



Sustainable mobility learning: Technological acceptance model for gamified experience with ClassCraft in primary school

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Abstract

The concept of sustainable mobility is related to the fulfilment of certain conditions that consider environmental, economic and social factors when making decisions on transport activity. The recognition of the role of education as a key factor for sustainable development and sustainable mobility has been growing. Therefore, the development of training schemes aimed at sustainable mobility education as a tool for a better future for the generations to come is of fundamental importance. This study analyses the factors affecting the adoption of the ClassCraft platform in activities related to sustainable mobility. The proposed experience involved children aged 10–11 years old, a total of 75 pupils. This experience was the basis for analyzing the pupils' perception of the gamification-based methodology. A mixed method has been used, combining qualitative results from a Focus Group (FG) with 6 students, and quantitative results through a questionnaire based on the Technology Acceptance Model (TAM) with all the 75 students. The results reflect that all students consider this methodology as an opportunity for a change in the school experience to make classroom activities more enjoyable. Our research contributes to the application of a mixed methods approach that addresses an educational challenge, considering the voice of the children when applying new teaching–learning strategies.

Keywords Sustainable mobility · Gamification · Technological Acceptance Model · Mixed method · Primary Education

1 Introduction

The concept of sustainable mobility finds expression through the implementation of certain conditions when making decisions on transport activity. These conditions should favour the ability to achieve a transport system that considers the balance of environmental, economic and social factors.

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The United Nations Conference on Environment and Development (Keating, 1993) recognized children as the main agents for the development of a sustainable environment. Therefore, it is important to develop training schemes aimed at sustainable mobility education as a tool for a better future for the generations to come.

The recognition of the role of education as a key enabler for sustainable development and sustainable mobility has been steadily increasing (Kazhamiakin et al., 2016; Marconi et al., 2018; Sipone et al., 2019).

One of the key aspects of sustainability is the focus on mobility and the importance of introducing attitudes to encourage voluntary behavioral changes towards different solutions. Facilitating and promoting more sustainable mobility means and habits is an increasingly important goal for cities around the world (Khoshkangini et al., 2017).

Among the new teaching strategies, gamification has become one of the most popular techniques in education to encourage specific or long-term behaviours, increase motivation and engagement. It is considered effective in educational contexts (Buckley & Doyle, 2017; Huang et al., 2020), has positive cognitive, behavioural and motivational effects (Sailer & Homner, 2020). Romo and Montes (2018) state that gamification has the power to motivate because it uses various game mechanisms that encourage student participation and, above all, the power to build their learning both academically and personally.

In the field of education towards sustainable development, gamification has demonstrated its potential as a strategic socio-technical element to increase participation and engagement (Bielik et al., 2012), as well as for the formation of environmental awareness and the promotion of sustainable behaviours (Kazhamiakin et al., 2016).

The use of gamification techniques in the field of sustainable mobility, as a way to encourage voluntary behavioural changes, has been applied in recent years in connection with the spread of smart cities in Europe (Khoshkangini et al., 2017). However, most studies on the application of gamification in sustainable mobility have been conducted with adults (Buning et al., 2014; Gabrielli et al., 2014).

A recent example of a gamified activity for children that aims to encourage sustainable mobility behaviours is Kids-Go-Green (Marconi et al., 2018). Kids-Go-Green aims to raise awareness and change the behaviour of children and their families in relation to active and sustainable mobility habits. Furthermore, it seeks to elicit a short-term commitment towards different mobility habits by leveraging the potential of gamified educational initiatives. It has been developed as a web application that can be accessed from any web browser and can be used at school via large screens, interactive whiteboards, smart tablets or computers.

The aim of our study is to consider and evaluate which factors influence the acceptance of the use of technology and, in particular, of the ClassCraft platform for learning sustainable mobility concepts. On the other hand, to analyse the overall satisfaction with the use of gamification techniques for learning and whether gender has any influence on all the aspects considered.

To this end, an experience has been developed with fifth grade children, designing, on the ClassCraft platform, gamified activities on sustainable mobility to promote attitude change (Sipone et al., 2021).

Some of the questions to be answered were the following:

- Can the use of the gamified ClassCraft platform meet pupils' demand for efficiency and ease of use?
- How do primary school pupils view the gamified learning experience through the use of the ClassCraft platform?

Our study is an important step forward as it focuses on the need to analyse the impact of gamified activities related to sustainable mobility to foster attitude change in primary school children. In addition, there are no relevant studies on the acceptance of technology with mixed methodology that are focused on primary school children and with the use of Focus Groups.

2 Literature review

In this section we focus on the analysis of studies on the use of the ClassCraft platform as an instrument to gamify educational activities and to know its effects on students.

On the other hand, we will analyse the Technology Acceptance Model (TAM).

2.1 Classcraft as a Gamification Platform.

Today, there are many accessible resources that can be implemented by teachers interested in using gamification as a part of their teaching and learning strategies. The proposed use of each is different and may be related to learning assessment, encouraging participation in the classroom or teaching specific subjects. One of this resource is representing of Classcraft platform.

Classcraft is an online platform that allows classes to be turned into role-playing games and students can learn by being engaged in an immersive, gamified environment (Sanchez et al., 2017).

It is a platform that was developed for secondary school students, but there are examples of its implementation with primary school children (Mora Márquez & Camacho Torralbo, 2019).

The design process is limited to the features the platform offers, but allows for the creation of consistent content using important components such as the game start icon, board, quests and messaging. The graphical user interface allows efficient access to the page. ClassCraft is not tied to a specific subject or time period, it is flexible. Teachers can design rules, rewards or punishments according to the game mechanics (Rivera-Trigueros et al., 2020). One of the characteristics of the platform is that it focuses on player behaviour and allows the development of certain desired attitudes to be encouraged (Haris & Sugito, 2015; Rivera-Trigueros et al., 2020).

For this purpose, the reward and penalty systems in Classcraft are designed to encourage students to recognize appropriate and inappropriate behaviours. Each time the game activities are performed, positive behaviours allow students to progress, pass levels, acquire powers to be able to modify their avatars and support their team (Mora Márquez & Camacho Torralbo, 2019). By leveraging rewards and

emotions, an effective gamification experience will motivate behavioural changes in people. This characteristic of the ClassCraft platform demonstrates that it can be considered as a tool that enables a well-designed gamification experience.

As demonstrated by Zhang et al. (2021), ClassCraft can contribute to creating very good gamified learning processes positively associated with learning performance and motivation. Driven by ClassCraft's motivating tasks and activities, learners can achieve high engagement in gamified experiences and reach learning objectives with an increasing level of challenge.

In their study Krishnan et al. (2021) review the features of the ClassCraft platform stating that it is a well-known and widely used tool in primary and secondary schools. Its use is encouraged by its variety of mechanics that engage and help students in their learning process.

2.2 Technology Acceptance of Use Model (TAM)

Many studies have attempted to examine the degrees of perceived usefulness and enjoyment of users in various contexts (Venkatesh, 2000; Yi & Hwang, 2003). Various models (Haris & Sugito, 2015; Park et al., 2014) have been developed and used to assess user acceptance of technology use. These models explain which factors motivate technology acceptance and are important in determining which actions need to be taken in practice to improve technology performance. The TAM model was first introduced by Davis et al. (1989) to explain the acceptance and use of information technologies. It was based on the "Theory of Reasoned Action" developed in social psychology by Fishbein and Ajzen (1975).

The theory of reasoned action (TRA) describes the close relationship between behaviors and specific attitudes of an individual. Since the introduction of TRA, many studies have used this theory to confirm that an individual's behaviors can be predicted by the individual's intention to use a given service or system (Park et al., 2014).

TAM models focus exclusively on information technology analysis (Chau, 1996; Featherman & Pavlou, 2003; Mathieson, 1991; Taylor & Todd, 1995; Venkatesh, 2000) and, unlike TRA models, pre-establish these factors. This conditions the user's attitude towards innovation, the intention of behavior and the intensity of use of the system. The two key factors for determining intention, which predict the development of an innovation and are present in all TAM model development studies, are: perceived usefulness and perceived ease of use (Davis & Wiedenbeck, 2001; Davis et al., 1989). Perceived Usefulness is considered an extrinsic motivation for the user and is defined as the degree to which a person believes that using a particular system can improve performance at work (Davis et al., 1989). Ease of use is defined as the degree to which the use of a platform, as in our case, is perceived as simple to work with. The greater the perceived complication, the lower the degree of Ease of Use (Moore & Benbasat, 1991).

Most TAM researchers have focused on its extrinsic perspective (Igbaria et al., 1996), only recently the importance of non-cognitive aspects, such as emotions, symbolism, desires, etc., has been considered. Consequently, there is a need to

incorporate intrinsic factors that can enhance the TAM model (Legris et al., 2003; Venkatesh & Davis, 2000).

In our research, the TAM model has been used with some extensions, since it has been shown that the same predictive validity can be obtained in similar contexts (Sánchez & Hueros, 2010). Our research model is based on the study of the variables that affect the acceptance of the Classcraft platform for learning through an extension of TAM. We incorporate, to the initial perceived usefulness, perceived ease of use, intention to use and attitude, the variables of: self-efficacy, perceived enjoyment, satisfaction and use.

We consider:

- self-efficacy as a factor that measures the learner's judgment of his or her abilities to develop a specific task on the platform. It is the confidence that people have in their own ability to execute actions to be carried out.
- Intention to use as a factor that measures the voluntary use of the platform.
- Attitude as the degree to which the user is interested in specific systems (in our case the platform) and has a direct effect on the intention to use those systems in the future (Bajaj & Nidumolu, 1998).
- Perceived enjoyment as a factor related to enjoyment and happiness, the perceived pleasure or benefit that can lead to the state of "flow" that Csikszentmihalyi (1990) talks about. Venkatesh (2000) defines it as "the extent to which the activity of using a particular system is perceived as pleasurable in its own right, apart from any consequences in performance that result from the use of the system" (pp. 342-365).
- Satisfaction related to the degree to which expectations about Classcraft were met.
- The actual use that each student has made during the experience.

3 Methodology

The research was carried out through a mixed method study combining the quantitative method, by analyzing questionnaire responses, with qualitative one, through Focus Group (FG), in a Primary Education school.

The use of the mixed method is intended to collect, analyze and mix quantitative and qualitative methods in a single study. This combination provides a better understanding of the research problem than any of the methods by itself with the advantage of deeper understanding of the data, clarifying apparently anomalous results that could have been obtained from other sources (Creswell & Plano Clark, 2018).

In this study, a convergent mixed method design has been chosen. Both quantitative and qualitative data have been collected simultaneously. Subsequently, both datasets have been analyzed separately, the results of their analysis have been compared and an analysis has been made to verify if the results were supported or contradicted themselves, by providing convergence of data sources.

In order to answer the questions of our study, the research was subdivided into four phases, which are summarized in the following Fig. 1.

3.1 Case of study

In the experience 3 classes of fifth primary school (25 students each one; in total 75 students), of the Marist Liceo Castilla School of Burgos (Spain) participated. In order not to interfere with the development of the classes, the experience was focused as an extracurricular activity and some face-to-face meetings were planned: one day of presentation of the activity and two days of intermediate group work. The other activities were done by the students online, at home, always with the follow-up of the game coordinators.

All students were 10–11 years old, with a slight prevalence in boys' gender over girls -this trend remains in all three groups-. In the overall, there were 53% of boys and 47% of girls.

To provide an answer to the objectives, a learning environment was designed on the ClassCraft platform. It is a web application, already created, that allows teachers to direct a role-playing game in which their students embody different characters. In the role-playing game the idea is that students are involved in a game where the evolution of their character is related to their school skills and class collaboration. The platform works on a real-time web engine, so game events are sent in real time to other users' devices, such as in an online video game (Sanchez et al., 2017).

ClassCraft has some characteristics that favoured its choice for our study. The first is to have the possibility of working remotely with the students. Our experience did not take place in the school's presence, but we were given the opportunity for each pupil to voluntarily connect to the platform and solve the proposed activities. Another feature is the ease of access for the students. We noticed how the possibility of creating one's own avatar, without needing the help of an expert, positively engaged the students. The most important feature is that ClassCraft is not related

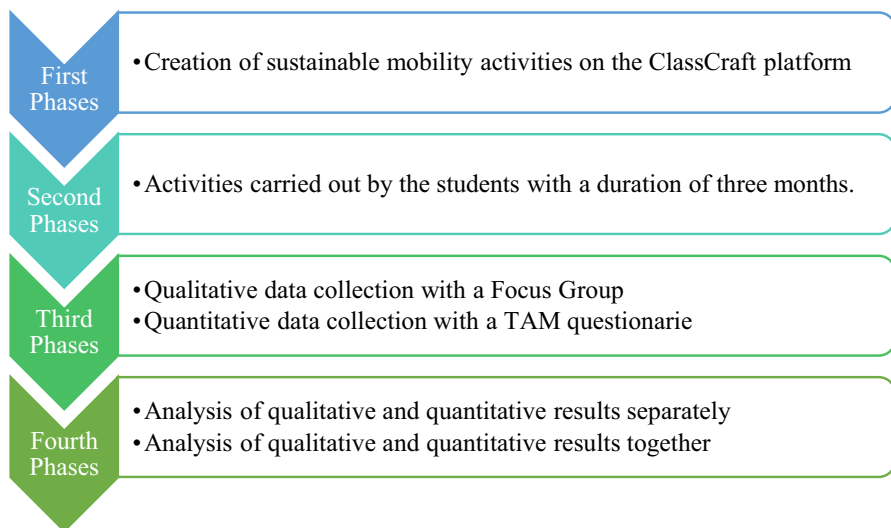


Fig. 1 Methodological schematic of the study

to a specific school subject, and the duration of the game depends on the teacher's expectations (from a few hours of class to the whole year).

Specifically, a story was created on the platform. Students were told that they were Eco-Heroes called by the Great Council of Earth to face a very important mission: Save the Polluted Island! For three months, the students were at home solving the tasks proposed in the game and were advancing and earning points for each action. They had to follow a map of activities with themes on sustainable mobility concepts. Activities of various types have been elaborated and presented throughout the map: crossword puzzles, word search puzzles, coded messages, images, concept maps, mathematical problems, informative and documentary videos, stories, chat discussions, real examples. In total, the story map with the activities consisted of 48 stages (Fig. 2). To solve each task the children had a time limit and could receive different rewards: experience points (XP) and power points (GP).

3.2 Quantitative Phase

All students who participated in the didactic experience completed the final questionnaire, which had a duration of one hour. The anonymity and confidentiality of the answers were always guaranteed.

Having used the model with extensions, unlike the classic TAM described by Davis et al. (1989), in our case it has been analyzed which factors are directly related to Global Satisfaction. Thus, we have based our study on the proposal prepared by Sánchez and Hueros (2010), using a questionnaire of 30 items answered through a Likert scale of 5 answer options. Our questionnaire finally included questions relating to 7 factors: Perceived Usefulness, Perceived Ease of Use, Intention to Use, Attitude, Self-Efficacy, Perceived Fun and Satisfaction (Table 1).

3.3 Qualitative Phase

A Focus Group (FG) was developed asking for students' opinions on the gamification-based methodology for learning and the use of the ClassCraft platform. In fact, small FGs are a good way to get data because they reproduce a form of natural and family communication (Eder & Fingerson, 2001; Mauthner, 1997).

The sample under study corresponds to 6 children (8% of the total students involved). The composition of the group was made according to the following guidelines in order to create a homogeneous opinion group:

- numerical criterion (the groups would be composed of six members, two for each class);
- gender representation (half boys and half girls);
- level of participation in the Classcraft platform (number of times they have logged on and interacted on the platform: many, some and few times).

The FG lasted one hour and was led by two researchers: a moderator who asked questions and an assistant who recorded the data in video and photo. A guideline

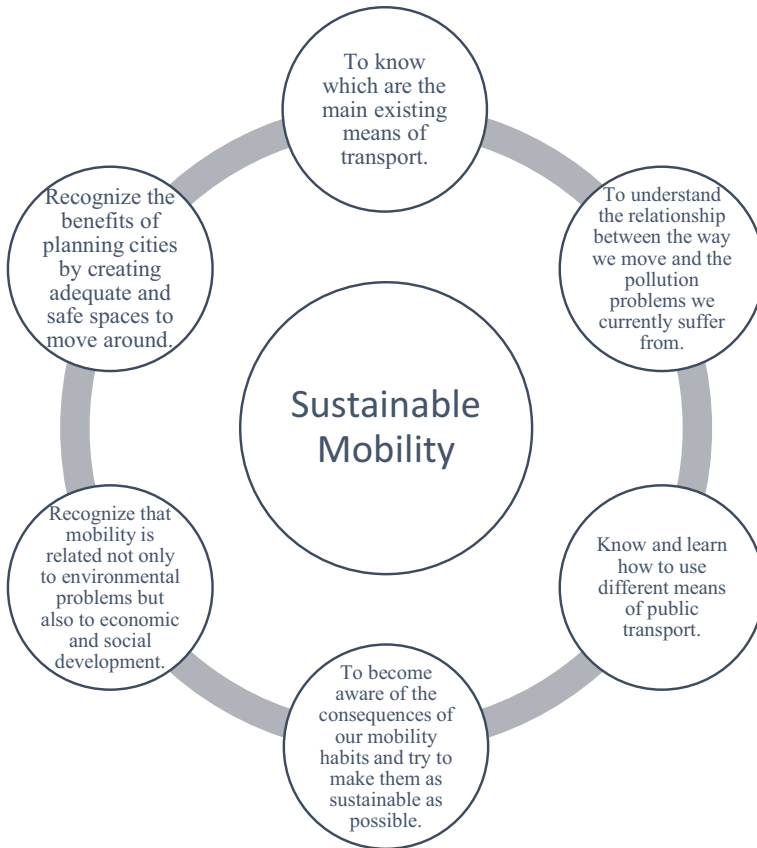


Fig. 2 Methodological schematic of activity in the Classcraft platform

was drafted to encourage debate and gain a high degree of participation. Children were directed to reflect on gamification as a learning methodology through brainstorming techniques and with some questions.

Focus groups have been used before in gamification contexts. Some studies used the FG to investigate whether the combination of gamification mechanics and context-sensitive techniques can increase people's motivation (de Croon et al., 2017). Leaning (2015) used the FG to check students' perception of the effectiveness of a gamification-based learning and teaching project to improve University students' learning. Following his experience and adapting it to primary school children, the idea of gamification and its use in education has been examined: how to use games and gamification to teach, whether that methodology is liked with regard to traditional teaching, and whether it could be used more in classes.

FG transcripts provided a wealth of qualitative data on students' perception of the use of gamification-based learning methodology.

Table 1 Variables in the TAM questionnaire

Perceived Usefulness (PU)	PU1: ClassCraft has helped me learn more than a normal class PU2: ClassCraft has improved my learning PU3: I think using ClassCraft has made my learning more effective PU4: I think ClassCraft has made it easier for me to learn PU5: I think ClassCraft has been helpful in learning PU6: Above all, I think using ClassCraft is good for learning
Self-efficacy (SE)	SE1: I am able to send the papers to the teacher through ClassCraft SE2: I have been able to navigate the platform with ease SE3: I am able to use the game without anyone telling me how it works SE4: If I have had problems with the platform I have been able to fix them S. SE5: I think I could use ClassCraft again without being told how it works SE6: Generally, I think I am able to handle the game
Perceived ease of use (PEU)	PEU1: Learning how to use ClassCraft has been easy for me PEU2: Using ClassCraft has not taken much effort PEU3: I have found ClassCraft easy to play PEU4: It is easy to access in-game content and activities PEU5: I found it easy to access ClassCraft and play
Perceived Fun (PF)	PF1: I had fun playing with ClassCraft PF2: I have found ClassCraft fun and fascinating PF3: I do not like to do other things when I play ClassCraft
Attitude (AT)	AT1: Learning through ClassCraft is simple AT2: I think using ClassCraft in subjects is a good idea AT3: Using ClassCraft is a good way to teach AT4: Generally, I like to use ClassCraft to learn
Satisfaction (SAT_GL)	SAT_GL1: Overall, I am very pleased to have used ClassCraft SAT_GL2: Using ClassCraft has been better than expected SAT_GL3: I would recommend using ClassCraft in other subjects
Intention to Use (IU)	IU1: I would like to use ClassCraft as much as possible IU2: I would like to continue using ClassCraft in other classes IU3: I would rather use ClassCraft than other methodologies in class

4 Results

After collecting quantitative and qualitative data, both have been analyzed separately. Subsequently, the results of their analysis have been compared and we have conducted an interpretation of whether the results are supported or contradicted by each other, achieving convergence of data sources.

4.1 Quantitative Results

The quantitative data analysis was carried out using multiple linear regression models, also considering the effect of student gender, by including dummy variables corresponding to this respondent characteristic, as well as the interaction of these with other independent variables (Tables 2 and 3).

To identify the factors influencing students' acceptance of the ClassCraft learning platform, the results were analyzed by looking at which variables (Perceived

Usefulness; Self-Efficacy; Ease of Use; Perceived Fun; Attitude and Intention to Use) were related to Global Satisfaction (SAT_GL).

The variable SAT_GL, which appears in the models, is always the same. Its value was obtained by averaging the value of the three items included in the Satisfaction dimension questionnaire (Table 2) for each student.

In the end, different models have been run for each variable depending on the results obtained. For each variable of the TAM items, the models were repeated several times, as many times as necessary, depending on the significance of the results that each variable showed with respect to Global Satisfaction.

In the case of Perceived Usefulness, three multiple regression models were created (Table 2).

In the first model (SAT_GL1PU), all the variables of Perceived Usefulness are related to the independent variable, with a significant regression. This first model shows that only some of the PU variables have a direct relationship with overall satisfaction (PU4, PU5, PU6 and female gender).

For this reason, it was decided to repeat the model, eliminating the variables that were not significant.

The results of this model were not different from the first model and a significant regression was obtained. Reliability is even higher for these variables (PU4, PU5, PU6) except for gender.

In the last model (SAT_GL3PU), the variable FEMALE by itself is removed and entered as an interaction variable. We obtain a significant non-linear regression. There is a positive interaction between gender and PU5, indicating that women consider ClassCraft to have been useful for learning more than men.

The same path was followed in the models related to the variable Self-Efficacy (SE). Again, three models were run (Table 2).

In the first one, we observed that the variables that have a direct relationship with Global Satisfaction are: SE2, SE4, SE5, SE6 and female gender.

The model was repeated removing those variables that had not given significant values and the results show that the significance remains high, dropping only for the variable SE5.

Finally, in the model (SAT_GL3SE) the variables SE5 and FEMALE were removed, as in this case they were introduced as interaction variables. A significant non-linear regression was obtained. There is a positive interaction between the variable gender and SE6 and a negative relationship between gender and SE4, indicating that women consider themselves more capable of handling the platform than men, but at the same time they have had problems, although they have been able to solve them more than men.

In the case of Perceived Ease of Use (PEU) it was necessary to repeat the model four times, although in all cases significant regressions were obtained.

In the first model (Table 2) of the five PEU variables, only two items are directly related to Global Satisfaction: PEU1 and PEU3. In this case female gender has no significant relationship with perceived ease of use.

Thus, the model is repeated eliminating the non-significant variables (PEU2, PEU4 and PEU5) to see if there are relevant changes (SAT_GL2PEU). In fact, by removing the other variables, the significance increases with the variables PEU1

Table 2 Multiple regression models of the variables PU; SE and PEU

Dependent V	SAT_GL _{1PU}			SAT_GL _{2PU}			SAT_GL _{3PU}			SAT_GL _{1SE}			SAT_GL _{2SE}			SAT_GL _{3SE}			SAT_GL _{1PEU}			SAT_GL _{2PEU}			SAT_GL _{3PEU}			SAT_GL _{4PEU}								
	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat						
PU1	0.058	0.80																																		
PU2	-0.049	-0.55																																		
PU3	0.091	1.17																																		
PU4	0.215	2.38	0.257	3.11	0.265	3.24																														
PU5	0.228	2.90	0.241	3.41	0.213	2.97																														
PU6	0.333	4.19	0.368	5.24	0.376	5.47																														
FEMALE	0.288	1.97	0.274	1.88																																
PU5*FEM					0.100	2.26																														
Adjusted R ²	0.962		0.961		0.961		0.961																													
SE1																																				
SE2																																				
SE3																																				
SE4																																				
SE5																																				
SE6																																				
FEMALE																																				
SE4*FEM																																				
SE6*FEM																																				
Adjusted R ²																																				
Intercept																																				
PEU1																																				
PEU2																																				

Table 2 (continued)

Dependent V	SAT_GL _{1PU}	SAT_GL _{2PU}	SAT_GL _{3PU}	SAT_GL _{1SE}	SAT_GL _{2SE}	SAT_GL _{3SE}	SAT_GL _{1PEU}	SAT_GL _{2PEU}	SAT_GL _{3PEU}	SAT_GL _{4PEU}				
	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat				
PEU3		75	75	75	75	75	0.239	2.44	0.241	2.85	0.233	2.78	0.190	2.16
PEU4							0.048	0.52						
PEU5							-0.064	-0.78						
FEMALE							0.331	1.53	0.356	1.76				
PEU1*FEM									0.114	2.16				
PEU3*FEM							0.562		0.548		0.557		0.112	2.01
Adjusted R ²													0.553	
Sample	75	75	75	75	75	75	74	74	74	74	74	74	74	74

Table 3 Multiple regression models of the variables AT; FP and IU

Dependent V	SAT_GL _{1AT}		SAT_GL _{2AT}		SAT_GL _{3AT}		SAT_GL _{1PF}		SAT_GL _{2PF}		SAT_GL _{1IU}		SAT_GL _{2IU}	
	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat	Coeff	T-Stat
AT1	0.317	4.13	0.335	5.34	0.265	4.01								
AT2	0.096	1.35	0.104	1.56	0.206	2.69								
AT3	0.082	1.27												
AT4	0.395	4.46	0.447	5.65	0.424	5.49								
FEMALE	0.190	1.02	0.184	1.18										
AT1* FEMALE					0.283	2.70								
AT2* FEMALE					-0.256	-2.27								
Adjusted R ²	0.959		0.958		0.961									
Intercept							0.811	3.43	0.852	3.82				
PF1							0.328	3.96	0.330	4.00				
PF2							0.242	3.08	0.241	3.09				
PF3							0.139	2.05	0.139	2.07				
FEMALE							0.098	0.54						
Adjusted R ²							0.640		0.639					
Intercept											0.70	3.08	0.81	4.02
IU1											0.36	4.77	0.22	2.55
IU2											0.23	3.44	0.24	3.72
IU3											0.19	2.83	0.28	3.70
FEMALE											0.17	0.93		
IU1*FEMALE													0.36	2.99
IU3*FEMALE													-0.30	-2.44
Adjusted R ²											0.64		0.68	
Sample	74		74		75		75		75		75		75	

and PEU3 and also FEMALE gender has a direct relationship with 90% significance (or confidence).

The SAT_GL3PEU and SAT_GL4PEU models were calculated by removing the variable FEMALE and introducing it once as an interaction variable with the item PEU1 and in the other as an interaction variable of the variable PEU3. Both models show significant non-linear regression.

The models help us explain how there is a positive interaction between the gender variable and PEU1 and PEU3 (SAT_GL3PEU, SAT_GL4PEU) indicating that women consider learning to use ClassCraft and playing ClassCraft to be easy than men.

In Table 3 we analyze the models referring to Perceived Fun (PF), Attitude (AT) and Intention to Use (IU). In the case of Attitude, we follow the same line as the first three. We run a multiple linear regression with all the items of this aspect in relation to Global Satisfaction and analyze the influences they have.

The first model (SAT_GL1AT) resulted in a significant regression and this shows how the self-efficacy variables that have a direct relationship with Global Satisfaction are: AT1, AT2 and AT4 and also no gender differences seem to appear. Performing the second model (SAT_GL2AT), selecting only the 3 significant items (AT1, AT2 and AT4) and gender, resulted in a significant regression. The third model was done by introducing gender as an interaction variable with AT1 and AT2. A significant non-linear regression was obtained. The results obtained in these three models lead us to conclude that there is a positive interaction between gender and AT1 and a negative relationship between gender and AT2, indicating that women consider learning through ClassCraft easier than men. However, they are less likely than men to think that it is a good idea to use it in subjects or in class. Finally, all students agree that they like using ClassCraft for learning (AT4).

The last two models in Table 3, although analyzing different items (FP and IU), the results go in the same direction. In both the results of the first model show that the regression obtained was significant and all three items are directly related to Global Satisfaction, showing no gender differences. In the second PF model the gender variable was removed, and a significant regression was obtained. These results show that perceived enjoyment is directly proportional to Global Satisfaction for all students, regardless of gender. In the second UI model, two interactions with gender were introduced, resulting in a significant regression. It is observed that females would like to use ClassCraft as much as possible (UI1) more than males, although males seem to prefer ClassCraft over females for use and application to other classroom methodologies (UI3).

4.2 Qualitative Results

The focus group was recorded and the qualitative data from the audio recordings were transcribed into text. The most significant parts for the study are collected here. The discussion and questions were guided by a reference guide written for the focus

group. The topics were specifically related to two macro-areas: Gamification and the ClassCraft platform (Table 4).

In the first part, several questions were addressed: the meaning of the word "Gamification"; whether it is possible to learn through games; whether it is fun and a useful tool; whether it is easy to learn using gamification; whether it motivates the learner to actively participate. In addition, they were asked whether they preferred a traditional or a gamified classroom, whether this type of methodology is adapted to a particular subject or a particular level of study, whether it is necessary to use points, rewards or leaderboards.

The moderator started by writing the word "Gamification" on the board and asked the children to reflect and express everything that this word conveyed to them. The children associate the word "Gamification" with play, the concept that it can be something that changes behaviour and that something can be obtained in return, such as prizes and rewards. At the end of this small discussion a very simplified definition of the word was given, saying that it is related to the word game and that it is a methodology that uses games in contexts where they are not normally used. Several questions were asked to stimulate and create a debate on the use of games as a form of learning.

Throughout the discussion, we observed how the children often contradicted each other.

The children state that it can be useful to change habits and learning, but they comment at the same time, changing their opinion, that it is necessary to distinguish what can really be used in real life from what can only happen in a game. From these comments we can see how the concept of play and its use, in children, is always related to something that is not only fun but can also sometimes be learned from them.

At the end of the discussion, children are confident about gamification as a technique that could be applied to any subject, but they still show doubts about the use of books and traditional classes, especially girls. But they agree with the statement that gamified activities can be an alternative to the normal routine of their classes.

Also, during the discussion, doubts arise when comparing a traditional class with a gamified one, regarding how to ask for information or explanations in case of need. Some agree with the fact that in a gamified class you can receive a load of information and instructions that allow you to advance in the game and, at the same time, to learn. Others view this aspect with mistrust, feeling that the presence of the book and the teacher who helps you to understand step by step what you are studying is important.

Continuing with the debate, questions are proposed about the ClassCraft experience to find out what opinions they have about the tool in general, about the dynamics, mechanics and components contained in it, the type of activity and some problems have appeared.

Some of the children say that they have had no problems, while there are some who do not answer. Considering the group composition criteria, the way they responded seems consistent.

The children agree that the graphics and structure of the platform had appealing elements such as avatars, mascots and costumes. They state that during the

Table 4 Summary of the transcripts of the qualitative results

Category	Subcategory	Excerpt
Gamification	Definition of gamification: <ul style="list-style-type: none"> Some considerations regarding the word "Gamification" 	<ul style="list-style-type: none"> a life-changing game. [Girl 1 and 2] a game [Girl 3] classification. [Boy 1] "caution" in English is like caution, concern. Danger. [Girl2] Vechange. [Boy 2] bonus. Like they give you something, you get it by doing something.... [Boy 3] Receiving awards. [Boy 1] to have fun, to learn by having fun and not to forget. [Girl2] because if you say it normally you understand it, but with a game you remember more. [Girl 1] with a game it is easier to learn. [All] it's fun, you have fun observing and you can confront yourself with what you learn and with your classmates. [Girl 2] you use your creativity, and you are not looking at the book all day, you try new things. [Boy 1] I think that the presence of the book and the teacher who helps you understand what you are studying is important. [Girl 1] I prefer to have traditional classes and only use gamification for some things. [Girl 3] classes can be fun and you can also learn. But, also the game can be boring, you don't care so much and you don't learn anything. Boy 3] My only interest is to earn points so that I get good marks, like in a game with the books we use in class: you read them and they give you tests and you earn points, medals. That's what we use in language. [Boy 3] all games teach you something or change your behaviour, but you have to distinguish what you can actually use in real life from what can only happen in a game. [All] physical education. [Girl 1] Social science. [Boy 1] mathematics. [Boy2] English. [Girl 3] Language [Boy 3] can also be used at university. [Boy 1] but it must be adapted to the level of the participants. [Girl 2] They might not understand it anyway! [Girl1] You must adapt the words and instructions [Boy 1] Adapted to age and curriculum. [Girl 3]
	The use of games to learn: <ul style="list-style-type: none"> It fun learning with games 	
	The use of components and game mechanics in gamification Playing, participating in a game, the use of points, rewards are like wasting time, it is distracting and not doing something concrete and useful or favours learning: <ul style="list-style-type: none"> gamified activities can be an alternative to the normal routine of classes 	
	Gamification is useful to encourage behavioural change: <ul style="list-style-type: none"> Why gamification can help in changing habits? 	
	Use in the classroom: <ul style="list-style-type: none"> Which subject is most adaptable to gamification? Gamification can be used at all levels of education and not only in schools 	

Table 4 (continued)

Category	Subcategory	Excerpt
ClassCraft	<ul style="list-style-type: none"> • Aspect of the platform • Did you enjoy using the ClassCraft platform? • What motivated you the most to use it? • The proposed activity was well designed • The activity was adapted to the ages • Their perception of the platform and their general satisfaction with the platform • Any problems 	<ul style="list-style-type: none"> • <i>The graphic was very nice. [Boy 3]</i> • <i>I enjoyed creating my avatar. [Boy 2]</i> • <i>I didn't get enough points to buy powers. [Girl 3]</i> • <i>It has been easy to access the platform and solve the challenges. [Girl 1]</i> • <i>I think it's easy to use. I haven't had any problems. [Boy 2]</i> • <i>Sometimes I couldn't find the activities. [Girl3]</i> • <i>I had no difficulty in solving the activities and I managed to understand the instructions. [Boy 1]</i> • <i>Some have not used the platform because they did not have time and because they didn't like it. [Girl 1]</i> • <i>Yes, some of my classmates tried it, but they weren't interested and that's like saying, "I don't want to play." It could also be an excuse. [Boy 1]</i>

experience, the possibility to earn points to advance levels and discover more challenges on the platform was what caught everyone's attention. Some of them show their global satisfaction with the experience and the use of the tool.

On the other hand, they are also asked why many of them have not played and what has been the motivation for this behaviour. They all agree that sometimes they lacked motivation to solve the proposed activities or simply did not find the time to dedicate to this activity.

In summary, the FG children, in different ways, believe that this learning methodology should involve different aspects: it should provide fun so that it is not boring, it should be adapted to the level and age of the people who participate, above all it should be motivating and provide the possibility of confrontation with peers favouring teamwork.

If we relate the responses to the objectives of our research, we can see that they generally liked to use the proposed platform, they managed it without many problems, but not having the possibility of teamwork or confrontation has reduced their motivation and desire to continue playing.

5 Discussion

This study has proposed the use of a mixed research methodology, with qualitative and quantitative instruments, to convergently analyze pupils' perception of gamification after a teaching experience oriented towards learning about sustainable mobility, using the ClassCraft platform.

To our knowledge, this is the first example of the use of these methodologies focused on the topic of sustainable mobility in primary school children that examines the adoption of technology in the use of the ClassCraft platform.

Gender was found to have a strong influence on Usability, Attitude and Intention to use the ClassCraft platform in particular and gamification in general. Looking at the quantitative results on the use of the ClassCraft platform, we can summarize that the Global Satisfaction is high for both girls and boys. Combining this result with the qualitative part, we can see how students perceive this methodology as an opportunity to change the school experience to get more pleasure from learning activities.

As in the study by Çakıroğlu et al. (2017), our results show that the use of gamification can be seen as a consequence, as some traditional classroom activities are nowadays intrinsically unattractive and do not attract students' attention. Our results highlight very clearly how the element of fun and motivation is very important for students. We can observe in both types of results—qualitative and quantitative—a convergence in relation to the fact that Global Satisfaction is directly related to perceived fun and perceived ease of use.

From the quantitative results, we can observe that Global Satisfaction is directly related to Perceived Usefulness, especially for girls. Still, it is necessary to analyze the results of some variables related to whether ClassCraft has helped learning more than a normal class (PU1) and whether it has improved learning (PU2). We did not found a direct relationship between these variables and Satisfaction, especially in the

case of girls; this can be explained if we complement this information with qualitative data. In the qualitative data, the girls expressed discordant opinions in this respect. In particular, they considered this tool useful, but were still satisfied with learning in traditional classes.

The same considerations can be made for the variables related to Attitude and Intention to Use, where we can observe contradictions. Regarding Attitude, we observe that all students like using ClassCraft for learning (AT4) and that this variable is directly related to Global Satisfaction. However, we observe that girls do not consider it a good idea to use the platform in subjects or in class (AT2). This data, like the previous one, should be analyzed with qualitative data where, especially girls, were in favour of this type of methods, but still trusted more in traditional teaching.

The same conclusion can be drawn for Intention to Use. All variables are related to Global Satisfaction, but we also found that girls again contradict themselves. They are satisfied with ClassCraft and want to use it as much as possible, but at the same time they do not prefer to use it compared to other methodologies applied in class. In these three cases we can see how the qualitative part helps us to understand the inconsistencies of the quantitative data and the experience in general.

On this point, our study differs from Paiva et al. (2022). They analyze the Intention to Use and the factors that influence the acceptance of using the ClassCraft platform. Paiva et al. (2022) propose their study with 2nd and 3rd high school students where students express the intention not to use ClassCraft because they do not find the visual elements appealing and because it conveys feelings of indifference rather than acceptance. The authors state that, from an educational point of view, this non-acceptance factor hinders the learning process, because students do not find it attractive and motivating.

In contrast, in our study, in the qualitative part, the students show a particular interest in the visual elements of the platform and do not find it difficult to use it. In fact, they state that it is the part that has motivated them most in the use of the platform. We can also conclude that age influences the perception of what can be attractive and motivating in this platform, and whether it can be useful from an educational point of view.

The results of this study are partly in line with those of Haris and Sugito (2015). Although these authors analyze the factors that affect students' acceptance of ClassCraft implementation, they do so at the university level, reaching similar conclusions.

It should be taken into account, as Abella-García et al. (2019) point out, that most studies that evaluate innovative educational activities are conducted through questionnaires that inquire about student satisfaction levels and do not take into account the impact that these innovative activities have on students. When qualitative approaches are made to innovative learning activities, in most cases the adult is usually considered as the participant, either by focusing on teachers or by analyzing innovations in higher education. However, our research confirms the idea that children, the main protagonists of learning innovations, should be seen as competent

creators, interpreters and narrators of their experiences who have the right to be heard (Qvortrup, 2015).

The use of Focus Groups has proved to be ideal for evaluating and validating the results, since, as Harris et al. (2009) indicate, it has allowed us to clarify results that could be considered illogical. The results of the application of a questionnaire have been linked to the analysis of the process, which has made it possible to develop a complex picture of the phenomenon to be understood and studied (Greene & Caracelli, 1997). In this way, the understanding of the quantitative data provided by the students in the questionnaire is enhanced, as a deeper exploration of the qualitative data represented by the opinions of the students in the Focus Groups carried out. This contrast is considered a key factor in interpreting the results (Stewart et al., 2008), as some responses in the quantitative data may not correspond to what is observed in the qualitative data. This type of information, in many cases contradictory, can add richness to the study by favouring the extension and follow-up of the factors of analysis (Bahl & Milne, 2006), as has been the case in our results.

The students, in the qualitative part, stated that the motivational factor in the use of ClassCraft is important. Consequently, the creation of teacher-led activities and game dynamics (e.g. teamwork) on this platform should be attractive enough to make learning with ClassCraft as interesting as possible in order to increase students' motivation.

This research can be considered as an exploratory study of students' motivations and the opportunity to use gamification for learning as in previous research (Alghamdi & Holland, 2017; Sailer et al., 2017), with the difference that in this experience it has been decided to use a mixed convergent design methodology to analyze the data obtained from a broader perspective. This experience allows us to conclude that, for students, the use of a methodology based on gamification must consider the experience to be transmitted and must be accepted and motivating.

The main contribution of our study is to include the qualitative part in studies on the acceptance of technology in education by primary school students and contributes to give voice to students as an important part of innovative teaching.

6 Limitations of the Study

Although our research was carried out following a systematic methodology that allowed us to achieve the established objectives and obtain interesting results that can be used from a practical point of view, we must recognize that there are limitations that must be considered.

The most important limitation is the sample used in terms of size. The lack of a comparison group reduces the generalizability of the study, although other researchers may find the data useful for further research.

Another limitation comes from the voluntary nature of the experience on the part of the students. In fact, some difficulties have been encountered in involving students in the study, leading us to create favorable situations to engage them to participate, such as the provision of real prizes that could be obtained by participating.

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Data availability The data used in this article have been obtained from surveys of study participants. Authors cannot share individual data but aggregate data included in the article tables.

Declarations

Disclosures This research doesn't involve sensible and/or individual data regarding human participants, and doesn't involve animals. The personal data in this paper are anonymous and/or presented in aggregate form. All the authors agree with the information provided and give their consent to the information provided.

Conflict of interest The authors declare that there is no conflict of interest associated with this research.

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References

- Abella-García, V., Delgado-Benito, V., Ausín-Villaverde, V., & Hortigüela-Alcalá, D. (2019). To tweet or not to tweet: Student perceptions of the use of Twitter on an undergraduate degree course. *Innovations in Education and Teaching International*, 56(4), 402–411. <https://doi.org/10.1080/14703297.2018.1444503>
- Alghamdi, J., & Holland, C. (2017). *Game-Play: Effects of Online Gamified and Game-Based Learning on Dispositions, Abilities and Behaviours of Primary Learners* (55–63). https://doi.org/10.1007/978-3-319-74310-3_7
- Bahl, S., & Milne, G. R. (2006). Mixed Methods in Interpretive Research: An Application to the Study of the Self Concept. In *Handbook of Qualitative Research Methods in Marketing* (pp. 198–218). Edward Elgar Publishing. <https://doi.org/10.4337/9781847204127.00023>
- Bajaj, A., & Nidumolu, S. R. (1998). A feedback model to understand information system usage. *Information & Management*, 33(4), 213–224. [https://doi.org/10.1016/S0378-7206\(98\)00026-3](https://doi.org/10.1016/S0378-7206(98)00026-3)
- Bielik, P., Tomlein, M., Krátky, P., Mitrík, Š., Barla, M., & Bielíková, M. (2012). Move2Play. *Proceedings of the 2nd ACM SIGHIT Symposium on International Health Informatics - IHI 12*, 61. <https://doi.org/10.1145/2110363.2110374>
- Buckley, P., & Doyle, E. (2017). Individualising gamification: An investigation of the impact of learning styles and personality traits on the efficacy of gamification using a prediction market. *Computers & Education*, 106, 43–55. <https://doi.org/10.1016/j.compedu.2016.11.009>
- Buningh, S., Martijnse-Hartikka, R., & Christiaens, J. (2014). Mobi - Modal Shift Through Gamification. Transport Research Arena (TRA) 5th Conference: Transport Solutions from Research to Deployment. <https://trid.trb.org/view/1315416>


- Çakıroğlu, Ü., Başbüyük, B., Güler, M., Atabay, M., & Yılmaz Memiş, B. (2017). Gamifying an ICT course: Influences on engagement and academic performance. *Computers in Human Behavior*, 69, 98–107. <https://doi.org/10.1016/j.chb.2016.12.018>
- Chau, P. Y. K. (1996). An Empirical Assessment of a Modified Technology Acceptance Model. *Journal of Management Information Systems*, 13(2), 185–204. <https://doi.org/10.1080/07421222.1996.11518128>
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research*. SAGE Publications, Inc.
- de Croon, R., Wildemeersch, D., Wille, J., & Verbert, K. (2017). *Anthropomorphism-Based Focus Group Protocol to Select Gamification Mechanics*.
- Csikszentmihalyi, M. (1990). *Flow : The psychology of optimal experience*. Harper & Row.
- Davis, S., & Wiedenbeck, S. (2001). The mediating effects of intrinsic motivation, ease of use and usefulness perceptions on performance in first-time and subsequent computer users. *Interacting with Computers*, 13(5), 549–580. [https://doi.org/10.1016/S0953-5438\(01\)00034-0](https://doi.org/10.1016/S0953-5438(01)00034-0)
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, 35(8), 982–1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Eder, D., & Fingerson, L. (2001). Interviewing Children and Adolescents. In Jaber F. Gubrium & James A. Holstein (Ed.), *Handbook of Interview Research* (pp. 181–201). SAGE Publications, Inc. <https://doi.org/10.4135/9781412973588.n13>
- Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: A perceived risk facets perspective. *International Journal of Human-Computer Studies*, 59(4), 451–474. [https://doi.org/10.1016/S1071-5819\(03\)00111-3](https://doi.org/10.1016/S1071-5819(03)00111-3)
- Fishbein, Martin., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior : an introduction to theory and research*. Addison-Wesley Pub. Co.
- Gabrielli, S., Forbes, P., Jylhä, A., Wells, S., Sirén, M., Hemminki, S., Nurmi, P., Maimone, R., Masthoff, J., & Jacucci, G. (2014). Design challenges in motivating change for sustainable urban mobility. *Computers in Human Behavior*, 41, 416–423. <https://doi.org/10.1016/j.chb.2014.05.026>
- Greene, J. C., & Caracelli, V. J. (1997). Defining and describing the paradigm issue in mixed-method evaluation. *New Directions for Evaluation*, 1997(74), 5–17. <https://doi.org/10.1002/ev.1068>
- Haris, D. A., & Sugito, E. (2015). Analysis of factors affecting user acceptance of the implementation of ClassCraft E-Learning: Case studies faculty of information technology of Tarumanagara university. *International Conference on Advanced Computer Science and Information Systems (ICACSIS)*, 2015, 73–78. <https://doi.org/10.1109/ICACSIS.2015.7415161>
- Harris, R., Holmes, H. M., & Mertens, D. M. (2009). Research Ethics in Sign Language Communities. *Sign Language Studies*, 9(2), 104–131. <https://doi.org/10.1353/sls.0.0011>
- Huang, R., Ritzhaupt, A. D., Sommer, M., Zhu, J., Stephen, A., Valle, N., Hampton, J., & Li, J. (2020). The impact of gamification in educational settings on student learning outcomes: A meta-analysis. *Educational Technology Research and Development*, 68(4), 1875–1901. <https://doi.org/10.1007/s11423-020-09807-z>
- Igbaria, M., Parasuraman, S., & Baroudi, J. J. (1996). A Motivational Model of Microcomputer Usage. *Journal of Management Information Systems*, 13(1), 127–143. <https://doi.org/10.1080/07421222.1996.11518115>
- Kazhamiakin, R., Marconi, A., Martinelli, A., Pistore, M., & Valetto, G. (2016). A gamification framework for the long-term engagement of smart citizens. *2016 IEEE International Smart Cities Conference (ISC2)*, 1–7. <https://doi.org/10.1109/ISC2.2016.7580746>
- Keating, M. (1993). *The Earth Summit's agenda for change : a plain language version of Agenda 21 and the other Rio Agreements*. Centre for Our Common Future. <https://unesdoc.unesco.org/ark:/48223/pf0000094323>
- Khoshkangini, R., Fondazione, G. V., Kessler, B., Fondazione, A. M., & Valetto, G. (2017). *Generating Personalized Challenges to Enhance the Persuasive Power of Gamification*. <https://www.researchgate.net/publication/315686740>. Accessed 20 Oct 2022
- Krishnan, S. D., Norman, H., & MdYunus, M. (2021). Online Gamified Learning to Enhance Teachers' Competencies Using Classcraft. *Sustainability*, 13(19), 10817. <https://doi.org/10.3390/su131910817>
- Leaning, M. (2015). A study of the use of games and gamification to enhance student engagement, experience and achievement on a theory-based course of an undergraduate media degree. *Journal of Media Practice*, 16(2), 155–170. <https://doi.org/10.1080/14682753.2015.1041807>

- Legris, P., Ingham, J., & Colletette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management*, 40(3), 191–204. [https://doi.org/10.1016/S0378-7206\(01\)00143-4](https://doi.org/10.1016/S0378-7206(01)00143-4)
- Marconi, A., Schiavo, G., Zancanaro, M., Valetto, G., & Pistore, M. (2018). Exploring the world through small green steps. *Proceedings of the 2018 International Conference on Advanced Visual Interfaces*, 1–9. <https://doi.org/10.1145/3206505.3206521>
- Mathieson, K. (1991). Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior. *Information Systems Research*, 2(3), 173–191. <https://doi.org/10.1287/isre.2.3.173>
- Mauthner, M. (1997). Methodological aspects of collecting data from children: Lessons from three research projects. *Children & Society*, 11(1), 16–28. <https://doi.org/10.1111/j.1099-0860.1997.tb00003.x>
- Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2(3), 192–222. <https://doi.org/10.1287/isre.2.3.192>
- Mora Márquez, M., & Camacho Torralbo, J. (2019). Classcraft English and role play in the primary school classroom. *Apertura*, 11(1), 56–73. <https://doi.org/10.32870/Ap.v11n1.1433>
- Paiva, L., Barbosa, M., Oliveira, S., Barbosa, M., Klisman, V., Duarte, J., Gomes, G., Gadelha, B., & Conte, T. (2022). To the Next Level! an Exploratory Study on the Influence of User Experience on the Acceptance of a Gamified Learning Platform. *Proceedings of the 14th International Conference on Computer Supported Education*, 281–288. <https://doi.org/10.5220/0011067900003182>
- Park, E., Baek, S., Ohm, J., & Chang, H. J. (2014). Determinants of player acceptance of mobile social network games: An application of extended technology acceptance model. *Telematics and Informatics*, 31(1), 3–15. <https://doi.org/10.1016/j.tele.2013.07.001>
- Qvortrup, J. (2015). A voice for children in statistical and social accounting. In *Constructing and Reconstructing Childhood* (pp. 74–93). Routledge. <https://doi.org/10.4324/9781315745008-5>
- Rivera-Trigueros, I., & Sánchez-Pérez, M. del M. (2020). *Classcraft as a Resource to Implement Gamification in English-Medium Instruction* (356–371). <https://doi.org/10.4018/978-1-7998-2318-6.ch017>
- Romo, M. G. A., & Montes, J. F. C. (2018). Gamificar el aula como estrategia para fomentar habilidades socioemocionales. *Revista Educ@rnos*, 8(31), 41–66. <https://revistaeducarnos.com/wp-content/uploads/2018/11/educarnos31-1.pdf>. Accessed 20 Oct 2022
- Sailer, M., & Hommer, L. (2020). The Gamification of Learning: A Meta-analysis. *Educational Psychology Review*, 32(1), 77–112. <https://doi.org/10.1007/s10648-019-09498-w>
- Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, 69, 371–380. <https://doi.org/10.1016/j.chb.2016.12.033>
- Sanchez, E., Young, S., & Jounneau-Sion, C. (2017). Classcraft: From gamification to ludicization of classroom management. *Education and Information Technologies*, 22(2), 497–513. <https://doi.org/10.1007/s10639-016-9489-6>
- Sánchez, R. A., & Hueros, A. D. (2010). Motivational factors that influence the acceptance of Moodle using TAM. *Computers in Human Behavior*, 26(6), 1632–1640. <https://doi.org/10.1016/j.chb.2010.06.011>
- Sipone, S., Abella-García, V., Rojo, M., & dell’Olio, L. (2021). Using ClassCraft to Improve Primary School Students’ Knowledge and Interest in Sustainable Mobility. *Sustainability*, 13(17), 9939. <https://doi.org/10.3390/su13179939>
- Sipone, Abella-García, Barreda, & Rojo. (2019). Learning about Sustainable Mobility in Primary Schools from a Playful Perspective: A Focus Group Approach. *Sustainability*, 11(8), 2387. <https://doi.org/10.3390/su11082387>
- Stewart, M., Makwarimba, E., Barnfather, A., Letourneau, N., & Neufeld, A. (2008). Researching reducing health disparities: Mixed-methods approaches. *Social Science & Medicine*, 66(6), 1406–1417. <https://doi.org/10.1016/j.socscimed.2007.11.021>
- Taylor, S., & Todd, P. (1995). Assessing IT Usage: The Role of Prior Experience. *MIS Quarterly*, 19(4), 561. <https://doi.org/10.2307/249633>
- Venkatesh, V. (2000). Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model. *Information Systems Research*, 11(4), 342–365. <https://doi.org/10.1287/isre.11.4.342.11872>
- Venkatesh, V., & Davis, F. D. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science*, 46(2), 186–204. <https://doi.org/10.1287/mnsc.46.2.186.11926>

- Yi, M. Y., & Hwang, Y. (2003). Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, 59(4), 431–449. [https://doi.org/10.1016/S1071-5819\(03\)00114-9](https://doi.org/10.1016/S1071-5819(03)00114-9)
- Zhang, Q., Yu, L., & Yu, Z. (2021). A Content Analysis and Meta-Analysis on the Effects of Classcraft on Gamification Learning Experiences in terms of Learning Achievement and Motivation. *Education Research International*, 2021, 1–21. <https://doi.org/10.1155/2021/9429112>

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