

# ***Gamified city for 6th graders:***

## **The effect of gameful experience on students' 21st century readiness in Finland**

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### **ABSTRACT**

Teachers are continuously challenged with questions of how to meaningfully convey skills of modern society, i.e., 21st century, to young children. Increasingly, gameful methods and playful learning environments are employed in formal education to enhance teaching. This paper examines a physical learning environment of Yrityskylä in Finland, which simulates a city where students act as employees and consumers through various gameful methods. We investigate the relation of 6th grade (12-year-old) students' (N = 253) skill and attitude formation based on 21st century framework before and after attending the learning environment. Through Partial Least Squares (PLS) Structural Equation Modeling (SEM), the results show a positive association between gameful experience and all examined 21st century skills dimensions. Whilst it is important to consider the novelty effect and holistic nature of the school day spent in the gamified learning environment, our findings nevertheless indicate the potentiality such a day can have on young students.

### **Keywords**

gameful experience, 21<sup>st</sup> century skills, learning environment, gamification

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## INTRODUCTION

Youths' interest and readiness to act in the society is necessary for the constructive development of civilization and more immediately to the individuals thriving as part of their social communities. Understanding the necessary skills and developing the appropriate attitudes towards functioning in a society are of crucial importance already from younger years. Hence, the European Union (EU) as well as The United Nations (UN) have commissioned nations to promote formal civic and citizenship education at all levels of education from primary school to higher (European Commission 2018; World Youth Report 2016). However, civic education programs differ greatly by country and local curricular requirements, as the complex nature of "good" nationality and citizenship raises several pedagogical, practical and even ethical questions (Themistokleous and Avraamidou 2016). Instead of focusing on traditional civic education, scholars have suggested shifting the emphasis towards 21st century learning, which compiles key skills needed to function in a modern society (Lonka et al. 2018; Ranta et al. 2022). However, 21st century skills, such as self-direction, accountability and communication (Battelle for Kids 2019), are rather vague and complicated to teach especially to young people, which is why meaningful, practical and appropriate methods are desperately needed in the educational field.

The pervasive spread of digital games into the daily lives of people through, e.g., culture and entertainment has resulted in teachers increasingly employing gamefulness into their teaching to make learning more relevant, fun and attractive for children and youth. Studies show that compared to "traditional" teaching methods (i.e., teacher-centered passive content delivery), game-like interactive lessons increase, for example, retention (Parker and Lepper 1992), motivation (Majuri et al. 2018) and engagement of students (Da Rocha Seixas et al. 2016). However, stand-alone games or individual gamification elements may not sufficiently meet the criteria of modern curricula, which emphasize large entities, project-based learning and comprehensive learning experiences (Parker and Thomsen 2019). To convey both theoretical content (i.e., curricular requirements) as well as social and personal skills, (e.g., 21st century skills), researchers have called for the need for more complex and pedagogically meaningful gameful experiences (Aura et al. 2022; Hassan and Hamari 2020; Parker and Thomsen 2019). In formal education, these sorts of experiential environments are still rather unique and, additionally, understudied.

In this paper, we examine one of the most popular educational innovations in Finland: *TAT Yrityskylä (Me and My City) Primary School* (Yrityskylä from here onwards), which is a pedagogically designed learning environment for 6th graders to learn about society, work and economy. The learning environment is a physical simulation of a miniature city, where students roleplay as managers, employees and customers whilst practicing 21st century skills through work tasks, teamwork and gameful activities. Via this gamified learning environment, Yrityskylä aims to teach practical and personal skills of students, as well as develop positive attitudes towards their future as members of modern society. In this study, we investigate 6th graders' (12-13-year-olds) ( $N = 253$ ) 21st century skills and attitudes (i.e., readiness) with the association to their gameful experience (GAMEFULQUEST) (Högberg et al. 2019) in the learning environment. More specifically, the aim is to answer the research question of: *How does a gamified learning environment affect 6th grade students' 21st century readiness?* Through quantitative measurements of students' self-reports before and after the Yrityskylä visit, we produce unique information and insights on how a holistic gamified learning experience influences students' skill acquisition and attitude formation towards the 21st century framework, and how such experience can be utilized internationally to design and support engaging, effective, and enjoyable pedagogical tools for young people.

## BACKGROUND

### 21st Century Learning

Several 21st century frameworks have been produced by various scholars and institutes to depict the abilities and traits citizens should acquire to function in modern work and society (Ranta et al. 2022). Renowned frameworks by, for example, Definition and Selection of Competences (DeSeCo) (Rychen and Salganik 2003), Assessment & Teaching of 21st Century Skills (ATC21S) (Care, Griffin, et al. 2018), as well as Battelle for Kids Partnership 21 (P21) (Battelle for Kids 2019), share many similarities, including skills of teamwork, creativity and problem-solving, among others. The Battelle for Kids Partnership 21 (P21) is often adopted in schools and employed in this study as well for its granularity and appropriateness in terms of key areas and its focus on business, as it is developed by teachers, educational experts, and business leaders (Battelle for Kids 2019). In addition to core academic subjects such as math, literacy and history, P21 divides the 21st century skills into three domains of *learning and innovation skills*; *information, media, and technology skills* and *life and career skills*. Learning and innovation skills entail abilities such as creativity, critical thinking, communication and collaboration. Information, media and technology skills includes information, media and ICT literacy. Lastly, life and career skills consist of e.g., adaptability, self-direction, productivity, responsibility and leadership skills. Overall, the frameworks for 21st century learning comprise a broad range of practical and personal abilities, however, the question of how to meaningfully and pedagogically deliver such skills already from younger years still remains.

The most common critique of the concept of 21st century learning is that it implies that there are skills that are especially relevant for this century only (Lucas 2019). Moreover, the P21 framework, which is utilized in this study, has been questioned for its overly positive take on transferable and personality skills, reducing the importance of core academic subjects and general knowledge. The developers of P21 have addressed this critique saying that teaching of 21st century skills could never be in separation from content, because “knowledge is the base of learning” (Cavanagh 2009; Kay and Greenhill 2011). However, knowledge changes, especially in these times of internet and floods of information, and therefore children should be equipped with learning skills as well as adaptability, critical thinking, and other abilities commonly included in the 21st century framework, to help them function in modern society (Geisinger 2016). Moreover, we think that especially in a context such as this study, a framework with explicit categorization of these skills may provide us a meaningful tool for measurement and research purposes.

Beyond the criticism, Lucas (2019) recommends the educational field to move on from the discussions about what the 21st century skills exactly are, towards designing pedagogical solutions to embed in formal education to support students’ lifelong learning. However, teaching these quite abstract and personal skills in practice involves various challenges. Subjects of productivity, responsibility and accountability might appear as distant topics for young people, who perhaps see them as only adults’ concern (Kahne and Middaugh 2008). Schooling today is increasingly assessed through academic performances and tests, which mainly evaluate skills that are measurable, such as math or linguistics, while traits such as collaboration and creativity are not formally examined (Kay and Greenhill 2011; Care, Kim, et al. 2018). This leads to emphasis on teacher-centered learning, where students are prepared for formative assessments but perhaps not for life outside school. Furthermore, even if teachers wish to focus on teaching social skills and other traits typical for 21st century framework, they might lack the proper methods to do so (Parker and Thomsen 2019; Kangas 2010). When the aim is to raise active members of society, expectedly also the methods to do so should promote curiosity, interactivity and engagement through relevant and

meaningful practices. Thus, pedagogical services such as *Yrityskylä* that seek to combine both academic learning and children's personal development may provide valuable pedagogical support for educational professionals in the midst of external pressure and expectations.

### **Gameful (Learning) Experience**

Gamification of education has gradually become the go-to rhetoric of teachers aiming to enhance students' will to explore, perceive and learn about the world surrounding them (Landers 2019; Majuri et al. 2018). Fundamentally, gamification leans on classical theories of play and learning by, for example, Vygotsky (1978) and Piaget (1977), as well as theories on flow (Csíkszentmihályi 1996) and self-determination (Ryan and Deci 2000), aiming to understand the representations and ramifications of human needs and play, and how to employ playfulness to facilitate beneficial behavioral and attitudinal changes in all areas of life, including educational settings (Krath et al. 2021; Hamari 2019). Studies have shown that the interactive and experiential features, which are common in games, offer greater levels of activity and engagement than students would experience within traditional, teacher-centered schooling (Bimber 2003; Raphael et al. 2010). However, integrating games and gamefulness in education may also induce detrimental outcomes, such as loss of performance (Toda et al. 2017), aggravate students' mental workload (Zhonggen 2019), or hinder classroom participation (Domínguez et al. 2013), thus, it is crucial to consider the desired aims and contributions before implementing gamification in any teaching.

In terms of 21st century skills, at best gamification can provide safe interactive learning environments that reveal the consequences of players' decisions for multiple actors and for society, allowing for the exploration of ethical and societal principles in more complex and systematic ways than other media have allowed in the past (Raphael et al. 2010). Scholars have especially emphasized the importance of roleplay in teaching, which allows collaborative negotiations, networking and experiencing society and citizenship from multiple viewpoints (Raphael et al. 2010; Bers 2010; Hassan and Hamari 2020; Kahne and Middaugh 2008). A recent review of empirical literature on gameful civic education shows the shift from classic gamification (points, badges and leaderboards) to emphasis on roleplay and social dimensions (Aura et al. 2022). Aligned with this trend is the learning environment of *Yrityskylä*, in which roleplay, storytelling and several levels of social interaction play a major part whilst facilitating the pedagogical content learning of 21st century skills.

## **METHODOLOGY**

### **Description of *Yrityskylä***

*TAT Yrityskylä (Me and My City) Primary School* is a pedagogical concept, aligned with the Finnish national core curriculum for basic education (Finnish National Agency for Education, 2016) that provides schools with a tool to teach 6th grade students about work, economy, and society. The service is provided by the company *Economy and Youth TAT* and it is purchasable for municipalities. *Yrityskylä* as a whole, provides teacher training, 10 in-class lessons with a workbook, and a one-day visit (approximately 5 hours) to the gamified learning environment (see Figure 1). The focus of this research is on the gamified learning environment, which is a simulation of a city, where students roleplay as consumers, citizens, as well as work different professions in various enterprises, complete simulated work tasks and earn in-game currency for their work.

Before attending the gameful environment, students apply for their desired job roles as part of *Yrityskylä* lessons and, accordingly, teacher determines a role for each student.

The roles are relatively customizable with appropriate costumes, equipment and props, such as lab coats for those who work in a healthcare company. In terms of content, the Yrityskylä day is structured according to a script, which determines time slots for job tasks and shifts between work and free time. Students follow a role-specific “to-do” -list, which consists of both individual and team exercises, such as, creative tasks, quizzes, and multiple-choice questions. The tasks require, for example, receiving and giving feedback to others, providing services to customers, as well as decision-making and negotiations within work team on how to develop company’s practices. One of the individual tasks for all is to open an in-game bank account and follow the balance of both own spending and company budget throughout the day. Students may choose to spend their personal salary on, for example, consumables (e.g., pencils, candy) or services (e.g., at a hairdressing salon or on a VR game experience) provided by other students. Additionally, students vote in city elections to democratically choose how to spend the society’s tax income. There is also a minor competitive aspect, as at the end of the day, students vote the “best service in the city”, however, the competition is not highlighted during the day as to avoid any excessive competitiveness. Overall, the environment allows learners to practically enact knowledge and skills they had been theoretically learning in the Yrityskylä lessons thus far. Yrityskylä reaches over 80% of Finnish 6th graders every year and it has 10 facilities throughout the country, in cities such as Helsinki, Tampere and Oulu.



**Figure 1:** The gamified learning environment of Yrityskylä (images included with permission)

## Participants

The participants of this study are 6th grade students (11-13-year-olds) ( $N = 253$ ) from Finnish primary schools who participated in Yrityskylä during the semesters of fall 2021 or spring 2022. The students were recruited through their teachers, who had enrolled in Yrityskylä. The study was voluntary and anonymous for all participating students, as well as their guardians, teachers and schools. The requirement for ethical approval was waived by the Ethics Committee of the Tampere Region as the study involves no risks to the subjects and the official research permissions were gathered from participating municipalities and students’ guardians. Additionally, it was ensured that the minors who take part in the study understand what the research is about and what participation requires of them by taking into consideration subjects’ age and stage of development. Detailed student demographics can be found in Table 1. The only missing data points indicate that there were 24 students who chose not to fill out the survey section which gathered information on student demographics but continued to participate in this study.

Gender	<i>n</i>	%	Native language	<i>n</i>	%
Girl	119	47,0	Finnish	210	83,0
Boy	93	36,8	Other	19	7,5
Other	8	3,2	Missing	24	9,5
Prefer not to say	9	3,6			
Missing	24	9,5			
Total	253	100%		253	100%

**Table 1:** Participant demographics

### Procedure And Measurements

The participants answered questionnaires before and after attending the gamified learning environment. In the pre-survey, the students were asked to fill out questions regarding their demographics and prior 21st century readiness (i.e., skills and attitudes). The post-survey repeated the section on 21st century readiness and included additional sections on the gameful experience (GAMEFULQUEST) (Högberg et al. 2019). All items in the survey were in Finnish.

The 21st century skills and attitudes were measured through the Battelle for Kids Partnership 21 (P21) Framework (Battelle for Kids 2019), which has 25 subdimensions in total. In our survey, we utilized 13 of those. Specifically, two subdimensions (communication and collaboration) from *learning and innovation skills*, as well as 11 subdimensions from *life and career skills* were included since they are aligned best with Yrityskylä’s aims and the children’s development stage according to TAT’s pedagogical experts. The complete dimension of *information, media, and technology skills* (five subdimensions) and two dimensions from *learning and innovation skills* (seven subdimensions) were excluded since Yrityskylä does not aim to develop specifically these skill areas, and to keep the survey as short as possible for young participants. The detailed list of measured subdimensions is shown in Table 2. To measure students’ attitudes on each skill, a self-report instrument containing statements of “I find this skill important” and “I find this skill interesting and exciting” as well as a statement of “I am good at it” was formed. Together, these three items create a variable of ‘21st century readiness’, which includes the concepts of attitudes and skills. Students responded to all items using a 7-point Likert scale (from 1 = “Strongly disagree” to 7 = “Strongly agree”).

Domain	Dimension	Subdimension
Learning and innovation skills	Communication and collaboration	Communicate clearly
		Collaborate with others
Life and career skills	Flexibility and adaptability	Adapt to change
		Being flexible

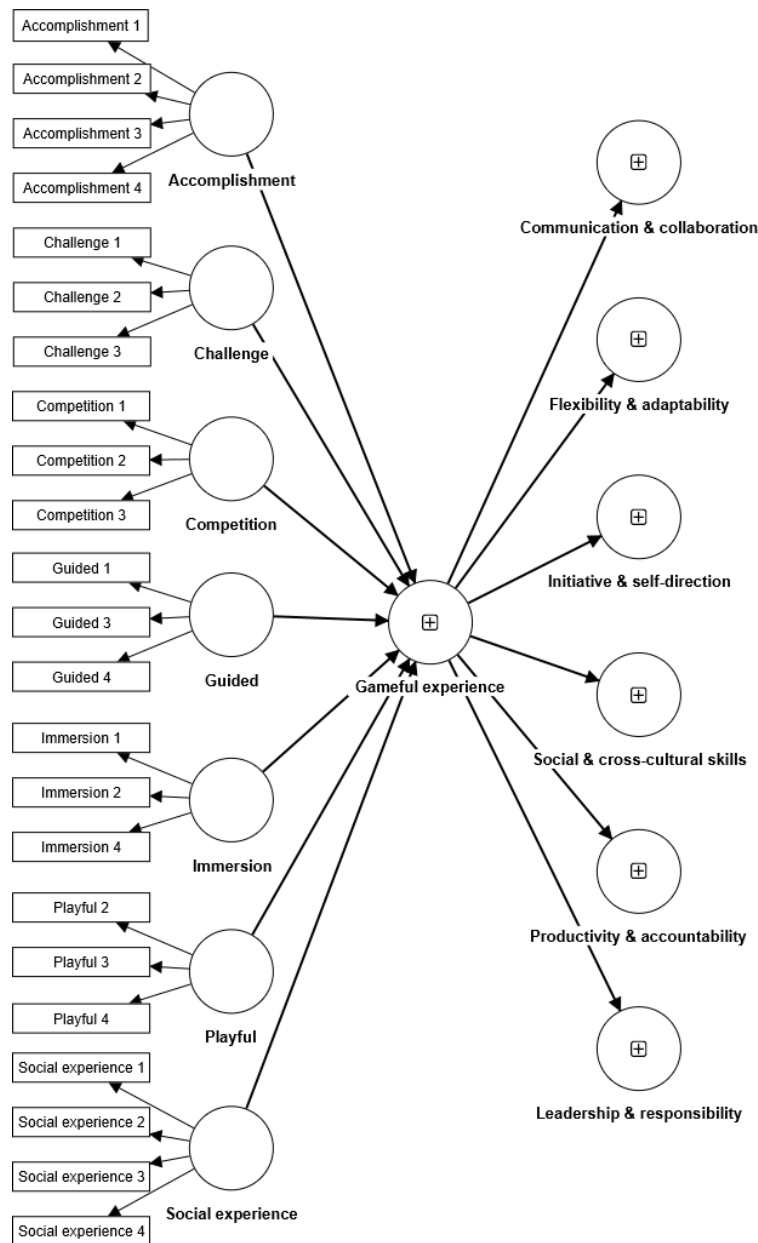
	Initiative and self-direction	Manage goals and time
		Work independently
		Being a self-directed learner
	Social and cross-cultural skills	Interact effectively with others
		Work effectively in diverse teams
	Productivity and accountability	Manage projects
		Produce results
	Leadership and responsibility	Guide and lead others
		Being responsible to others

**Table 2:** P21 framework for 21st century skills (Battelle for Kids 2019)

The gameful experience of the Yrityskylä learning environment was measured through a simplified and shortened version of the Gameful Experience Questionnaire (GAMEFULQUEST) (see Appendix A) by Högberg et al. (2019), which has been considered applicable with children by for example Rantala et al. (2022). It consists of seven subscales of students' experiences of accomplishment (e.g., "Motivates me to progress and get better"), challenge (e.g., "Makes me push my limits"), social experience (e.g., "Gives me the feeling that I'm not on my own") and competition (e.g., "Feels like participating in a competition"), as well as feelings of immersion (e.g., "Gives me the feeling that time passes quickly"), guidance (e.g., "Gives me a sense of being directed") and playfulness (e.g., "Appeals to my curiosity"). Students responded to all items using a 7-point Likert scale (from 1 = "Strongly disagree" to 7 = "Strongly agree").

### Data Analysis

At the beginning of data processing, outlier removal and straight lining errors were identified in SPSS (28.0.1.0) through examining variance. To test the research model, Partial Least Squares (PLS) Structural Equation Modeling (SEM) was utilized using SmartPLS (4.0.8.2) (Ringle et al. 2022). SEM is particularly suited to analyze complex relations in multivariate data. Whereas covariance-based SEM methods generally aim at confirming strict hypotheses by examining to what extent the observed data can produce the covariance matrix of the theoretical model (in other words, examining model fit), PLS-SEM aims at maximizing local factor loadings and explaining the variance in the model's dependent variables (Hair et al. 2022). Additionally, PLS is considered a suitable method when analyzing data slightly more exploratively with small- or moderate-sized data sets (Hair et al. 2022). A reflective-formative model was constructed to analyze the associations between gameful experience and change scores (the difference between post and pre scores) of 21st century readiness (see Figure 2). To ensure reliability of the used measures, low loading items (<0.7) were removed from the scales (Challenge 4, Competition 4, Guided 2, Immersion 3 and Playful 1 were removed), see Appendix A.



**Figure 2:** Research model

Internal consistency / reliability of the scales were assessed using Cronbach's Alpha ( $\alpha$ ) and Composite Reliability (CR), and the values were found to be of acceptable level ( $>0.7$ , see Appendix B). Convergent validity of the scales were assessed with Average Variance Extracted (AVE) index, where  $>0.5$  and  $<0.9$  is considered acceptable level (Hair et al. 2022), and all lower order variables passed this threshold (see Appendix B). Discriminant validity was also at sufficient levels ( $<0.9$ ) as assessed using Heterotrait-Monotrait (HTMT) ratio (Hair et al. 2022).

## RESULTS

Our results indicate that gameful experience has a positive relation to all examined 21st century dimensions ( $p < .001$ ). Together, the gameful experience, including perceptions of accomplishment, challenge, social experience, competition, immersion, guidance and playfulness, is associated with the change in self-reported skills and attitudes before and after attending the gamified learning environment of Yrityskylä. A detailed information of full results can be found in Table 3.



Path coefficients	$\beta$	CI 2.5%	CI 97.5%	f-square	<i>p</i>
Gameful experience -> Communication & collaboration	0.315	0.188	0.471	0.111	<b>0.000***</b>
Gameful experience -> Flexibility & adaptability	0.405	0.314	0.522	0.196	<b>0.000***</b>
Gameful experience -> Initiative & self-direction	0.325	0.210	0.484	0.118	<b>0.000***</b>
Gameful experience -> Leadership & responsibility	0.412	0.292	0.544	0.204	<b>0.000***</b>
Gameful experience -> Productivity & accountability	0.297	0.204	0.428	0.097	<b>0.000***</b>
Gameful experience -> Social & cross-cultural skills	0.431	0.330	0.545	0.228	<b>0.000***</b>

CI = confidence interval, \*\*\* =  $p < 0.001$

**Table 3:** Total effects

While *p* values demonstrate a high degree of statistical significance on all examined relations, effect sizes (f-squares) show only moderate effects (Cohen 1988) on dimensions of social and cross-cultural skills (.228), leadership and responsibility (.204), and flexibility and adaptability (.196). Effect sizes on initiative and self-direction (.118), communication and collaboration (.111), as well as on productivity and accountability (.097) demonstrate only small effects (Cohen 1988).

## DISCUSSION

The results imply that a unique learning experience in a gamified simulated city can foster young students' skill acquisition and attitude formation towards 21st century learning. Together, the perceptions of accomplishment, challenge, social experience, competition, immersion, guidance and playfulness may support students' learning experience and facilitate holistic changes in their mindsets. Not only did students value 21st century skills more after the gameful experience, but they also reported an increase in their abilities, which is a rather significant outcome from only a day's long intervention. Similar positive findings have been reported in studies of, for example, escape rooms (Nicholson 2018; Tahvanainen et al. 2021), virtual learning environments (Niemi et al. 2014; Yang 2012) as well as edu-larps (Vanek and Peterson 2016; Bowman and Standiford 2015), which comparably represent brief, yet meaningful educational interventions.

However, whilst association between gameful experience and 21st century learning may exist, causal influence cannot be fully shown. Especially since Yrityskylä is a multilayered experience with underlying social, cultural and societal influences, it is important to note other possible factors that were not measured in this study (Pourhoseingholi et al. 2012). Additionally, the effect sizes show only moderate or small effects, which might indicate limited practical applications of our results. However, effect sizes are always relative, not only to each other, but to the field or even more particularly to the specific content and research method (Cohen 1988). In our case study, we believe that even quite small effect sizes can be rather impactful considering Yrityskylä is only a one-day simulation as part of a much broader pedagogical initiative, in which the majority of Finnish 6th graders take part.

Overall, based on our results, we believe that the various gameful dimensions of Yrityskylä provide students several different ways to engage with the activities and to find the most suitable approach for each to explore, discover and learn in the simulation. In line with scholars investigating playful methods and environments (e.g., Kangas 2010; Parker and Thomsen 2019), we recommend educational practitioners to invest in holistic playful experiences, in which students are allowed to find their own personalized paths and reflect their possible strengths and pitfalls in terms of effective and meaningful learning (see e.g., Rodrigues et al. 2021). However, designing such experiences requires not only knowledge on the end-users and pedagogy (which teachers often possess), but time, resources and iterations to ensure quality (e.g., (Morschheuser et al. 2018). External parties, such as *TAT Yrityskylä*, might provide services and material that support and give guidance towards gamified education, however, the cornerstone of public education and quality pedagogy should not be purchasable products but equal and accessible to all. However, they might inspire and spark ideas towards fun and playful teaching, which could direct both teachers and students to the path of meaningful learning, as well as discovery of abilities and interests towards their future.

## **LIMITATIONS AND FURTHER RESEARCH**

This research has three main limitations. Firstly, the study would have benefited from a larger sample size or comparison groups of students not participating in Yrityskylä. Not having comparative cases is a common pitfall and raises questions on which aspects are actually related and can it be proven in one case study (Flyvbjerg 2006). However, as the specific pedagogical content that Yrityskylä provides in terms of economy, society, and work, is not directly required in the Finnish curriculum, the comparison groups in this case study would have not been exactly comparative. Additionally, since most of the Finnish 6th graders participate in Yrityskylä, comparative peers may have been challenging to recruit. Given the uniqueness of Yrityskylä and as scarcely researched as it is, we believe that a rather small study such as this may be valuable to elucidate some of the key domains already in the early stages of research (Slavin and Smith 2009).

Secondly, this study was conducted during the Covid-19 pandemic, which notably influenced formal education and students in Finland in terms of remote schooling and reduced well-being. The pandemic-related uncertainties might have had an influence on our results, however, these outcomes remain hard to identify, as we did not track Covid-related variables in the surveys. The third and final main limitation, as already mentioned in the discussion section, is that the direct causality of only gameful experience to 21st century readiness cannot be fully shown. Yrityskylä is a multilayered environment with several social, educational and cultural layers, which are probable to have an effect on students' experience, in addition to all demographic factors such as socio-economic background, differences in teaching and other unknown matters that influence children's development of skills and attitudes. Furthermore, the novelty effect with one-day simulation is presumably high, hence attending Yrityskylä continuously might not provide such positive results.

For future research, we aim to examine the effect of gameful experience in more detail, revealing more granularity and depth in our dataset as well as to examine e.g., aspects of successful gamification in terms of learning. Additionally, qualitative methods, such as interviews, could foster our understanding of a gamified learning environment whilst emphasizing children's own views. A qualitative approach or mixed methods might raise youths' possible concerns or unfold new insights regarding gamified learning that haven't been considered among scholars or teachers before. Overall, in the context of gamified learning simulations, longitudinal studies should be conducted in order to

examine their possible benefits and pitfalls compared to education without any gamification or playful experiences.

## CONCLUSIONS

In modern society with an ever-shifting job market, novel technology and other societal uncertainties, the educational field is increasingly faced with challenges and questions on how to prepare young students for the world after formal schooling. As the nature of knowledge and learning has changed along with the internet, social media and floods of information, there is a need to equip children with personal and practical abilities of, e.g., adaptability, communication and self-direction, which are commonly included in the framework of 21st century skills. However, as these skills might seem irrelevant or uninteresting for young students, there is a need to provide engaging pedagogical methods in order to deliver such traits meaningfully. Gamification of education has been introduced as one of the tools to convey complex subjects for youth, which has also been employed in the pedagogical concept of *Yrityskylä* through a gamified learning environment, in which 6th graders simulate society in a playful manner by role-playing as employees and consumers. According to our results, such a holistic and unique learning experience may facilitate 21st century skill acquisition as well as attitude change as part of formal curriculum. Whilst it is important to note the potential novelty effect and other social, cultural and educational factors that shape students' thinking, our study nevertheless indicates a rather significant outcome from only a day's long intervention, and elucidates how gameful experience in a traditional, physical space can at best facilitate engaging, effective, and enjoyable education for young people.

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**APPENDIX A. GAMEFUL EXPERIENCE (GAMEFULQUEST)  
(HÖGBERG ET AL., 2019) INSTRUMENT ITEMS AND LOADINGS**

<b>Accomplishment</b>	<b>Loadings</b>
1. pushed me to strive for accomplishments	0.783
2. made me strive to take myself to the next level	0.753
3. motivated me to get better	0.810
4. made me feel like I have clear goals	0.733
<b>Challenge</b>	
1. challenged me	0.841
2. motivated me to do things that feel highly demanding	0.887
3. made me push my limits	0.879
4. pressured me in a positive way by its high demands (omitted)	
<b>Competition</b>	
1. felt like participating in a competition	0.874
2. made me want to be in first place	0.846
3. inspired me to compete	0.899
4. made victory feel important (omitted)	
<b>Guided</b>	
1. gave me a sense of being directed	0.865
2. gave me a sense of knowing what I need to do to do better (omitted)	
3. made me feel guided	0.849
4. made me feel like someone is keeping me on track	0.870
<b>Immersion</b>	
1. grabbed all of my attention	0.842
2. caused me to forget about my everyday concerns	0.798
3. gave me the feeling that time passed quickly (omitted)	
4. caused me to stop noticing when I get tired	0.745
<b>Playful</b>	
1. gave me an overall playful experience (omitted)	
2. made me feel like I discover new things	0.779
3. gave me a feeling that I want to know what comes next	0.854
4. appealed to my curiosity	0.744
<b>Social experience</b>	
1. gave me a sense of social support	0.826
2. gave me the feeling that I'm not on my own	0.766
3. made me feel like I have someone to work with	0.791
4. gave me a feeling of being connected to others	0.883

**APPENDIX B. THE VALUES OF GAMEFULQUEST'S (HÖGBERG ET AL., 2019) SUBSCALES**

<b>GAMEFULQUEST's subscale</b>	<b><math>\alpha</math></b>	<b>CR</b>	<b>AVE</b>
Accomplishment	0.771	0.853	0.593
Challenge	0.838	0.903	0.756
Competition	0.844	0.906	0.763
Guided	0.826	0.896	0.742
Immersion	0.711	0.838	0.634
Playful	0.707	0.836	0.630
Social experience	0.834	0.890	0.669