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Gamification and player type: Relationships of the HEXAD model with the learning experience

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Abstract

Gamification is a widely utilised educational tool designed to promote specific behaviours. An effective gamification design must consider users' experiences and perceptions to enhance engagement and participation. This research is part of a broader study that develops gamified activities to teach primary school pupils about sustainable mobility.

The study investigates the relationship between player profiles, as defined by the Hexad scale, and the use of the ClassCraft platform for learning sustainable mobility concepts. The Hexad scale serves as an instrument to analyse the various motivations exhibited by each student when interacting with the gamified application. Specifically, we examine the connection between player profiles, learning levels, the components of the ClassCraft platform, and the impact of gender on this relationship.

An experiment was conducted with 75 fifth-grade primary school students (aged 10–12) who used the ClassCraft platform. Several linear regression models correlated various variables with the player profiles included in the Hexad scale.

The results indicate a relationship between player profiles and the variables considered: final score on the platform, number of activities completed, number of connections made, player level achieved, student satisfaction level, and learning levels. Additionally, the high percentage of socialiser profiles found among the students is perfectly in line with some of the intrinsic characteristics of the ClassCraft platform.

Furthermore, the analysis revealed minimal differences between male and female players across most profiles.

Keywords: Gamification, Hexad scale, ClassCraft, Learning, Primary education

1 Introduction

Technology is increasingly applied in education for today's digital generation. Among these new teaching activities, gamification has become a widely used methodology in promoting specific behaviours.

The aim of gamified teaching is, among other goals, to enhance students' learning by increasing their motivation to participate in forums and courses, review class material,

and grow the overall student experience (Barata et al., 2017; Pilkington, 2018). Gamification can help teachers find a balance between achieving their goals and meeting the changing needs of their students (Huang & Soman, 2013). According to research by Krath and von Korfflesch (2021), it is important to tailor the content of gamified activities to the requirements and motivations of different users to achieve the desired outcomes.

Lopez and Tucker (2019) considered it necessary to explore the relationships between player types, their performance using a gamified application, and their preferences for different game elements after interacting with them. They explain this need because different individuals react and perceive gamification in different ways, depending on their characteristics. Their research led to the conclusion, as in the case at hand, that it is important to find gamified applications that favour the motivation and performance of each individual.

The present research is part of a larger project aiming to observe and evaluate the use of gamification techniques as key to fostering learning and attitude change towards sustainable mobility (Sipone et al., 2021). The research project targeted children aged 10–12 and used the ClassCraft platform.

The research presented in this article applies the Hexad scale to identify different player profiles within the sample and test the hypothesis regarding their relationship with learning outcomes. Specifically, this study addresses the following research questions:

1. How do player profiles, as defined by the Hexad scale, significantly influence the learning levels of sustainable mobility concepts when using the ClassCraft platform?
2. Do the activities completed and the player level achieved on the ClassCraft platform vary significantly according to the player profile defined by the Hexad scale?
3. How is student satisfaction related to different player types?
4. How does gamification, particularly the features of the ClassCraft platform, affect the performance of various player types, and is gender a significant factor?

2 Literature review

2.1 Gamification in education

Gamification is a concept widely used in many fields of human activity, becoming a popular practice in many contexts, including business, health, education, and advertising, with different degrees of acceptance and success (Deterding et al., 2011).

According to Şenocak et al., (2021), gamification is adapting certain gaming mechanics, such as points, symbols, and leaderboards, to learning environments to make them more entertaining, engaging, and sustainable. However, gamification is not just that; gamification and gaming systems are effective when they support the user in achieving their goals, often involving knowledge acquisition, changes in attitude or behaviour, and increased interest in specific subjects (Busch et al., 2015).

Used in education, gamification can be considered a positive influence on students' performance and attitude toward courses, as it lengthens attention spans and increases engagement by transferring popular game structures to educational processes (Yıldırım, 2017). As explained by Alsawaier (2018a, 2018b), gamification has a significant

relationship with students' motivation and engagement in learning, positively impacting their performance.

Lee and Hammer (2011) considered educational gamification to be a technique that improved the learning experience by making game elements more attractive and transparent to learners, engaging them on a social, emotional, and reflective level. The exercise aims to increase the students' desire to participate in their education and possibly change the way they see themselves as learners.

Gamification can be implemented with or without the use of computer resources. There are examples of valuable experiences of using gamification with non-ICT instruments and more linked to traditional role-playing games on paper (Carrión & De La Cruz, 2018; Sampedro-Martín & Giménez, 2022).

On the other hand, we find many resources that use computer-based tools and are currently available to teachers interested in using gamification as part of their teaching and learning strategies. Most are presented as software, online, or as mobile applications, examples include ClassDojo, Edmodo, Socrative, and ClassCraft, among others. The suggested use of each of these is different and can be related to how to assess students, encourage classroom participation, or teach specific subjects.

For example, the ClassCraft platform, created by Shawn Young in January 2011, is a web application allowing teachers to run a role-playing game in which students become different characters. In a role-playing game, the idea is that students engage in a game in which their character's evolution is related to academic skills and their collaboration in the classroom. They aim to progress as a team while learning and developing their knowledge. Teachers have access to an interface through which they can create a storyline and invent a set of activities for students to solve, for which they receive points and rewards. Each student has a private online profile where they can see how many points or rewards they have earned and for which activities, etc. Students are required to complete the activities proposed by the teacher and, in return, receive points and rewards in recognition of their work.

Several studies have adapted gamification to the classroom and have shown that it can improve student behaviour and performance (Denny et al., 2018; Ortiz-Rojas et al., 2019), as well as the transfer of new knowledge (Carrión Salinas, 2017; Mora Márquez & Camacho Torralbo, 2019; Sipone et al., 2021).

2.2 Player types in gamification

Players are the basic ingredient of all games because they are the ones who decide and perform actions that have concrete consequences. These decisions differ greatly according to player type, as the ability to decide how to behave in the game gives them a sense of power and control over it.

For these reasons, game designers can engage players in many different aspects of the game: problem-solving, maintaining their interest from beginner to expert level, breaking a challenge into small manageable steps that allow them to overcome it, encouraging teamwork, providing a sense of control, personalising the experience for each player, rewarding those who think differently and reducing the fear of failure, etc. (González Jorge, 2016).

Attempts have been made to classify gamers into *player types* to explain different behaviours during the game. According to Yee (2016), not all players have the same reasons for playing games, so it is important to define all the different types of players. Player types can be considered according to motivation, features, and behaviour. Bartle (1999) proposed one of the best-known and referenced sets of player types. His player typology is based on observations of player behaviour in Multi-User Dungeons (MUDs). According to his proposal, playing has two dimensions: action versus interaction and player orientation versus general orientation. We can reveal the resulting player type by determining one's position on each axis. Bartle (1999) later extended the study by adding a third dimension, implicit or explicit (whether the player's actions are automatic and unconscious or thoughtful and planned). His initial classification has been modified over time, as evidenced by several studies using his models to expand the range of player types (Bateman et al., 2011; Hamari & Tuunanen, 2014). The player types defined by Bartle have been criticized for being too dichotomous and simplified (Hamari & Tuunanen, 2014).

The main criticism seems to be based on the notion that people's behaviour and motivation can change over time and depend on context, which means that it can be difficult to identify precisely which category a person belongs to (Santos et al., 2022; Tondello et al., 2016). Another important point raised by critics is that players feel a range of motivations simultaneously. In contrast, the magnitude of these different motivations differs between players and types of players.

Yee et al., (2012) proposed a new model using a factor analytic approach that did not rely on Bartle's player types. Their analysis identified three main components (with ten subcomponents) of player motivation with weak correlations: Achievement component (progress, mechanics, ability), Social component (socialization, relationships, teamwork), and Immersion component (discovery, role-playing, personalization, escapism). Like Bartle's model, the scope of Yee's components is limited to a specific type of game, massively multiplayer online role-playing games (MMORPG), which probably makes them unsuitable for a wider range of game types.

Marczewski (2015) proposed six user types differentiated by the degree to which they could be motivated by intrinsic (e.g. self-realization) or extrinsic (e.g. rewards) motivational factors when interacting with game systems. Marczewski (2015) developed the Hexad scale for gamification user types, based on research into human motivations, player types, and practical design experience to address this need. The Hexad scale user types are classified by different interaction styles with gamification applications following six types: *Philanthropists*, *Socializers*, *Free Spirits*, *Achievers*, *Players*, and *Disruptors* (Fig. 1).

The contribution of this model is that it provides a basis for grouping and segmenting users according to their differences and preferences when interacting with gamified systems. Like the other typologies, Hexad scale user types should be understood as an archetypal categorization, where different types represent users for whom certain motivations are stronger than others (Hamari & Tuunanen, 2014).

Expanding on this work, Tondello et al., (2016) developed and validated a standardized 24-item scale to rate a person according to the six user types. Creating a standardized and validated scale to assess user types based on their interactions with

<i>Player de type</i>	Characteristics
<i>Philanthropists</i>	Motivated by the goal. They are altruistic and willing to give without expecting a reward.
<i>Socializers</i>	Motivated by relationships. They wish to interact with others and create social connections.
<i>Free Spirits</i>	Motivated by independence, meaning freedom of expression and behavior without external control. They like to create and explore within a system.
<i>Achievers</i>	Motivated by ability. They like to progress within a system by completing tasks or to prove themselves by taking on difficult challenges.
<i>Players</i>	Motivated by external rewards. They will do whatever it takes to receive a reward within a system, irrespective of the type of activity.
<i>Disruptors</i>	Motivated by creating change. They tend to interrupt the system directly or through others to force negative or positive changes. They like to challenge the limits of the system.

Fig. 1 Marczewski, player types (Marczewski, 2015)

gaming systems is a promising approach with real potential utility for personalising such systems.

It should be recalled that player types have often been criticised for being based on discontinuous psychological factors rather than presenting and measuring their characteristics on a continuous scale (Hamari & Tuunanen, 2014). However, this is not the case with the Hexad scale model, as it measures the scores of each user type on a continuous scale and presents the results as a collection of six scores corresponding to each type.

Diamond et al., (2015) suggested that this questionnaire could be applied in several different ways, as it is based on player motivations specific to gaming applications: it could be used during the design phase of the gamified system to help aggregate game mechanics to motivate all types of players; it could be used to create a customized range of incentives in order to motivate each user to play individually; it could be used to understand the kinds of users present in a specific group in order to design a more relevant product; or it could be used to assess adoption and usage rates of a specific system in order to better understand the user experience and thus refine the design.

The Hexad scale differs from other player classifications because it defines the user type specifically for gamification and it is a valid model for personalizing gamified applications. The scale allows us to analyse the correlation of each user type with the 32 most used elements in game design, showing positive correlations between the Hexad scale user type and the corresponding game design elements. To summarise, the design and planning of the game need to be built around the users' experiences and perceptions to increase their engagement levels. Participation, relevance, interaction, and openness flourish as a function of both aspects of content and presentation.

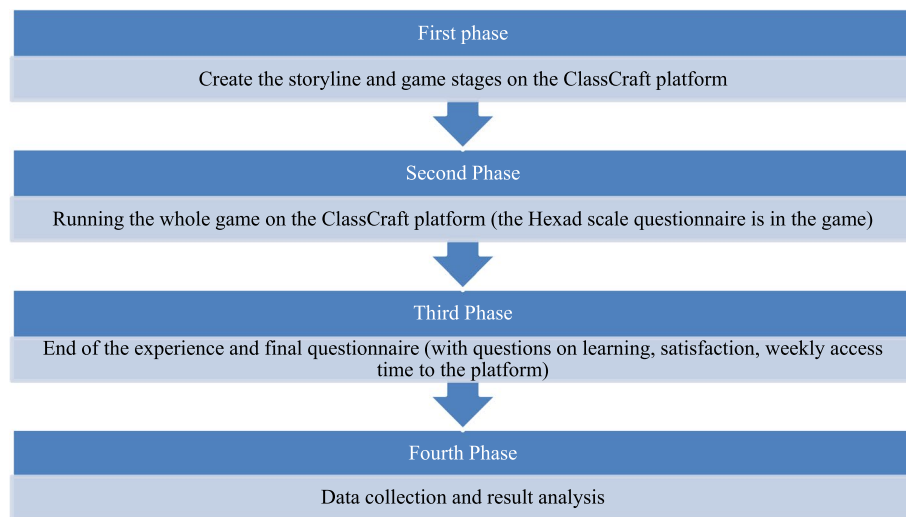
The overall objective of this research is to find out the different player profiles present in the available sample and whether they affect learning. More specific objectives are to discover the relationship between player profiles and certain components of the ClassCraft platform used for the learning experience and whether gender affects on this relationship.

3 Methodology

To answer the questions posed in the study we designed a gamified experience was designed with fifth-grade primary school students (10–12 years old) creating activities about sustainable mobility on the ClassCraft platform. We analysed which type

Table 1 Gender of the study sample

GENDER	TOTAL	5A	5B	5C
Boys	53%	13	13	14
Girls	47%	12	12	11

**Fig. 2** Outline of research phases

of player was more involved in the game based on factors such as the final learning score obtained, the number of activities carried out, the final level achieved in the game, the number of times they played, and their overall satisfaction levels.

In line with the approach of this research, the type of survey design used a quantitative methodology (Creswell, 2012).

The students involved belonged to three classes of 25 (for a total of 75 students).

The characterization of the participants shows a slight differentiation by gender, with some boys more than girls (Table 1). No differentiation was made by age, as all the students in the sample were between 10 and 12 years old.

Before starting the experience, the normal dynamics adopted in the classes were explained to us in a meeting with the teachers. The students were used to working in groups and individually. For this reason, we chose to use the ClassCraft platform because it allows students to work both in groups and individually.

The study was organized in four phases. The first phase saw the creation of the story and the activities on the ClassCraft platform; the second phase saw the start of the activity in the classroom, where the students engaged in the story and answered the Hexad scale questionnaire; the third phase saw the conclusion of the experience and the provision of the learning questionnaire on the concepts of sustainable mobility. In the last phase, all the data produced, both through the questionnaires and those that could be obtained from the platform, were collected and further analysed. (Fig. 2).

3.1 Materials

3.1.1 ClassCraft Platform

The ClassCraft platform is an educational gamification platform designed to transform the learning experience in the classroom. ClassCraft is not directly related to sustainable mobility; in fact, its design and setting resemble the medieval era. In our study, we took advantage of its benefits by including our themes rather than relying on the graphical aspect. Below, we explain the various features that best suit our project and study.

It was chosen for several reasons, mainly of a practical nature. Firstly, it offered us the possibility to work with students remotely. To not interfere with normal class work, the experience was focused on extracurricular experience, and only a few meetings were face-to-face.

Another feature of the platform is the possibility of monitoring the students' results and progress by obtaining detailed information on their performance. For example, we found out how much time they spent on the activity and how many times a week. The experience lasted three months, but with the data from the platform, we could see each student's performance every day. The platform's ability to track student progress and behaviour provided valuable data to analyse.

Another feature that helped us a lot was the possibility of dialogue with the students. The platform, in its tools, offers the possibility of maintaining a direct thread with the students. In fact, when they have a problem, they can communicate it with the supervisor and solve doubts by simply writing and chatting.

The most important element offered by the platform is the ability to create activities and incorporate them into the story using any tool (graphic or writing). In our case, the proposed activities were of various types: crosswords, word searches, coded messages, images, concept maps, mathematical problems, informative videos and documentaries, stories, chat discussions, and real examples. In total, the story map with the activities consisted of 48 stages. To solve each task, the children were given a time limit and could receive different rewards (XP and GP) if they finished before or after the given time. The gamified activities designed within ClassCraft focused on sustainable mobility, a critical topic in today's educational landscape. Students participated in quests that required them to solve problems related to transportation, energy conservation, and environmental impact. These activities were designed to be educational and engaging, encouraging students to apply their knowledge in practical scenarios.

Figure 3 shows the map of activities that each student discovered as they solved the proposed activities.

To stimulate communication and group work, the ClassCraft platform offers an activity called "boss battle", where each group has to defeat a villain by answering some questions. Students take turns in teams to overcome the challenge, maintaining life points and earning points. We used this tool in the few in-person classes we had. Figure 4 shows the students involved in the activity.

3.1.2 Questionnaires

Two questionnaires were handed out: the Hexad scale questionnaire designed by Tondello et al., (2019) without making any changes and a questionnaire aimed at the final



Fig. 3 Map of activities in the ClassCraft platform



Fig. 4 The students involved in the activity

evaluation of the experience in which were asked about the subjects under study (Annex 1).

These questionnaires have allowed us to better understand the engagement, enjoyment, and learning of the students who participated in the proposed gamified experience.

The final questionnaire provided certain data to be applied relating to the player type: the final score of the questionnaire (PFINAL), the weekly access rate (ACC_SEM), and the overall level of satisfaction (SAT_GLOB).

The final score from the questionnaire (PFINAL) was calculated from the first 11 questions (see Annex 1) using the scores explained below:

- Question 1: 11 exact answers = 11 points in total.
- Question 2: 6 exact answers and 2 with a value of 0 (tram and metro) = 6 points in total.
- Question 3: 6 exact answers and 2 with a value of 0 = 6 points in total.

- Question 4: 1 point for an answer of yes and 0 for no.
- Question 5: 4 exact answers = 4 points in total.
- Question 6: 1 point for an answer of yes and 0 for no.
- Question 7: 1 correct answer = 1 point.
- Question 8: 1 correct answer = 1 point.
- Question 9: 1 correct answer = 1 point.
- Question 10: 1 correct answer = 1 point.
- Question 11: 1 correct answer = 1 point.

The sum of the points gives the PFINAL score for each student.

For the weekly access index (ACC_SEM) students could choose between 5 possible answers (never, rarely, occasionally, often, frequently). The overall level of satisfaction (SAT_GLOB) had 3 possible answers (very satisfied, fairly satisfied, and not satisfied) and they could only choose one answer.

The Hexad scale questionnaire was included in the story created on the platform. It was used as a standard scale to qualify the preferences of the users concerning the six different motivations for using a gamified system in accordance with the Hexad framework: *Philanthropist, Socialiser, Free Spirit, Achiever, Disruptor and Player* (Tondello et al., 2016).

The final Hexad scale contained 24 elements, which together can precisely describe the preferences of the user and the inclination of each individual towards each of the different Hexad user types (Table 2).

Table 2 Elements within the scale for each player type (Tondello et al., 2016)

Player type	Elements of the scale
Achiever:	I like to solve difficult tasks I like to overcome difficult tasks It is important for me to fully complete my tasks I find it difficult to abandon a problem without solving it
Free Spirit:	I like to try new things I am often guided by curiosity It is important for me to follow my path It is important for me to be independent
Disruptor	I describe myself as a rebel I like to question the state of things I like being provocative I don't like following rules
Philanthropist	I like to guide others in new situations I like to share my knowledge with others It makes me happy to be able to help others The well-being of others is important to me
Player	If the reward is sufficient, I will make an effort It is important for me to recover what I have invested I like competitions where it is possible to win a prize Prizes are an important incentive for me
Socialiser	I enjoy group activities Interaction with others is important for me I like being part of a team To feel part of a community is important to me

Users are not necessarily gamers and may not be aware of their gaming preferences, as they are unfamiliar with game design vocabulary, so the questionnaire used common vocabulary.

In their article, Tondello et al., (2016) proposed using the scale. Users are asked to rate each item (possible response) on a 7-point Likert scale (from -3 to 3), and each item should be entered randomly without providing any knowledge about the corresponding player type. The points for the items corresponding to each subscale of the player profile should then be summed separately, resulting in 4 questions for each category. In the tally, 3 positive points define the category to which the player belongs, and 3 negative points in the opposite case. This allows us to conclude that a score of 9 or more points means the player belongs to a certain category. Therefore, once the category has been identified, a value of 1 is assigned if the player belongs to the category and 0 otherwise, thus generating 6 dummy variables (variables that indicate the presence/absence of a quality or attribute) that define the six player profiles: Free Spirit (DFR_SPI), Socializer (DSOCIAL), Achiever (DACHI), Philanthropist (DPHILA), Disruptor (DDISR), Player (DPLAYER).

The data included in the ClassCraft platform used for the online work has also been obtained. The final points of the game (P_JU) have been provided by the scores that each student has obtained after solving each activity or challenge in the game; the number of activities in which he/she has participated (N_ACT); the number of times he/she has connected to the game (N_CON) until the end of the experiment and the final level he/she has reached in the game (NIV_JU).

3.2 Data collection

As the experiment involved minors' participation, their parents were asked for permission to participate. They were informed of the research's aims, the voluntary nature of participation, and the anonymity of the results.

The Hexad scale was introduced into the game. A story was written for the ClassCraft platform in accordance with the overall subject behind the research, sustainable mobility. The students became a group of superheroes called on to save a contaminated island. However, during the first stage of the story, they are captured by the island's inhabitants who want to get to know them, so the students were asked to answer the Hexad scale questionnaire.

The questionnaire for evaluating the amount of learning achieved was asked in person, lasting one hour, at the end of the game and after the whole experience, which lasted three months.

At the end of the experience, the data included in the ClassCraft platform were analysed, and all the connections registered by each student were reviewed.

4 Results

The analysis of the results started by examining the replies to the Hexad scale questionnaire to identify the different types of players found among the students. These results were then compared with other variables, such as the final score on the questionnaire (PFINAL), the final score on the platform (P_JU), the number of activities carried out in the game (N_ACT), the number of connections accessing the game

(N_CON), the level reached in the game (NIV_JU), weekly access (ACC_SEM) and overall satisfaction (SAT_GLOB).

Table 3 summarises the data in percentages for the different player profiles, divided between the 3 classes and by gender.

Table 3 shows a higher presence of the Socializer profile (DSOCIAL), followed by Philanthropist (DPHILA). The data for Disruptor (DDISR) stands out for its scarcity in all classes. A gender analysis of these results shows that the percentages are similar for the different player profiles. Female players are absent in the Disruptor profile (DDISR).

Below, we present a series of models that relate the player profiles considered dummy variables to a series of variables we use as dependent variables in each model. The dependent variables are the final score of the questionnaire (PFINAL), the final score of the platform (P_JU), the number of activities developed in the game (N_ACT), the number of connections (N_CON), the level reached in the game using the platform (NIV_JU), weekly access (ACC_SEM) and finally the global satisfaction level (SAT_GLOB). (Table 4).

The first model estimates a multiple regression to predict the final score of the verification questionnaire (PFINAL) as a function of the six possible player profiles.

A significant regression is obtained ($F(6,69) = 75.930, p < 0.001$), with an R^2 of 0.868. The prediction of the final score is equal to $-2.442(\text{DFR_SPI}) + 14.180(\text{DSOCIAL}) - 0.606(\text{DACHI}) + 4.912(\text{DPHILA}) + 9.179(\text{DDISR}) + 8.779(\text{DPLAYER})$ where each dummy variable corresponding to the player type is coded as 1 if the student belongs to that profile and 0 otherwise.

It can be observed that the final score is directly proportional to the following player profiles that are ordered according to the influence that each variable has on the PFINAL (marginal effect): Socializer, Disruptor, Player, Philanthropist; and inversely proportional if they are Free Spirit or Achiever. These last two profiles are not statistically significant at a 95% confidence level; therefore, their contribution to the final score can be considered small.

The second model estimates a multiple regression to predict the final score achieved on the platform (P_JU) as a function of the six possible player profiles. A significant regression is found ($F(6,69) = 15.590, p < 0.001$), with an R^2 of 0.575. The predicted final score achieved on the platform is equal to $-506.963(\text{DFR_SPI}) + 3435.884(\text{DSOCIAL}) + 1230.176(\text{DACHI}) + 1228.960(\text{DPHILA}) + 4065.818(\text{DDISR}) - 143.572(\text{DPLAYER})$.

Table 3 Player profile percentages

%	DFR_SPI	DSOCIAL	DARCHI	DPHILA	DDISTR	DPLAYER
TOTAL	42.67	80.00	57.33	65.33	5.33	46.67
FEMALE	20.00	38.67	28.00	32.00	0.00	20.00
MALE	22.67	41.33	29.33	33.33	5.33	26.67
CLASS A	16.00	28.00	18.67	22.67	2.67	16.00
CLASS B	16.00	25.33	17.33	21.33	1.33	17.33
CLASS C	10.67	26.67	21.33	21.33	1.33	13.33

Table 4 Model Summary

V. Dep	PFINAL		P_JU		N_ACT		N_CON		NIV_JU		ACC_SEM		SAT_GLOB	
	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat	Coef	T-Stat
DFR_SPI	-2.442	-1.15	-506.963	-0.44	-0.447	-0.13	-6.722	-1.47	-0.703	-0.54	-0.064	-0.16	-0.417	-1.50
DSOCIAL	14.180	6.49	3435.844	2.89	9.250	2.55	14.666	3.13	4.014	2.99	1.740	4.26	0.993	3.49
DACHI	-0.606	-0.29	1230.176	1.06	3.260	0.92	1.594	0.35	1.462	1.12	0.374	0.94	-0.094	-0.34
DPHILA	4.912	2.26	1228.960	1.04	2.959	0.82	7.040	1.51	1.528	1.14	0.748	1.84	0.560	1.98
DDISR	9.179	2.21	4065.818	1.80	9.769	1.41	21.444	2.41	4.625	1.81	1.182	1.52	0.960	1.77
DPLAYER	8.779	4.94	-143.572	-0.15	-1.242	-0.42	4.634	1.22	0.228	0.21	0.619	1.86	1.046	4.51
R ² aj	0.868		0.575		0.503		0.599		0.606		0.781		0.729	
Obs	75		75		75		75		75		75		75	

Note that all the models code all the variables in approximately the same way

The only statistically significant variables were DSOCIAL and DDISR (the latter significant to a 90% confidence level). This shows that the only variable that statistically affects the score achieved on the platform is the Socializer player profile membership.

The third model estimates a multiple regression to predict the number of activities performed on the platform (N_ACT) as a function of the six possible player profiles. A significant regression is found ($F(6,69) = 11.616, p < 0.001$), with an R^2 of 0.503. The prediction of the number of activities performed on the platform (N_ACT) is equal to $-0.447(DFR_SPI) + 9.250(DSOCIAL) + 3.260(DACHI) + 2.959(DPHILA) + 9.769(DDISR) - 1.242(DPLAYER)$. The only statistically significant variable is DSOCIAL, with a confidence level of 95%. Again, this shows us that the variable that statistically affects the number of activities performed on the platform is having a Socializer profile.

The fourth model estimates a multiple regression to predict the number of connections (N_CON) made on the platform as a function of the six possible player profiles. A significant regression is found ($F(6,69) = 17.150, p < 0.001$), with an R^2 of 0.599. The prediction of the number of connections made on the platform (N_CON) is equal to $-6.722(DFR_SPI) + 14.666(DSOCIAL) + 1.594(DACHI) + 7.040(DPHILA) + 21.444(DDISR) + 4.634(DPLAYER)$. The statistically significant variables are DSOCIAL and DDISR at a 95% confidence level. This shows us that having a Socializer or Disruptor profile statistically affects the number of connections on the platform.

The fifth model estimates a multiple regression to predict the game level reached on the platform (NIV_JU) as a function of the six possible player profiles. A significant regression is found ($F(6,69) = 17.720, p < 0.001$), with an R^2 of 0.606. The prediction for the game level reached on the platform (NIV_JU) is equal to $-0.703(DFR_SPI) + 4.014(DSOCIAL) + 1.462(DACHI) + 1.528(DPHILA) + 4.625(DDISR) + 0.228(DPLAYER)$. The values show us that the only variable having a statistical effect at a 95% confidence level on the game level reached on the platform is that of having the Socializer player profile.

Summarising the first five models, we can say that the number of activities undertaken (N_ACT) seems to depend solely on the Socializer profile. However, the number of connections (N_CON) and the game level reached (NIV_JU) are directly proportional to whether the player is a Disruptor or a Socializer.

The sixth model estimates a multiple regression to predict the weekly access to the platform (ACC_SEM) as a function of the six possible player profiles. A significant regression is found ($F(6.69) = 41.098$, $p < 0.001$), with an R^2 of 0.781. The prediction for weekly access to the platform (ACC_SEM) is equal to $-0.064(\text{DFR_SPI}) + 1.740(\text{DSOCIAL}) + 0.374(\text{DACHI}) + 0.748(\text{DPHILA}) + 1.182(\text{DDISR}) + 0.619(\text{DPLAYER})$. Weekly access (ACC_SEM) directly relates to whether the player is a Socializer, Philanthropist, or Player; the latter 2 are significant to a 90% confidence level.

The seventh model estimates a multiple regression to predict the player's overall satisfaction (SAT_GLOB) with the activity as a function of the six possible player profiles. A significant regression is found ($F(6.69) = 30.889$, $p < 0.001$), with an R^2 of 0.729. The prediction of the overall satisfaction (SAT_GLOB) with the activity is equal to $-0.417(\text{DFR_SPI}) + 0.993(\text{DSOCIAL}) + 0.094(\text{DACHI}) + 0.560(\text{DPHILA}) + 0.960(\text{DDISR}) + 1.046(\text{DPLAYER})$ where the variables are coded in the same way as in the previous model. Regarding overall satisfaction (SAT_GLOB), the most satisfied students are the Players, Philanthropists, and Socializers, significant to a 95% confidence level, followed by Disruptors, at 90%.

5 Discussion

This study has analysed the types of players participating in an experiment in gamified activities aimed at increasing awareness about sustainable mobility among fifth-grade primary school students. Another objective was to understand how the player type, defined by the Hexad scale model, affected their learning. The research also discovered the type of players most attracted to the ClassCraft platform and the effect of gender on the results. The results have shown a relationship between the player type, the characteristics of the gamified ClassCraft platform, and learning.

The Hexad scale and survey proved useful in choosing and adapting the ClassCraft platform to the students' demands according to their player profile preferences. As suggested by Tondello et al., (2016), the designers, in our case the teachers, were able to assess their audience using the suggested survey and consequently choose the most suitable design elements for each learner.

After analysing the data, we can see the prevalence of the Socializer and Philanthropist profiles, followed by Achiever, Player, Free Spirit, and, finally, Disruptor.

Overall, 80% of players fit the Socializer profile. Fischer et al., (2018) also found that when using gamified activities for learning, Socializer is the most common profile, along with Free Spirit and Philanthropist. Other studies (Mora Márquez & Camacho Torralbo, 2019; Tondello et al., 2016, 2019) have indicated that the most common user profiles are Philanthropist, Achiever and Free Spirit, with Disruptor being the least frequent.

Interestingly, the results found in these studies are very similar to those found in the present research, with the only difference being the age of the sample population. While the research mentioned above was aimed at a more adult population, only children between 10 and 12 years of age participated in our study. We could hypothesise that with gamified activities, the user's age is an independent factor with respect to the player's profile.

No player identifies with a single profile but may have different percentages of various profiles. As Ugur-Erdogmus and Çakır (2022) stated in their study, we cannot accurately

assign and define a player type by analysing only the answers provided. They suggest that the reason may be that the player types are related to the personality and the motivations behind an individual's behaviour. Therefore, it would be better to consider that each person has a combination of preferences and player types and not to assign them to a particular player profile. The present study also verifies the observation that there are players who combine more than one profile, which is positive. Considering that the mission and the ClassCraft platform used by the students encouraged teamwork and overcoming difficult challenges, sometimes without reward, we could hypothesise that the more motivated players are those with the Socializer, Philanthropist, and Achiever profiles.

The analysis of the models relating player profiles to the dependent variables considered in this research (PFINAL; P_JU; N_ACT; N_CON; NIV_JU; ACC_SEM and SAT_GLOB) shows that the predominant profiles in the classes are exactly those that the game favours: Socializer, Philanthropist, and Achiever. The profile Player also provided high values, which is an important factor, as this profile belongs to those motivated to play to get a reward. This profile was found to encourage other player types to continue playing during downtime throughout the experience.

The results have shown that playing on the ClassCraft platform was more attractive to players with the Socializer profile, which was also very present in the classes. However, we can also say that the role played by the Disruptors, of which there were very few in the classes, has been relevant for the development of the game and in the acquisition of knowledge. This is explained by the characteristics of the Disruptors: the attraction to change and to challenge the limits of the gaming system. The presence of some students with the Disruptor profile positively influenced and attracted others who did not have this profile. This was evident in the execution of the activities. On the platform, the activities were organised on a map and hidden to avoid being discovered; the students had to find and unlock them. Due to their characteristics, students with the Disruptor profile unconsciously challenged their peers to do the same.

The top three classified in each class had a higher percentage of Socializer, Disruptor, Achiever, and Philanthropist. At the same time, Players and Philanthropists showed a high degree of overall satisfaction and knowledge acquisition concerning the other variables considered. The Free Spirits and Achievers present in the classes do not appear to be significantly related to any of the variables considered.

The type of platform used, in this case, ClassCraft, and the design of the gamified learning environment appear to be related to player types among students and affect successful learning and motivation. For example, Barata et al., (2017) found that students with different player profiles showed different behaviours and performance levels within a gamified learning environment.

As a final reflection and differing from other research (Mora Márquez & Camacho Torralbo, 2019; Tondello et al., 2019), when examining the different types of player profiles in relation to gender, we found that females did not perform differently from males in most profiles. Tondello et al., (2019), when examining the gender of different user types, found that females in the Philanthropist, Socializer, Free Spirit, and Achiever profiles scored slightly higher than males, while males in the Disruptor profile scored slightly higher. Mora et al., (2019) also found that females were often Philanthropists and Achievers, while males were more often Players and Disruptors. Our research found that not a

single female fit the Disruptor profile. This finding contradicts the research of Şenocak et al., (2021), who found that, when using open and distance learning, females were more willing to define themselves as Disruptors than males, which differs from other studies (Fischer et al., 2018; Tondello et al., 2019). In their conclusions, they explained this by the presence of different social and cultural factors relevant to the research context.

6 Limitations and future research

Although our research followed a systematic methodology that met the initial objectives and provided some interesting results that can be used practically, we must recognise certain limitations that need to be considered:

The most significant drawback is our sample size. We could not repeat the exercise in another school with a different group of students. The lack of a comparison group makes generalising the results from our small sample size difficult.

Another limitation arises with the voluntary nature of the experience for the students. We encountered some difficulties involving students in the experience, so we had to create favourable situations for them to participate, such as making real prizes they could win by participating.

Following the above, the lack of skill represents another factor the students had when using the ClassCraft platform. No matter how many explanations they were given, having to use it independently caused difficulties in some cases. Frustration at not knowing how to proceed led some students to abandon the activity. We do not rule out that this aspect may have influenced some of the variables studied, sometimes more than the Hexad scale profile itself.

However, the research presented here lays the foundation for future studies to determine whether our results can be generalised. Conducting similar studies with larger and more diverse samples could validate our results and improve their generalizability.

To improve student engagement and participation in situations outside of the curricular context, as in our case, strategies should be envisaged to prevent drop-out.

Finally, it is important that if one decides to use a gamified platform, one provides the right support for students to use it safely without difficulty.

7 Conclusions

The relevance of gamification and technology in education became clear after the conclusion of our research. Research on these topics is steadily increasing. The design of an activity or a gamified application that can be successfully applied in an educational context is of great interest to the scientific community.

Our results confirmed the importance of defining player profiles when choosing this methodology and the instrument used (in our case, the ClassCraft platform). The ClassCraft platform promoted collaborative learning among students from three different classes and met the expectations of students with a Socializer profile, which was the most numerous in our sample and the one that learned the most from the experience.

The results indicate that to effectively use a gamification-based methodology, designers must consider the experience they wish to convey or test and ensure it is accepted and stimulating for the students.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1007/s44322-024-00021-w>.

Supplementary Material 1. ANNEX 1.

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Disclosures and declarations

This research does not involve sensible and/or individual data regarding the human participants, and does not involve the use of 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.

Authors' contributions

Silvia Sipone: conceptualization, investigation, writing original draft, methodology, visualization; Victor Abella: data curation, formal analysis, visualization, methodology; Marta Rojo: reviewing and supervision; José Luis Moura: resources, reviewing and supervision.

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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

Ethics approval and consent to participate

The authors of this manuscript state that ethical approval was not necessary for data collection in this study. Consequently, we confirm that informed consent was obtained from all parents and legal guardians of the participants. Additionally, we have rigorously anonymized the acquired data, ensuring full compliance with ethical requirements for publication.

Consent for publication

Not applicable.

Competing interests

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

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