Social Engagement in a Digital Role-Playing Game dedicated to Classroom Management

Guillaume Bonvin, Eric Sanchez

University of Fribourg, CERF, P.-A. de Faucigny 2,
CH-1700 Fribourg, Switzerland
{guillaume.bonvin, eric.sanchez, }@unifr.ch

Abstract. Classcraft is a role-playing game for classroom management in high schools. Teachers can create teams and assign an avatar to students, as well as points and 'powers' as rewards for desired behavior. Classcraft aims to foster players' social engagement. We conducted a preliminary study on classrooms from Switzerland. The objective aims to characterize the social component of players' engagement. Our approach is based on the identification of engaged-behaviors. This work is grounded on the idea that players' engagement encompasses four components (environmental, social, self-component and action). We developed a methodology based on playing analytics to monitor players' behavior. The detection of socially engaged-behaviors is based on the collection and analysis of players' digital interactions with kTBS4LA, a playing analytics tools. Different categories of players emerged in terms of social engagement. The data collected shows that social engagement varies across time, classroom or gender. This variation seems linked both to specific game features.

1. Introduction

1.1. Classcraft, a role playing game

Launched in 2014, Classcraft is a digital role playing game dedicated to classroom management [1]. The objective of Classcraft is to transform the classroom into a role-playing game for the duration of the school year. Teachers can create teams and assign an avatar to students, as well as points and 'powers' as rewards for desired behavior. In order to acquire powers, the player must demonstrate behavior that is expected of him by the school, such as participating in class, helping other students. The students are warriors, mages or healers and they can buy and use powers that have an impact on real life.

For example, a student who comes five minutes late to class may use the power called "Invisibility'. Consequently, he will not be punished by the teacher. In case if the student does not own this power, the teacher, as game-master, deducts points. A loss of too many points causes death (which means detention in school depending on the rules decided by the game-master). Students can use individual or collaborative powers. For example, mages have the most powerful powers, often benefitting their entire team. The game intends to foster collaboration within students' teams.

A platform, called Play-Management System [2], allows for the orchestration of the game: creating teams, assigning avatars, displaying the rules or rewarding students. Students are allowed to access to the platform and to personalize their avatar.

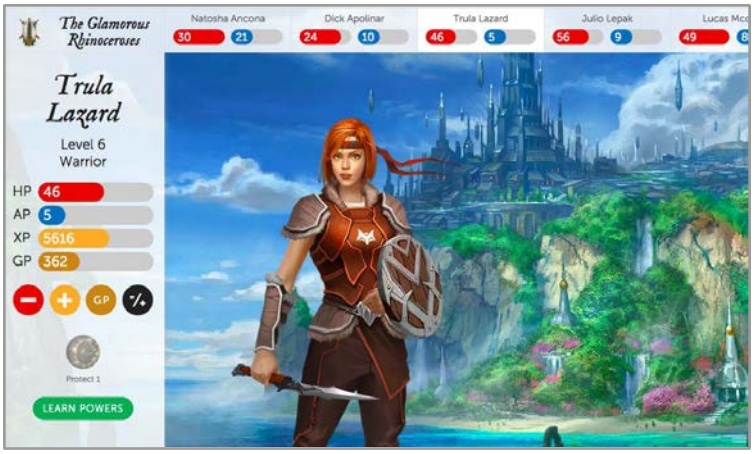


Fig. 1. Classcraft: Student view of avatar, points and level in a team

Since Classcraft has been launched, 2.5 million users in 85 countries are registered.

1.2. Ludicization

Classcraft is a tentative to transform the classroom into a role-playing game. Indeed, different game features are used to convert an ordinary class into a playful situation. These game features have been called by Caillois, *âgon*, *mimicry*, *alea* and *ilinx* [3]. *Mimicry* means playing a role. For classcraft, an avatar with specific characteristics represents each player. *Classcraft* also leverages competition (*âgon*). This competition consists of a conflict with the game itself. Depending on its capacity to adapt his behavior to the rules of the game, the player will win or lose points. Randomness (*alea*) is another gameplay element that is leveraged in Classcraft. Indeed, every class starts with a random event. This event may have a positive or negative impact, such as losing or winning points, on every team. Randomness also manifests itself when, having lost all his points, the player must throw the "cursed die".
However, Classcraft is not limited to use game features in a mechanical way. Classcraft is based on a metaphor that changes the meaning of the actions performed by the students. When Classcraft is played, the classroom is not a classroom anymore. The classroom is a battle where players have to overcome difficulties in order to "survive". An analysis of Classcraft with the Activity Theory framework [4] illustrates that the game enables for a shift of the meaning of the actions performed by the players and not on the action themselves (table. 1)

Table 1. Ordinary class vs Classcraft

Levels according to the Activity Theory	Ordinary class	Classcraft
Operation (How?)	Following the classroom rules (i.e. arriving on time in class)	
Action (Why?)	Driven by the classroom rules (i.e. the teacher expect to have students arriving on time)	Driven by the game rules (i.e. arriving late means losing 10 points)
Activity (For what?)	Being a "good" student (i.e. earning the teacher's esteem)	Being a good player (*âgon*) (I.e. winning the level)

The shift from an ordinary to a playful situation is not performed at the operation level. However, this shift operated with Classcraft changes the motives of the operation and also the meaning of the activity of the students. Play emerges from the player intention and the meaning given to the performed actions. We use the

term *ludicization* [1] to name the changes of motives and meaning of an ordinary class and it conversion into a playful situation.

1.3. Objectives of the study

By playing Classcraft, students are expected to help other students and to collaborate during school activities. Thus, Classcraft aims to foster players' social engagement. As a result the objective of our study consists of characterizing the players' social engagement and its evolution. We also want to compare social engagement for different classes and to assess if social engagement depends on gender.

2. From engagement to social engagement

Different definitions have been provided for players' engagement [5]. Engagement has been considered to be the lowest level of immersion [6] or a generic indicator of game involvement [7]. Fredricks, Blumenfeld, and Paris [8] consider that engagement encompasses 3 dimensions. *Behavioral engagement* entails participation, positive conduct and effort. *Emotional engagement* relates to the interest for the activity and positive emotions. *Cognitive engagement* entails psychological involvement in the activity and self-regulation. However, due to the ambiguity of the related concepts and their context-dependent definitions [5] the operationalization of players' engagement characterization might be difficult. Thus, our approach is based on the identification of *engaged-behaviors* (*Ibid.*). Based on the Self-Determination Theory [9] which states that motivation results from innate psychological needs, Bouvier et al. [5] consider that players' engagement encompasses four components. The *environmental component* is in relation with the autonomy need, the *self-component* relates to the autonomy need, the *action component* is in relation with the competence and autonomy needs. The *social component* is in relation with relatedness.

3. Methodology

3.1. Playing Analytics

From a methodological point of view, we developed a specific methodology based on *playing analytics* |10] and dedicated to monitor players' behavior. The detection of engaged-behaviors is based on the collection and analysis of players' digital traces. Digital traces are players' interactions performed during a digitally mediated activity. *Obsels* (observed elements) [11] are elementary player's actions (like buying or using powers). Each *obsel* is automatically collected and characterized by a type of event, a timestamp (beginning and end of the event) and information that is useful to derive meaning (attributes and relations with other *obsels*).

Among the wide variety of the collected *obsels*, some are inherent to players' social engagement. As indicators of social engagement we selected two specific categories of *obsels*: buying and using collaborative vs individual powers. Indeed, we consider that the use or the willingness to use collaborative powers brings information on the participation of the player to a collaborative play where the outcomes of the game depend on the capacity of players to take their teammates into consideration.

For this preliminary study, we collected the digital traces produced by secondary students in Switzerland. They played Classcraft during the full duration of the school year.

3.2. Extraction and Data Preparation

The data collected come from 11 classes in Switzerland. For each class, the data consists of 8 JSON files. The events that occurred during the game are described in the main file (logbook.JSON). The following lines give an idea of the format:


```
{
"_id": "qMKyAzyz3zAS6BKMc"
```

```
"actionType": "hp",
"actionValue": -10,
"groupID": "BnGfFgigYReGNjtE3",
"targetPlayerID": "bGjjjjF6Jk7nQurh3",
"extraDescription": {
       "description": "matériel",
       "value": -10,
       "_id": "7444699a-9da7-4747-a396-482a07861cdd",
       "mods": {
              "hp": "-10",
        }
},
"screenDisplay": true,
"userID": "TdTZwQ6ygFKtjBASX",
"timestamp": "2017-01-18T08:34:08.736Z",
"createdAt": "2017-01-18T08:34:08.736Z",
```


The event "qMKyAzyz3zAS6BKMc" indicates that the player "bGjjjjF6Jk7nQurh3" ("targetPlayerID") lost 10 ("actionValue") HP ("actionType") because he forgot his school material ("extraDescription") on January 18, 2017 at 8:30 am ("timestamp").

All JSON files have been converted to CSV format. *Logbook* file has been completed with information extracted from the other files: gender, team and game-level reached by a given player. These operations were carried out with the digital traces of every class to have the same file structure. Finally, four sets of data (four classes) have been selected for our exploratory study.

3.3. Data Processing with kTBS4LA

The analysis of these digital traces is performed with a specific digital platform called kernel Trace Based System for Learning Analytics (kTBS4LA) [12]. kTBS4LA is a trace-based system platform dedicated to the analysis of digital traces. The data collected are uploaded and different tools dedicated to data processing are available.

First, a kTBS4LA export model is created this model gives a precise description of the digital traces uploaded on the platform. It means that the columns of the file and the different variables are named. The export lasts a few minutes. Once the file is loaded, data exploration can start.

The platform allows for:

- Selecting specific *obsels* from the data collected. The *obsels* that are considered to be relevant for the study (i.e. buying and using collaborative powers) are extracted from the whole dataset.
- The visualization of these *obsels* among a timeline. Different colors and shapes can be used for making apparent specific features.

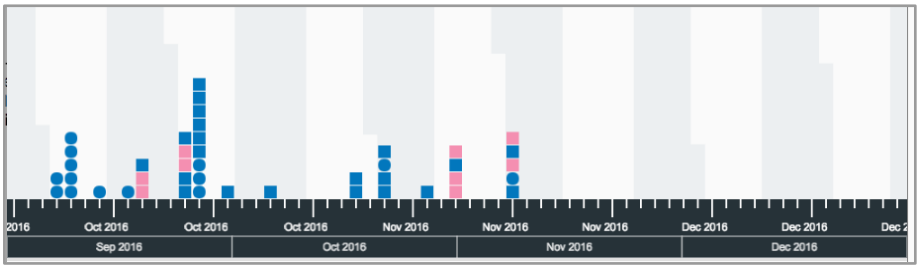


Fig. 2. Example of visualization on the timeline with kTBS4LA. In this view, each *obsel* is depicted by a quare or round dot.

In order to obtain consistent and debatable results, the same protocol is applied to each dataset. We designed and recorded several scenarios for data processing that combine the use of collaborative powers (green) o individual powers (red) with class, genre, teams or avatars. The results of these different scenarios are discussed in the following section.

4. Preliminary Results and Discussion

In this section we discuss the first results of our preliminary study coming from four classes who produced exploitable data. The classes have on average 16 students, 6.75 girls for 9.25 boys and 3.25 teams. The recording of the data last from 4 to 7 months.

Class 4 is a specific case. The teacher gave all the powers to everyone at the beginning of the game. As a result, the players quickly reached a high level.

Table 2. Information about the different classes of the study.

Traces	**Class 1**	**Class 2**	**Class 3**	**Class 4**
Obsels	640 *obsels*	568 *obsels*	2352 *obsels*	7923 *obsels*
Start of data	September 22, 2016 at 16:29	October 13, 2016 at 08:32	15 September 2016 at 16h53	September 22, 2016 at 07:33
Stop of data	December 27, 2016 at 22:30	January 13, 2017 at 09:03	16 January 2017 at 10.10 am	April 09, 2017 at 08:36
Period	3 months and 5 days	3 months	4 months	6 months and 17 days
Average *obsels* / day	17.77	6,1	18, 37	39, 02
Language	French	French	German	German
Students	18 students	13 students	14 students	19 students
Teams	3 teams	2 teams	3 teams	5 teams
Gender	8 girls and 10 boys	3 girls and 10 boys	9 girls and 5 boys	7 girls and 12 boys
Characters	6 Mages 5 Warriors 7 Healers	4 Mages 4 Warriors 5 Healers	3 Mages 6 Warriors 5 Healers	5 Mages 5 Warriors 9 Healers
Use of powers	44 powers	52 powers	184 powers	467 powers

4.1 Evolution of social engagement during the school year

Purchases and uses of powers are two categories of recorded *obsels*. The types of powers purchased or used by players are good indicators of social engagement. Indeed, to progress through the game, students can buy new powers. They can choose between collaborative powers and individual powers. In 3 out of 4 classes, students mostly purchase individual powers (fig. 3) . They first play as individual players.

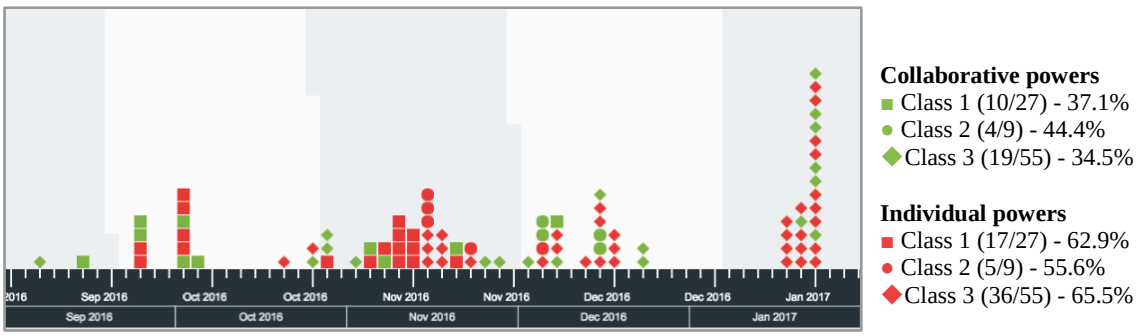


Fig. 3. Purchasing Powers: Collaborative Powers vs Individual Powers

The data show that, along the school year, the students from classes 1, 2 and 4, use more and more collaborative powers. However, for class 3, this is not the case. There is a balance between individual and collaborative powers. As a result, for 3 classes, social engagement varies along the game. The students are more and more involved into a collaborative play.

The rules of the game intend to foster collaborative behaviors. Indeed, to get through the different game levels, students must use collaborative powers. A majority of students seems to have understood this and, regarding this issue, the game meets the objectives of fostering social engagement in the classroom.

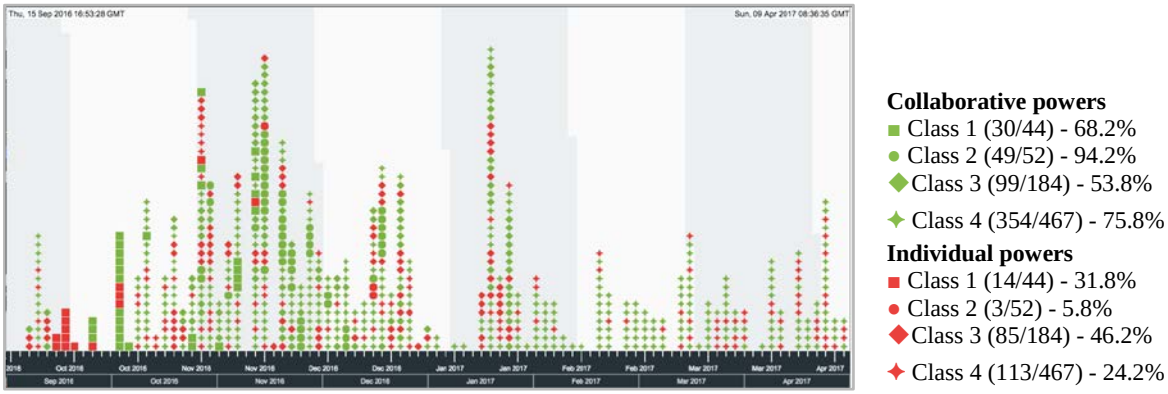
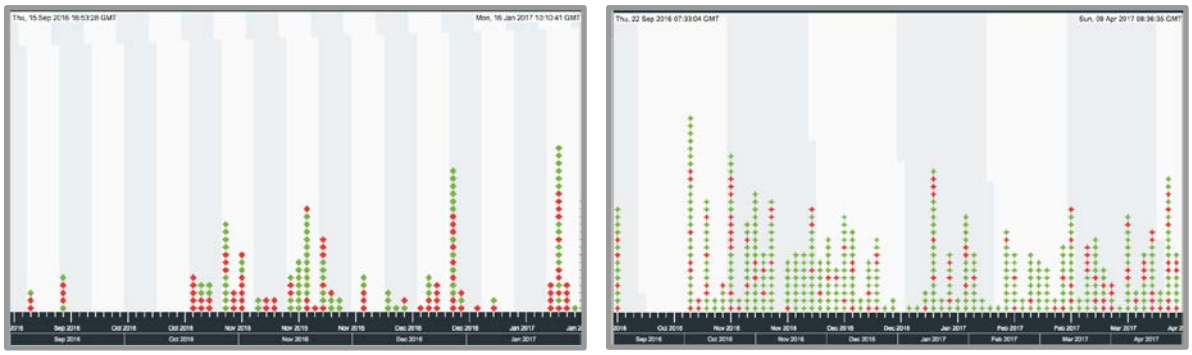


Fig. 4. Using Powers: Collaborative Powers vs Individual Powers.

4.2 Comparison of social engagement for different classes



Class 3 : (99/184) - 53.8% (85/184) - 46.2%

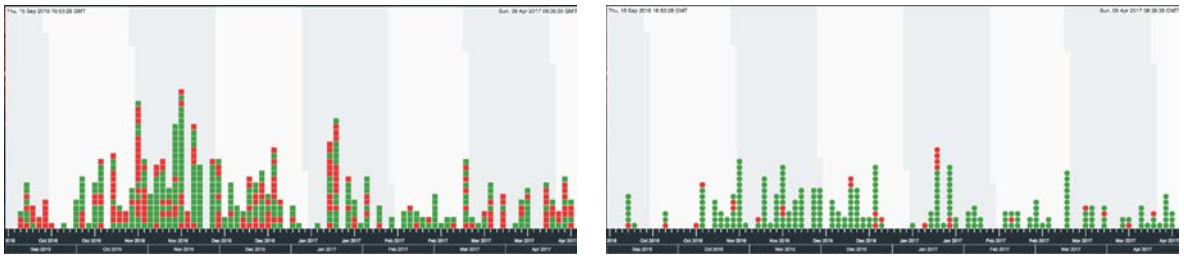
Class 4 : (354/467) - 75.8% (113/467) - 24.2%

Fig. 5. Comparison of social engagement for different classes.

Figure 5 confirms the evolution of social engagement during the school year. The players use more individual powers at the beginning of the school year. Later on, there is a shift from the use of individual powers to the use of collaborative powers (green dots) (Fig. 4). However, as mentioned above, this is not the case for class 3. The comparison of class 3 and class 4 illustrates the difference between players very active and involved into a collaborative play (class 4) and players less active and mostly involved in an individual play. Social engagement varies among classes and this variation is probably due to the context in which the game is implemented. Indeed, Vandercruysse and Ellen [13] stress that the context is of great importance for the game implementation. In this regard there are probably decisions taken by the teachers that influence students behavior.
Classcraft changes the classroom context. The class becomes a battle and the game consists of overcoming difficulties in order to survive together. Advancing in the game cannot be done alone. The game itself, but also the rules decided by the teacher as the game-master, converge towards a collaborative approach.

4.3 Gender, avatars and social engagement

The data collected also show differences between how girls and boys play. While boys use more collaborative than individual powers, they still use a lot of individual powers. Girls are less active but more efficient and use few individual power. Figure 6 shows more red squares for the boys than red circles for the girls.



Male
collab. (304/493) - 61.7%
individual (189/493) - 38.3%

Female
collab. (228/254) - 89.8%
individual (26/254) - 10.2%

Fig. 6. Uses by Gender: Collaborative Powers vs Individual Powers.

When creating teams, it is recommended that better students (those who are used to respect the rules) play the role of healer or warrior. The healers are supposed to heal their teammates and the warriors to protect the team. Focusing on the data of the 3 teams of class 3, teams 1 and 3 use more collaborative than individual powers, team number 2 uses more individual powers (Fig. 7 : Red diamonds).

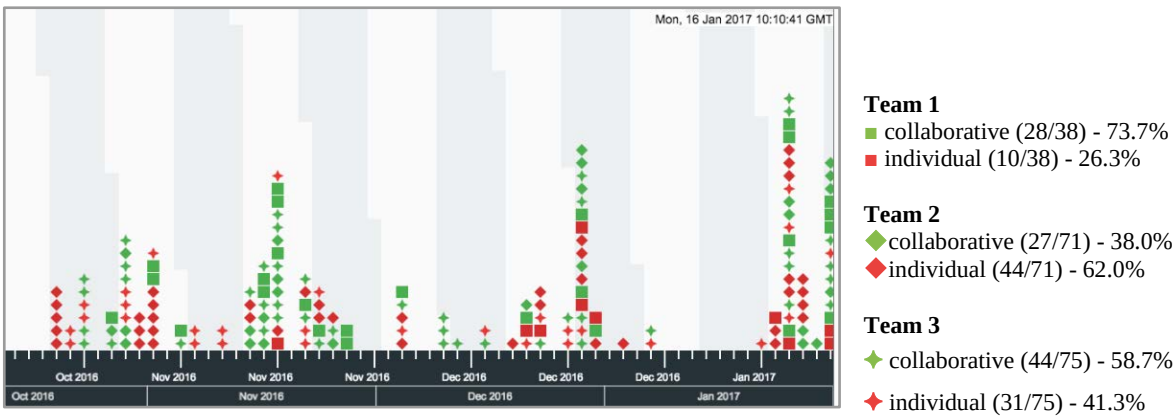


Fig. 7. Uses by team : Collaborative Powers vs Individual Powers.

Table 3 enables for the comparison between mage/warriors and healers. The data collected for team number 2, enables to show the differences on social engagement according to the character played by the students. The 5 players from team number 2 use 71 powers, 27 collaborative and 44 individual. Some students are "strong" healers. They use only collaborative powers. This is the case for two girls. The male students playing as warriors and the female student playing as mage use more individual powers. According to the rules of the games, it means that they are weaker and they need the help of their teammates playing as healers.

Table 3. Collaborative vs individual powers used by players from Team 2 of Class 3

Player 1	**Player 2**	**Player 3**		**Player 4**	**Player 5**
Mage	Warrior	Warrior		Healer	Healer
Girl	Boy	Boy		Girl	Girl
3	5	6		6	7
6	17	21		0	0

Social engagement varies by students' gender. Girl are more involved into collaboration that boys. In addition, social engagement varies among characters played by students.

Conclusion

Classcraft aims at fostering desired conduct in students and, based on our preliminary study, there are arguments to state that the game reaches this objective. For three classes that we selected among four from our study, social engagement, assessed through the use of collaborative powers, increases during the time dedicated to play. These first results tend to demonstrate that the game has an influence on how students collaborate with their teammates. The game manages to foster social engagement in students.

It is not totally clear how the game influences students' behavior. Rewards and penalties might play an important role regarding this issue. However, we think that there is no specific game element that can be used to make a game as suggested by previous definitions of gamification [14]. We think that it is possible to subtly combine elements in order to design a context (a metaphor) that changes the meaning of the situation. With Classcraft, the classroom is not anymore an ordinary classroom but becomes a "battle" where students use powers to overcome difficulties. Sanchez et al. [1] use the term *ludicization* to emphasizing that play is performative. They state that it is not possible to "make" the game, as suggested by the suffix "*-fication*" (*facere*) of gamification. As suggested by the suffix "*-icization*, ludicization means that it is possible to convert an ordinary situation into a game. We consider that students' behavior result from the meaning that they give to the experienced situation in the classroom.

The results about students' social engagement seem to support this hypothesis. Students' social engagement varies among gender and role played by the students (warrior, healer or mage). The results also vary among classes. It means that the way the students and the teachers take on the game is of great importance. The differences that we noticed need further investigations and we plan to apply similar data processing frameworks to a larger dataset. We also need to carry out classroom observations and to get a better understanding of the role and influence of the teacher on how students play. We also want to investigate if social engagement developed by the students during the time devoted to play is transferable to ordinary classrooms. In addition to the analysis on a larger dataset, the next step of this study will be a collaborative research carried out with voluntary teachers from a secondary school in Switzerland.

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