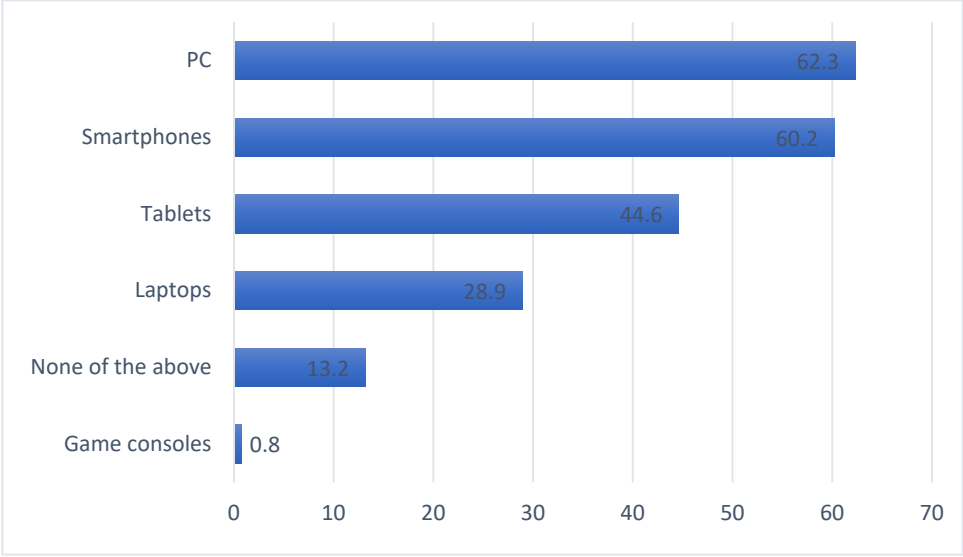

Figure 2. Technologies for games used in the classroom, percentage in respondents, N = 1258.

3.3. Teachers Motivation

To explore the reasons why teachers started using games and their reasons for doing it (RQ2), the following data were retrieved. The first question proposed was: from where did you get the idea to use games? Most (76.8%) of the teachers reported to have the ideas from formal training/school, and 61.7% responded that they get their ideas from their colleagues. Official trainings are the most

prominent source for motivation, and most of the teachers use their peers as triggers and sources for information to keep their practices updated and going. The results tell us that teachers rely on each other rather than more scientific recourses for information. It was their own initiative to start using games for 63% of the teachers. Teachers have the autonomy to decide on the methodology they use in their classes and to use games, so teacher's internal motivation needs to be triggered. However, 36.9% of the teachers reported that the ideas came from the students/children, and 19.3% of the teachers had the initial idea from the educational technologist. Less than half (44.6%) of teachers reported having an educational technologist in their school.

The multiple choice closed question, with an open option, was: "For which of the occasions you have used games?" The results are seen in Figure 3. We see that most of the teachers use games for alternation or change and less for physical development or behavioral change.

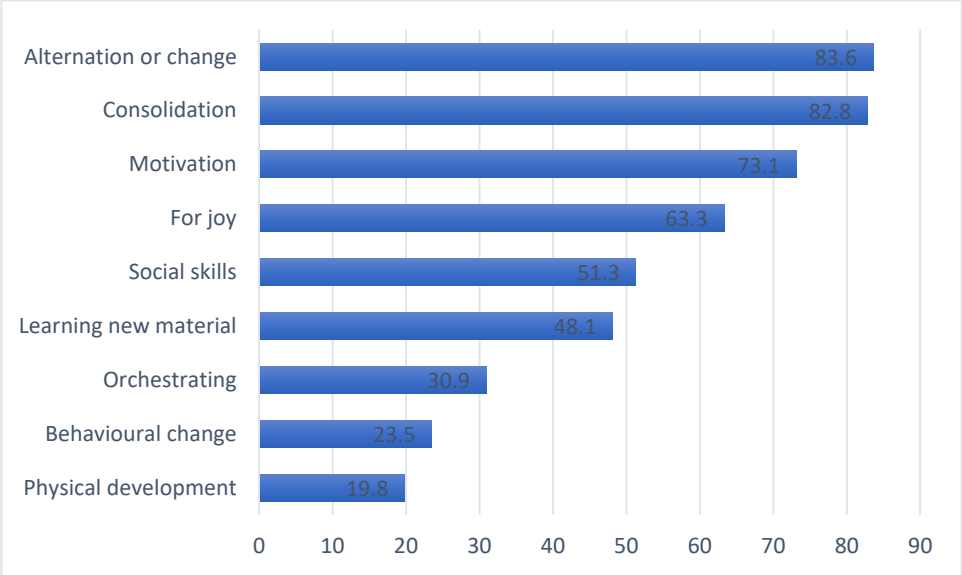

Figure 3. Reasons for teachers to use games, percentage in respondents N = 1258.

3.3.1. Perceived Benefits of Using Games in the Classroom

Whereas RQ1 mainly looked at the initial motivation and the triggers, investigating the benefits that teachers see in using games is a critical concern, as it can be assumed to be an important factor in teachers' motivation to continue to use games (RQ2). As we did not want to bias the responses and wanted to give teachers the opportunity to express themselves freely, we opted for studying the perceived outcomes of using games by open questions and qualitative coding. We asked with two open questions what they perceived to be the outcomes of using games for themselves and their students. As the categories overlapped and the results for teachers and students were alike, the results are shown in one table. Below is the clustered list of responses from qualitative content analysis.

3.3.2. Perceived Benefits for Teachers and Students

Although most of the comments were positive, which you can see in Table 5, there were also opinions that playing is a waste of time and it is overrated, it is not suitable for high school, and it gives nothing to the teacher. There were a few opinions that playing is a waste of time and they learn nothing, and it is an opportunity to avoid studying. Some teachers are afraid that students might get angry or frustrated. One teacher said, "Not in my class, because we actually work".

Table 5. Perceived outcomes of using games for teachers and students.

Category	Sub Categories	Quotes
Motivation	Creates interest Activates Seemingly effortless learning Sparks students' curiosity Students can choose their own pace Active participation Students can move around the classroom and can go outside	*"It catches and keeps students' attention"* *"More lively participation"* *"Games help against exhaustion"* *"Time limit makes slow students work faster"* *"They see that learning can be modern and cool, too"* *"Playing comes naturally for the children"*
Alteration	Variety Exemplify, illustrate Put theory into practice Consolidation Visual resources	*"It makes studies more interesting and brings variety."* *"Makes drilling more fun"* *"Helps to give an alternative perspective to the subject"* *"It makes learning non-traditional."* *"It shows that you can use materials learned in class in a different situation."* *"Gives an opportunity for the teacher for a different kind of cooperation with the students."*
Emotion	Creating joy, thrill, fun, and excitement Experiencing success Joy of discovery Competition Reduces stress Empathy	*"If they feel success, they want to come to school and class."* *"Using games can trigger competition among students, but this is not always good."* *"It is enjoyable to watch children learning eagerly."* *"It creates positive feelings toward the subject"* *"It can be an emotional let-out."* *"Everybody feels success and the joy of making things on your own."* *"Students are not afraid and they can repeat as much as needed."* *"Games create competition and thrill."* *"Gives the feeling of success to every student"* *"They consider each other more"*
Evaluation	Enables student evaluation See how they behave in a new situation Comparison	*"Gives the opportunity to grade or evaluate."* *"I can see the students in a new situation, how they communicate, and what they know."* *"Gives information about the students' abilities* *"They can compare over the web with other alike students."*
Feedback	Fast and immediate feedback	*"Endless possibilities to comment"*
Skills	Using digital tools in a purposeful way Physical development Hand–eye coordination Reaction Courage to perform and present Ability to focus Skills to read instructions Entrepreneurship Critical thinking Decision making Abstract thinking	*"It teaches them how to use smart devices in an educational purpose"* *"How to digitalize their knowledge"* *"The possibility to create their own games"* *"They can put their skills into practic.e"* *"Games make them communicate." "Speed of reaction improves"* *"'New talents' arise"* *"It boosts their analyzing skills"* *"Broadens their vocabulary"*
Social skills	Cooperation Emotional control Self-regulation skills Helpfulness Independence Self-efficacy	*"Gives them courage to communicate with the teacher"* *"Students teach each other"* *"Teaches them how do deal with losing"* *"Competition with yourself and others"* *"Getting to know your peers"*
Orchestration	Discipline Inclusion Fulfills time in a meaningful way Resting Creating atmosphere	*"It helps to manage and prevent discipline problems."* *"Using games creates tensionless environment"* *"It teaches respect, honesty, and fallowing game rules."* *"It stops cheating."* *"Playing games can be used as a reward after work."*
Class cohesion	Creates a whole Tunes in Creates a good learning environment Supports different learning styles Inclusion Caters to students on different levels Students can learn at their own pace Adaptability	*"Everybody is involved."* *"Using games glues the class together."* *"Creates the right mood"* *"Creates the flow"* *"Sense of belonging"* *"Creates better relations between teacher and students"* *"The knowing that you are not alone—there are people just like you out there."* *"Helps shy students to show their strong sides"* *"It makes teaching to special needs children possible."* *"Games give the opportunity for both cooperation and working on your own."*

Table 5. *Cont.*

Category	Sub Categories	Quotes
Learning	Mental challenge Interdisciplinary Adding extra material Supporting exploratory learning Broadening the world view Boosts creativity Helps to understand Consolidates knowledge Boosts their proficiency Informal Exploratory learning Proficiency Resilience Changes their behavior	*"Makes new material more easily acquired"* *"It is easier to get the information through a game."* *"They teach the importance of rules and waiting for your turn."*
Teachers	Develops their skills Keeps them up to date It is exciting for them, too Boosts their confidence Time management	*"The sparkle in the students' eyes gives me more energy."* *"It is a one-time effort to learn a new game or to prepare the materials—you, and your colleagues, can use them repeatedly after that."* *"Students trust their teacher more and are more open."*
Saving	Students can use their own devices Virtual resources Re-using materials	*"Using virtual resources saves paper and the environment."* *"This enables using materials made by others."*

There is a big variety in the benefits that teachers perceive of using games in schools. Although initially they were asked to list the outcomes for themselves and students separately, most of them gave similar answers to both of the questions. So, this means that teachers do not play only for the students, but it also gives themselves quite a lot of benefits. Similar to keeping their skills updated, it is exiting for them too and enables reusing already existing materials.

Besides the topic content for learning, using games teaches the students a lot of real-life skills such as emotion handling, independence, self-regulation, and abstract and critical thinking. Games as a means of teaching are appealing and motivating for the students, and teachers can see them using different set of skills in an informal context. The immediate feedback, adaptability, and visual resources cater to the needs of students who have different skill levels or learning styles. Games can be used as rewards, for tuning in or resting, teaching new materials, or evaluating student's skills.

3.4. Problems That Have Occurred

The third research question was about the barriers teachers have encountered (RQ3). In order to address the problems teachers have faced while using games in class, we need to map them first. Teachers were asked to write down in their own words the problems that have occurred while using games. Thematic analysis was conducted to analyze the problems that teachers had encountered. Four broad themes emerged from the analysis: technical, resources, teacher-related, and student-related.

3.4.1. Technical

A number of the problems that teachers have encountered were technical. At least 17 different technical problems where mentioned. Some of them were related to connection and hardware issues that have been already solved by the government in 2022—all Estonian schools will have brand-new IT infrastructures (HITSA) [31]. Some of the problems mentioned were related to BYOD (bring your own device) such as low batteries and different operating systems. A more detailed overview of the technical problems is described in Jesmin and Rinde (2018) [30].

3.4.2. Resources

A total of 27 different problems about resources were mentioned. Teachers report the lack of resources, such as money to buy games as well as databases that would offer games for all subjects and ages, a lack of thematic (suitable) games, and the lack of (educational) games and environments in the Estonian language. Available games may not be educational or there is a lack of info about the

educational purpose or proof; there is no statistical feedback. In addition, there was a lack of suitable places, physical elements, and a lack of games for older students or adults. Teachers also mentioned copyright issues and that there is no training available for this.

3.4.3. Teacher

There were 11 concerns about the teacher, such as the lack of time, ideas, and skills. Sometimes, the teacher does not want to use smart devices or is not interested in games, has low self-esteem, or does not trust his/her skills. One teacher had a problem that colleagues do not take her seriously because she plays. Other had to convince the students that educational computer games are necessary. Some teachers felt the lack of support from colleagues or parents or the lack of IT support.

3.4.4. Students

Most of the concerns—34 all together—were about the students. The main concerns about students were related to discipline—they get too excited, noisy, and emotional, and it is hard to return to more classical ways of studying. In addition, there were also concerns regarding the uneven level of students, lack of motivation to do something different, or that students tend to go to social media when they are using the Internet. There are also relationship problems—they do not want to be in groups or pairs with some other students; more active students shade the shy ones or losers are unhappy. One teacher stated that, "The student who always wins, does not want to play anymore because he/she is embarrassed." Another complained that, "Sometimes, they don't read the instructions but push random buttons." Sometimes, they can't finish in time or some games take too long, so the students get bored. Sometimes, the students start to compete or cheat. Some of the students just do not want or do not know how to play. Some students say that playing is not learning or they get the feeling that this is just plain fun and have to do nothing. There were opinions that students spend too much time on their phones anyway. There is a danger of physical harm—falling or hurting themselves—it is safer just to sit down.

3.5. Teachers' Needs

The final research question was about teachers support mechanisms (RQ4)—what do they feel that has been supporting them so far and what is still missing? Almost all of the questions in the survey had an open field where teachers could add their comments. Most of the comments expressed teachers' needs and opinions. Here is a clustered summary of the needs that teachers expressed across the survey.

The technical tools that are mostly needed are more computers, tablets, personal tools for every child, a digital board, more computer classes, and better connection including Wi-Fi outside of the schoolhouse.

Teachers mention that they need support from others. From parents, they expect the understanding that games are not just played for entertaining students, but that they are an important part of student learning. From management, mostly material support is needed, such as funds for buying games or better infrastructure. Students are very motivated and eager to give initiative to teachers, so they are the ones already supporting the teachers in using games.

Many schools in Estonia employ educational technologists whose job is to support teachers in their use of technologies in the teaching process. Not only do they give technical support, but they also support the pedagogical application of technology. In the survey, several teachers noted that more support was needed from them.

Teachers were often referring to the need for inspiration and ideas from peers and colleagues. Support from peers is expected mostly in the format of ideas and initiatives. They should share their good experiences and examples with others—it saves a lot of time for the others. In addition, there is a need for more experienced and knowledgeable colleagues to whom to turn to when advice is needed. Communities where teachers can share with others who teach the same subject were mentioned a few times. Current practices are unsystematic and rely on teachers' own motivation to test and try

everything out for themselves, rather than use the experiences of others. Teachers are willing to acquire new (digital) skills for the use of tools via easily accessible trainings, which are needed. They proposed that once or twice a year there could be a training session to learn new opportunities.

Teachers report that they need more and flexible time to prepare, because a lot of games need a lot of time to create and prepare (such as quizzes and outdoors games). There is doubt that the reward for preparing for such a long time but playing for such little time is enough.

The resources and games available need to be interesting for the teacher as well. The games and materials need to support exploratory learning and need to be in line with the national curricula.

They need a single place for inspiration and resources such as games and support materials that are systematized by subject, topic, language, level, etc. They need environments where you can freely look around and search on your own as well as online libraries/collections/repositories where teachers can add their own resources with a few tags. Teachers as the best practitioners possess the knowledge and experience of what works and what not. To make sure that the games used in schools have an educational value, best practices are valuable.

4. Discussion

4.1. The Prevalance of the Use of Games in the Classroom

Contrary to what seems to be common assumptions in the literature, we find that the use of games is widespread in Estonia. Most (93%) of our respondents use games in classroom teaching, most of them use them regularly. Only 4.2% of the respondents claim not to use games at all. This shows the importance and popularity of GBL in Estonian schools. It is probable that we will see this as a trend also in other countries, as games are more widely seen as tools rather than just mere entertainment. In addition, many countries now focus on educational reforms focusing on student-centered learning. As previous research has shown that the current educational system is considered as a huge barrier for adoption of games in schools [11], this does not seem to be the case in Estonia. Teachers have successfully adopted games despite the difficulties they might have encountered. This means that the future educational reforms could include GBL as one method of teaching and provide tools to make that happen efficiently. Dickey et al. (2015) [18] reported that teachers expressed conflicting feelings of optimism and skepticism about the use of games for learning. Our research shows the while there is still some skepticism, the wide variety of benefits that teachers report to come out of GBL tilts the scale to more positive feelings and outcomes.

The gender differences we see in game use might be because there are few male teachers in Estonia overall (around 10%), and they are even more underrepresented in primary schools where games are used more. Another reason could be as well that physical education teachers do not consider their activities as games; they take them as regular activities.

Proctor and Marks [20] found that the adoption of computer-based games for educational use in the classroom was accepted more by primary teacher populations as their uncertainty around technology is largely resolved, while secondary teachers are willing to adopt the technology as long as they understand how it fits with their lives. This may be the case of our study as well, as we see that in primary school, the highest percentage (98.5%) of teachers are using games, and this percentage descends the older the grades get, down to 90.1% in high school. So, it is important to encourage teachers to adopt innovations and explain to them what the benefits of using games in classes are.

4.2. Perceived Benefits, Barriers, and Support

With this research, we were also intending to explore the wider context of game use, such as the reasons why teachers used games (RQ2). As in many other cases, we see also here, almost three-quarters of teachers use games to motivate students [1,14,17]. This is a common situation—teachers use games rather as awards, treats, or for drilling, but only less than half of the respondents used games for actually teaching new skills. This shows that teachers themselves are not familiar or are afraid to

use games as educational tools rather than just tools for entertainment. Serious games with specific aims are developed rapidly, but teachers still prefer to use games in a more entertaining way. This shows that there is a gap between educational games developers and teachers using actual practices. This gap needs to be addressed, for example with more systematic collaboration between developers and teachers. In addition, an evidence base of educational games for teachers is needed, as we discuss also below.

Our third research question was about the barriers teachers have encountered (RQ3). We identified four themes of problems: technical, resources, teacher related, and student related. The technical problems are already being solved, but the lack of resources is still prevalent. Teachers report a lack of games—either there are none or the existing ones are not suitable or specific enough. This suggests that there is still an untapped opportunity for the design of suitable educational games. Universities have addressed this need by offering programs that provide skills for the development of specific digital games for educational purposes. The barriers that teachers reported, such as technical—a lack of time, ideas, games; or teachers' skills and knowledge are very common and have been mentioned in previous research repeatedly [1,11,14]. The lack of skills need to be addressed by better integrating the use of new technologies in education into teacher trainings, which should be now a priority in many countries. One way to fix the lack of ideas is to propose an evidence base where teachers can share their positive and negative experiences using games in schools. We will discuss this more thoroughly in Section 5.

In line with Koh et al. [18], our teachers seemed to agree that games can be a useful aid in education. However, these authors also stressed that their current use is irregular and infrequent. While we see that games are frequently used, there is still a lot of irregularity and lack of knowledge. Therefore, our final research question was about teachers' support mechanisms (RQ4). As Tsekleves et al. (2016) highlight the importance of understanding the constraints under which teachers work as a necessary foundation for improving the viability of using games as an educational tools, we looked into these factors. While current studies of game adoption seem to focus on the awareness and motivation of teachers to use games, it is obvious from our results that the problems lie somewhere else. Our research shows that the current support mechanisms that teachers draw on are their individual motivation and inspiration, as well as inspiration they draw from experiences made by others or suggested to them in trainings. As Hamari et al. (2015) [14] stated, the willingness to adopt games seems to rely heavily on individual factors but, at the same time, a supportive social environment can play a significant role in providing encouragement. In line with this, in our study, the needs that teachers expressed focused quite a lot on the social and organizational context from which they sought better support (such as from their fellow teachers, management, and parents).

5. Implications and Limitations of the Research

5.1. From Experimentation to Evidence-Based Innovation

While previous research focused on raising awareness of the opportunities of games in the classroom and motivating teachers to use games, our research points to a different need. Our research shows that awareness and motivation among teachers are high and experimentation on using games is widespread. Instead, what seems to be the problem is that practices appear fragmentary and not widely sustained and supported. We assume that there are two reasons for this, which we will discuss briefly below.

(1) Using games in the classroom is not sufficiently evidence-based

Our study suggests that the use of games in the classroom is widespread but rather ad hoc and not evidence-based. For example, our data show that a lot of the teachers have initially received an invitation to start using games from their peers or it has been their own initiative. This has been the same case as that in the Level-Up learning survey on teaching with digital games that found that game

integration is hard and teachers are learning to teach with games informally [26]. Our respondents also agreed that they were looking for ideas and sources from other teachers. However, there is also the danger that the informal information flow and procedures between teachers are rather unsystematic. While there is a realization by teachers that games have a broad set of positive influences (e.g., academic learning outcomes, technological skills, motivation, social cohesion in the class), in the current literature, there is only a little research that looks at the wider influences of adoption of games. Qualitative analysis of the open answers reveals a quite widespread insecurity about the effectiveness of games and how they should best be put to use in pedagogical practices. For example, teachers are expecting more systematic and sustainable ways of learning and sharing about evidence-based game use. This is also in line with a point of Hamari and Nousianen (2015) [14] about insufficient resources in terms of time and technology. Teachers do not want to waste their scarce time on searching, creating, or testing a game that has no educational value.

As an implication of this study, we suggest the creation of an evidence base that is integrated into teachers' social support structures. The evidence base needs to include not only evidence of effectiveness, but also a rich exchange on current experiences and best practices. We need to provide a solution where good examples of others and learning from peers' experiences is present. Similar conclusions were made by Koh et al. [16], who suggested to create a community of teachers to build a nationwide resource library about games to support learning. Such a knowledge-based library would benefit teachers through providing selection guidelines for appropriate games as well as building expertise in using specific games.

(2) Current support for teachers focuses on individual factors and misses social and organizational support mechanisms

In our results, there is evidence that perceived social support, embeddedness in support systems, and organizational practices are weak. Qualitative analyses reveal a strong wish for more opportunities for peer learning and support with regard to game adoption, especially with regard to subject-specific innovations. We see that that practices are triggered by one-off trainings, but support after that is to some extent missing. Creating an opportunity to form communities of teachers who support each other in developing the games and their use further after trainings should make the learned skills and practices more sustainable.

The results of the International Innovative Teaching and Learning Research (ITL) study show that innovative teaching flourishes in such school environments where there is a collaborative and supportive overall culture particularly in terms of (1) peer support and sharing, (2) teachers' direct involvement in practicing new teaching methods, and (3) a common vision that encourages novel approaches [27]. This is also confirmed in our survey results, as a majority of our respondents got their initial ideas and motivation from their peers, and 81.2% of the teachers in our survey admit that they have teachers teaching each other. This means that workplace learning and peer-to-peer knowledge sharing is important and needs to be factored in when professional learning opportunities are created. An example of how such integration may happen is the "Teacher's Innovation Laboratory" training methodology, which was recently proposed in research done by Leoste, Tammets, and Ley [32].

Another important support mechanism for teachers is curriculum integration. According to Romeo and Barma (2015) [20], one of the main factors in the teachers' decision-making process when deciding to use games in formal educational contexts is whether the games support the curriculum. In the context of integrating digital games into formal education, teachers' experience and the curriculum-relatedness of the games are particularly crucial in the adoption process [17]. In our survey, teachers also reported the need for systematic and practice-driven information flows. This suggests that important criteria that should be taken into account when making information about games available (e.g., in a knowledge base that was mentioned above) is the relation to national curricula. As national curricula differ and also change over time, there would be a need to provide this information in dynamic form and linked to several national curricula.

5.2. Limitations of the Research

Certainly, our research has some limitations that are connected to typical biases in survey research. For example, concerning sampling, although the invitation to participate asked all teachers, regardless of their game use, to give their opinions about games in teaching, it is possible that teachers who used games were more likely to answer the survey. This may have introduced a response bias. The questionnaire was in Estonian only; this might mean that teachers using other languages (e.g., Russian) might have been underrepresented, although the percentage of respondents from mainly Russian-speaking schools is high (Ida-Virumaa 6.6%, N = 83), and some filled the questionnaire out in the Russian language.

The questionnaire asked teachers to self-report their current practices. While there is a question of the validity of such statements, we believe that the answers have been accurate. First, the questions were related to their behaviors in the classroom, and it is known that self-reporting about behavior is usually more accurate than inferences about attitudes or intended behaviors [31]. Secondly, the chance for social desirability can be regarded as low, because Estonian teachers are autonomous to decide how they teach. The national curriculum sets the topics and gives suggestions, but the teacher is the final decider. So, there is no real social desirability to take place, because there are no ideals to strive to.

As there were altogether 60 questions in the survey, together with additional sections for different purposes, the dropout rate could be explained by the length of the survey and teacher's scarcity of time. The survey itself was online, so all the teachers who received the invitation had access to it. If they personally might not have had access to Internet, then all the Estonian schools have access, as most schools use online study systems (eKool, eSchool). What has likely reduced the response rate is the fact that teachers are overloaded with questionnaires, especially in the spring time, as they are popular research subjects in Estonia.

A further limitation may be seen in the generalizability of the results to other countries. Our results may be driven by the special circumstances in the Estonian school system. For example, in Estonian schools, teachers have a high degree of autonomy and there exists generally a technology-friendly culture [25]. This might have led to a quick adoption of game use. Although previous research has shown that Estonian teachers report similar issues as other teachers when it comes to games use in schools [11], Estonian teachers have quite high autonomy in regard to the methods they use for teaching. They have to follow the national curricula that states the topics, but methods-wise, it is up to the teacher to decide how to pass on the knowledge. This is not so common everywhere, but as we see that GBL is becoming more popular all over the world, we can suggest that the status of Estonian teachers' game use can be taken as an example of how things are going to be developing elsewhere.

A possible limitation of the study is its broad concept of games. We included all forms of games such as serious, physical, role-playing, and board games. The interpretation of different types and genres of games was left to respondents.

Another limitation was that the qualitative analysis was done by only one author. This proposes the possibility of a researcher bias. This research took an open grounded theory approach; there were no expectations of the researcher to bias the analysis. We were not looking for conformation or contradictions to any specific theory. The aim was to map, not to draw extended conclusions. Currently, we are looking for possibilities to make the raw data publicly available.

6. Conclusions

In this article, we have presented the first large-scale study to look into game adoption in Estonian schools. We looked into teacher's practices of using games in schools. We proposed four research questions. The first of the questions was: "How widespread is the use of games in the classroom in Estonia?", and we found that the use of games is very extensive in Estonian schools. Only 4.2% of the respondents do not use games in their classes. The second question was: "What are the motivations of teachers?", and we found a large number of benefits that teachers see for themselves and for the students such as motivation, emotions, class cohesion, new skills, etc. We addressed the problems

with third research question: "What are the main barriers they encounter?" The problems were related to four broad topics, which were technical, resources, teacher, and student-related issues. The final research question tried to look for solutions for problems: "What are the support mechanisms they use and need?" Support from management, colleagues, and parents is needed. It could be material or mental in the form of understanding and supporting their strives for innovative teaching methods. Inspiration and good experiences are also expected from peers.

The findings are significant as they show that GBL is a more common practice of teachers than previously thought. These practices need to be taken into account when providing new guidelines of materials for the educational systems. In addition, the funding must be overlooked, and the teacher trainings plans need to be rewritten to adapt to the actual practices of teachers. There is a need to support the teachers materially and also knowledge-wise.

This analysis leads us to propose further research that is needed as well as practical mechanisms to support adoption in a situation where the use of games is already quite well established but might not be not as systematic as one would hope. To improve the integration with daily teaching and learning practice, issues of scaling, sustaining, and about the lack of evidence need to be addressed. Teachers need to be better enabled to share their ideas and best practices with their peers. We suggest the creation of an evidence base through which research on the use of games in learning should can be shared and systematized. Research should also focus on a more systematic study of the concerns of teachers with regard to games adoption, and collect evidence on a wider set of criteria (that go beyond student motivation and learning gains).

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Appendix A

Questionnaire Elements. Translated

1. Background information
    a. Gender
        i. Male
        ii. Female
    b. County
        i. Harju
        ii. Hiiu
        iii. Ida Virumaa
        iv. Jõgeva
        v. Järvamaa
        vi. Läänemaa
        vii. Lääne Virumaa
        viii. Põlva
        ix. Pärnu
        x. Rapla
        xi. Saare
        xii. Tartu
        xiii. Valga

xiv. Viljandi
xv. Võru

c. Age
d. Years of teaching
e. Level of teaching

i. 1–3 grade
ii. 4–6 Grade
iii. 7–9 Grade
iv. 10–12 Grade
v. Vocational school
vi. Other

2. Game use

a. Do you use games in your classes?

i. Yes
ii. no

b. How often do you use games?

i. At least once a day
ii. At least once a week
iii. At least once a month
iv. At least once during the semester
v. Seldom or not at all

c. For what have you used games in your classes?

i. Consolidation
ii. Teaching new material
iii. Alternation/change
iv. Motivate
v. Joy
vi. Orchestrating
vii. Behavioral change
viii. Social skills
ix. Physical development
x. Other

d. What technologies have you used for playing?

i. Table tops (PC)
ii. Laptops
iii. Game consoles
iv. Smartphones
v. Tablets
vi. Haven't used
vii. Other . . .

e. Mark all the types of games that you have used

i. Digital games (ex. computer games, apps, social media games, etc.)
ii. Gamification tools (ex. Kahoot, Quizziz, etc.)

iii. Board games
iv. Outdoor games
v. Role games
vi. Party games
vii. (Physical) Movement games
viii. Simulations, VR
ix. Do not use games
x. Other . . .

3. Motivation and benefits

a. From where have you received ideas to use games?

i. Colleagues
ii. Educational technologist
iii. Training/school
iv. Students/children
v. It was my own initiative
vi. Other . . .

b. What do you get from using games?
c. What do the students get from using games?

4. Problems and barriers

a. I have had the following problems with using games . . .

5. Teacher needs and support

a. What has been supporting so far in the game use?

i. Tools
ii. Inspiration/ideas
iii. Motivation
iv. Trainings for tools
v. Formal trainings (HITSA; koolielu.ee, etc.)
vi. Support from the management
vii. Support from parents
viii. Initiative from students
ix. Support from colleagues
x. The possibility to learn on my own
xi. Online resources
xii. Self-efficacy
xiii. Do not use games
xiv. Other

b. What is still needed for you to (start) using games? (Each option had a comment section)

i. Tools
ii. Inspiration/ideas
iii. Motivation
iv. Trainings for tools
v. Formal training (HITSA; koolielu.ee, etc.)
vi. Support from the management

vii. Support from parents
viii. Initiative from students
ix. Support from colleagues
x. The possibility to learn on my own
xi. Online resources
xii. Self-efficacy
xiii. Do not use games
xiv. Other

6. Feedback

a. I have received feedback from … (with commenting options on each line)

i. Students
ii. Parents
iii. Colleagues
iv. School board

b. Would you recommend the use of games to their colleagues?

i. Scale 1 to 5 (No to Yes)

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