A Link Between Worlds: Towards a Conceptual Framework for Bridging Player and Learner Roles in Gamified Collaborative Learning Contexts

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Abstract. Gamification has been widely used in education with mixed results. Some empirical findings indicate that gamification can increase motivation and engagement in students; other findings highlight that gamification can be a distraction to students; and therefore it may end up hindering learning. To deal with this problem, it is necessary to design gamification to fit properly in individual and collaborative learning contexts. Unfortunately, there is a lack of studies on frameworks mapping game elements and learning theories to support the adequate design and application of gamification in education. Moreover, most proposed solutions do not take into account the need for personalized gamification. To bridge this gap, we set out to create models and a vocabulary to represent learner-player roles interactions in gamified collaborative learning contexts. We developed a conceptual framework using these models and the vocabulary. To demonstrate the framework's viability to design theory-based gamified collaborative learning scenarios, we describe a case study using the theory Peer Tutoring. Our conceptual framework is an effort to support the development of social software tailored towards improving the learners' interactions, providing rich and systematic new ways to learn and to explore the knowledge.

Keywords: Gamification · CSCL · Collaborative learning · Group formation · Framework · Social computing · Roles

1 Introduction

The term gamification originated in the digital media industry, however, such term only gained widespread acceptance after the end of 2010 [1]. Gamification refers to the use of game design elements like mechanics, aesthetics, and game thinking to non-game contexts that aim to engage people, motivate action, improve learning, and foster problem solving [2]. In gamification approaches, these game design techniques are not

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the center of the system, rather, the goal of these gamification approaches is to improve the user experience. Given that applying game elements to education has the potential to maximize the engagement of students and motivate them [2], there has been a growing interest in applying gamification to education [3].

However, simply inserting game elements in a system and hoping for the best will not improve the user experience [4, 5]. The same applies to gamification efforts that rely only on distributing points and badges (e.g., *pointfication*, *exploitationware*, shallow gamification) [6, 7]. Therefore, building sound educational systems that capitalize on gamification techniques require a careful analysis of the most suitable game design elements that will help to achieve the desired learning outcomes [2]. In this sense, the representation of learner roles and player roles, which rely on sound pedagogical basis, is highly desirable.

Despite the well-known benefits of Computer-Supported Collaborative Learning (CSCL), collaboration in education only has a positive influence on the learning process if its design and utilization take place in a proper way [8] since CSCL is not per se beneficial [9]. Consequently, the carefully design of CSCL environments and collaborative learning (CL) activities is a vital task; otherwise, there is no guarantee that the learning outcomes will meet the desired expectations. In this context, the role played by group formation is fundamental: it influences how students perceive the environment, interact with peers, use available didactic materials, and take part in learning activities and processes [10]. Group formation in CSCL refers to strategies, algorithms, techniques, and methods to cluster individuals according to several criteria with the objective of creating well-thought-out groups that will lead students to better interact with each other and maximize their learning gains. Thus, when a group is properly created, every student brings something relevant to the table, adding improvements to the group learning experience. To proper select students to create effective groups, characteristics such as, knowledge, learning style, performance in previous learning activities, and language barriers, to name a few, have to be considered in hopes of improving learning interactions and benefits [10].

Several researchers have been investigating how to design effective group formation methods that support collaborative learning sessions. However, as pointed out in [7], when scripts designed to support CL tasks are used, there are situations in which these scripts may interfere, at least to some degree, with the students' motivation. The interplay of motivation and cognition when students undertake collaborative group work is a research area that has not been fully investigated [11]. Still, it can be a promising area, because the success of both individual and group learning is closely related to the motivation of the students [12]. There are numerous different motivation construct analyses in the literature [13]. Usually, those analyses share a common distinction between two factors: intrinsic and extrinsic motivation. Briefly, extrinsic motivators are external factors to the person that can influence his/her interest and attitudes, while intrinsic motivation are internal mental states that can influence person's predisposition towards interests and attitudes [14].

As a result, many researchers and practitioners have been investigating gamification-based alternatives to motivate students in CL scenarios [2, 15]. However, since gamification is highly context-dependent, ill-designed gamification solutions can lead to harmful effects instead of the expected benefits [4, 5]. In addition, learners have

different player styles, so it is important to understand such styles and adapt the reward system appropriately, since the customization of incentives, rewards, and the way they are presented to the individual can benefit learners [16]. Therefore, the construction of sound gamified CL sessions requires not only a careful analysis of appropriate gamified activities (e.g., environment's design) and meaningful rewards (e.g., suitable game elements) but also the ability to assign appropriate player roles for each learner.

As a first step towards these objectives, we set out to create *models* and a *vocabulary* to represent learner-player roles interactions. The vocabulary and models were organized as a conceptual framework that represents the interactions between learner-player roles in gamified CL contexts. This conceptual framework was designed in hopes of supporting the development of social software, improving learners' interactions and providing systematic new ways to learn and explore the knowledge [17].

2 Related Work

There is a large amount of research on motivation and learning coming from different backgrounds; all demonstrating that motivation plays a vital role in individual learning. However, in the case of CSCL, learning is a more complex process, and despite this, research in this field has not been completely explored yet [9]. In [18] for instance, a meta-analysis of 41 studies investigated the effects of having choice (related to autonomy) and possible intrinsic motivation outcomes. These studies investigated both children and adults samples in different environments. The meta-analysis shows evidence that backs up the idea that enabling learners to choose from different learning alternatives enhanced not only intrinsic motivation, but also: task performance, effort, and perceived competence. However, in [9], they raised some concerns with regards to manipulate students' motivation. In this study, an experiment was performed and the students' competence was evaluated (if appropriate) after completing specific collaborative tasks. The exploratory analyses presented evidence that the appraisal of one partner may have played an unexpected role increasing a freeride behavior on the other partners that did not receive an appraisal. The authors assumed that the freeride effect indicates that part of the participants lost their motivation, thus suggesting the influence of motivation also during CSCL.

Currently, to the best of our knowledge, no research effort has proposed a link between player roles to learner roles in CL and gamification. In [19], they present an e-learning environment wherein generic mechanics and player types found in the gamification literature were incorporated. They also investigated the effects of such mechanics into different learning activities aimed to observe the learning effectiveness of the selected mechanics and the relationship between the mechanics and player types. In [20], a gamified collaborative learning environment was built to foster group collaboration: the authors applied gamification techniques to motivate a group of learners while they performed a task in a collaborative fashion. During this investigation, the authors employed visible progress of task completion as feedback. Groups that used such feature demonstrated high levels of collaboration compared with groups that did not used any visible progress indicator. In [7], an ontology to gamify CL scenarios is described, although the focus of the study is the formalization of concepts concerned to

gamification as a persuasive tool in CL, and the relationship between player roles and suitable learner roles is not taken into account. Furthermore, despite many attempts to unify players' behaviors and, as a result, to establish an ultimate taxonomy of players types, few studies have investigated players types from the standpoint of educational theories [15]. There is a lack of studies investigating what kind of player role a learner should play to trigger the desired behaviors in gamified CL settings.

3 Method

Firstly, in order to develop the framework, we designed a protocol to collect and analyze the literature on **group formation in CSCL**. More specifically, we carried out a systematic mapping study by following the guidelines proposed by [21]. Initially, we collected 3571 papers about CSCL that had the potential to provide valuable information about research on group formation. After a careful analysis of each paper, only 106 met the necessary requirements/criteria defined in our protocol. As a result, each of the 106 papers was categorized according to their contributions using information extracted from this systematic mapping.

Secondly, we performed another systematic mapping study to investigate the state of the art on how **gamification** has been applied in educational settings [15]. The information extracted from both mapping studies gave us a useful overview of the state of the art of both domains, such as new methods, algorithms or criteria for group formation; the rationale (or the absence of one) behind the group formation strategy; and also possible advantages, drawbacks and pitfalls when using gamification in learning environments.

Thirdly, we investigated the previous efforts developed by [10, 22–24], all based on sound instructional and learning theories, these studies provide significant contributions on how to model learner roles, and how to conduct CL activities in intelligent learning environments. Finally, we devised our definition of player roles crossing information extracted from **Motivations to Play** [25], **Self-determination Theory** (SDT) [13], and **players types** found in the gamification literature [26].

Motivations to play is an approach that differs from most available player models. Instead of using psychological archetypes in an effort to fit a player in one kind of dominant personality type, the proposed approach tries to identify not only the reasons that can motivate an individual to play a video game, but also their relationship and overlaps. In this way, the scale developed by [25] does not attempt to identify in which archetype one individual must fit, but rather to understand *what can motivate such an individual to play*. In addition, by identifying the reasons that may arouse motivation to play, by analyzing the results of the scoring system developed, one can also identify what can be deemed less attractive for such an individual.

To understand the psychological needs that drive motivations to play, we rely on SDT concepts. SDT seeks to explain how *intrinsic* and *extrinsic* motivators influence human behavior and the development of individuals. According to this theory, the three basic psychological needs considered fundamental to influence motivation are *autonomy*, *relatedness*, and *competence*. Therefore, by promoting the internalization of these

psychological needs, individuals have the potential to carry out their activities with improved performance, persistence, and creativity, for instance.

Considering that our main goal was not to come up with a new player typology, we decided to keep things simple, by initially limiting the number of player types to five (Achiever, Killer, Socializer, Creator and Explorer). Although this is not an exhaustive set of players, we believe that this granularity can cover a reasonable scope of the most common player types found in the gamification literature, therefore fulfilling the purpose of the definition of our player roles [25, 26].

Next, we compared each selected player type with motivations to play and the psychological needs (extracted from SDT). As shown in Table 1, we linked the components *Achievement*, *Social*, and *Immersion*, with the following psychological needs: *Competence*, *Relatedness*, and *Autonomy*, respectively. The component Achievement has the subcomponents: Advancement, Mechanics, and Competition. In order to keep things simple, as shown in Table 1, some subcomponents and psychological needs were grouped together according to their synergies. We related the subcomponents Advancement and Mechanics to the psychological need Competence. We decided to join them because we consider that they are associated with the player type: Achiever. To support this decision we checked many player typologies [26–29] looking for information that could help us devise appropriate player roles for each subcomponent. We found, for example, that in the gamification literature, Achievers enjoy not only beating a game but also being the most successful player, accumulating rewards in the process. To do this, achievers strive to understand the game mechanics and/or they scrutinize the game to reach their goals. In other words, the achiever behavior is goal-oriented, and people experiencing this behavior will spend a lot of time to reach their goals. We used the same approach to connect the remaining components, subcomponents, psychological needs and player types.

In Table 1, both Achievers and Killers belong to the component Achievement, however, while Achievers are more interested in increasing their in-game reputation by completing different tasks, Killers are more interested in tasks that involve besting other people in some sense. In other words, Killers are people-oriented, and they score high in the subcomponent Competition. Killers, in game design literature, are the type

Table 1. Motivations to play X self-determination theory X player types

Motivations to play [25]		Self-determination theory [13]			Player types [26]
Component	*Subcomponent*	Psychological needs			*Common in the literature*
		Competence	*Relatedness*	*Autonomy*	
Achievement	Advancement	●			Achiever
	Mechanics	●			
	Competition	●			Killer
Social	Socializing		●		Socializer
	Relationship		●		
	Teamwork		●		
Immersion	Discovery			●	Explorer
	Customization			●	Creator

of players highly motivated by Competition. They find zero-sum game mechanics appealing [26, 30], so they enjoy rushing and competing against other people.

Next, we grouped all social subcomponents in a single player type, Socializer. Socializers are motivated mainly by interacting with people (e.g., being in groups and teams, forming partnerships, and playing collaborative games). Like Killers, Socializers are also people-oriented, however, instead of emphasizing defeating other players, they value socializing, sharing experiences, building relationships, and performing shared tasks. Finally, Explorers are associated with the subcomponent Discovery. Explorers are system-oriented players, and exploration is mainly what motivates these players: Explorers enjoy investigating the system's ins-and-outs (e.g., hidden or remote places, finding loopholes, knowing the rules that govern a space). Creators were linked to Customization: these players are also system-oriented, but they are more interested in customizing the system or modifying the virtual world (e.g., backgrounds, fonts, buildings, characters, weapons, and vehicles).

Once we gathered all information in Table 1, we devised the five **player roles** shown in Fig. 1 and described in Table 2. Although we borrow all names from the gamification literature, it is important to note that, instead of player types, we are looking for the creation of a set of player roles. According to [31], although there is no consensus about the definition of roles, it is possible to assume that a role is an entity that is played by another entity in a context. In this sense, "context" can be understood as something as a whole, including a relation in which the former "entity" is defined.

Fig. 1. Player roles [6–8]

Moreover, considering that these player roles are meant to be used in educational environments, we carefully chose these labels, among several labels found in the literature, to avoid possible negative connotations (e.g. killer, exploiter). As pointed by [30, 32], to avoid the externalization of bad and/or undesirably behaviors, it is important not to provide the system with the kind of game design element that can lead to harmful behavior. As an example, Blizzard's electronic card game Hearthstone® does not allow players to chat with each other. There are pre-selected emotes that can vary slightly depending on the character. However, there is no way to send your custom text message to your opponent. The company recognizes the huge tradeoffs involved in such decision, however, since the game can be very competitive, they stated that this was the right decision to keep Hearthstone® fun, safe, and appealing to most players [33]. By substituting the chat system to pre-selected emotes, Blizzard tailored their game in order to restrain inappropriate vocabulary and harassment.

Nevertheless, although one can argue, since the research focus is on collaborative learning activities, why players such as *Achiever* and *Conqueror* should be considered, given that their specific nature is not collaborative at all. The answer is that it all

Table 2. Player roles description

Player role	Description	Source
Achiever (goal-oriented)	They enjoy not only completing a game, but also being the best winner, accumulating all rewards the game can offer. They are motivated by receiving glory (points, titles, medals, trophies, achievements); gathering (virtual currency and goods); and collecting rare or all in-game items (equipment, weapons, armor, vehicles, mounts, pets)	[25–27, 29, 30]
Conqueror (people-oriented)	They enjoy rushing and competing against other people. Usually, they enjoy testing their skills and seeing how they stack up against other people. They find external ranking systems and zero-sum game mechanics appealing	[25, 27, 29, 30]
Humanist (people-oriented)	They enjoy socializing with people (e.g., being part of groups and teams, forming partnerships, and playing collaborative games). They value socializing, sharing learning, and relationship building via shared tasks	[25, 27, 29, 30]
Explorer (system-oriented)	They enjoy exploring the system by discovering the ins-and-outs (e.g., hidden or remote places, finding loopholes, knowing the rules that govern a space)	[25, 27, 29, 30]
Creator (system-oriented)	They enjoy customizing the system (e.g., backgrounds, fonts, buildings, characters, armor, weapons, and vehicles)	[25–27, 29, 30]

depends on the context. The structure of the interaction between players is a choice to be decided early in any game project (or gamified project). Although the most well-known interaction pattern is the *player-vs-player*, there are other patterns to be considered [34]. *Community collaboration* pattern, for example, can be used to pose challenges to the users while working against the system in a collaborative fashion (e.g., tasks related to time limit or tasks that have to be performed against an Artificial Intelligence).

4 Vocabulary to Represent Interactions in Gamified Collaborative Learning

In Table 3, we present a non-exhaustive compilation of behaviors and player types. It is important to remember that, as stated before, there is no guarantee that all behaviors can be useful or appropriate for an educational environment, therefore behaviors should be carefully chosen to avoid triggering undesirable interactions. The information shown in Table 3 should be read as, for example: "The *Achiever* is *acting* on the *System* by *Comparing* his *Progress* (e.g., on the leaderboard)".

We used such information as a starting point to devise appropriate behaviors that one can use in a gamified CL environment to foster learning. By appropriate we mean behavior that is able to motivate learners to play and at the same time satisfies their respective psychological needs as established by SDT. As any model, the scheme presented in Table 3 is a simplification of the reality and therefore it is likely to suffer

Table 3. Examples of player types and behaviors commonly found in the game-related literature [25–27, 29, 30, 35]

	Player types		Performance		Who/what		Doing (*behavior*)	Who/what
The	Achiever	is	acting	on/ with	System	by	Tracking, Collecting, Gathering, Pursuing, Comparing, Bragging, Showing-off, Winning	Progress, point, medal, achievement, honor, currency, items, virtual goods, quests, status, leaderboard, prizes
	Explorer		interacting		System		Discovering, Exploring, Viewing, Investigating, Traveling, Searching, Looking for	Virtual world, Maps, remote places, secret places, Easter-eggs, hidden quests
	Killer		acting		Others		Harassing, Hacking, Killing, Disturbing Troublemaking, Defying, Cheating, Taunting, Teasing, Fighting	Players, characters, GMs (game masters) NPCs (non-player characters), guilds
	Socializer		interacting		Others		Helping, Greeting, Giving, Supporting, Sharing, Collaborating, Commenting	Players, characters, GMs (game masters) NPCs (non-player characters), information, forums, guilds
	Creator		interacting		System		Creating, Tweaking, Building, Customizing, Transforming, Adapting, Inventing, Crafting	Interface, maps, MODs (modification), avatar, weapons, armors, vehicles and mounts

from eventual drawbacks, such as overfitting or the missing of important interactions. Due to space constraints, in Table 4 we list only a subset of selected behaviors, one behavior for each player role.

Table 4. Example of player roles and potential behaviors

Player role	Behavior	Description	Source
Achiever	Tracking	To keep track of other learners progress and his/her own progress	[25, 27, 29, 35, 36]
Humanist	Empathizing	To have empathy for other learners	[25, 27, 29, 30]
Conqueror	Troublemaking	To unsettle the other learners by proposing solutions that are sometimes trustworthy but other times erroneous	[25, 27, 29, 30]
Explorer	Exploring	To unveil new things in the system as the learning process progresses (e.g., features, tasks, content)	[25, 26, 35, 36]
Creator	Tweaking	To tweak the system towards personalizing something (e.g. learning path, tasks)	[25, 26, 35, 36]

In Fig. 2, we present the basic structure of the conceptual framework. The first columns contain the planned ❶ Learner role and, for each learner role, all ❷ player roles we created. In the column ❸ Conditions, we describe the necessary conditions (*) and the desired conditions (−) that a learner should fulfill for each combination of the current learner role and respective player role. If a learner-player does not satisfy all necessary conditions, the student cannot play the role. The ❹ Expected effects column describes both learning and psychological outcomes, named (❹a) *pedagogical lenses* (PL) and (❹b) *motivational lenses* (ML). The last column, ❺ Source, summarizes the sources of the compiled information. The importance of this column is twofold, first, we believe it is important to keep track of such information because it will enable us to evolve and refine the framework. Second, it will be useful to support other designers, not only when checking the origin of the provided information, but also facilitating further corrections and/or enhancements.

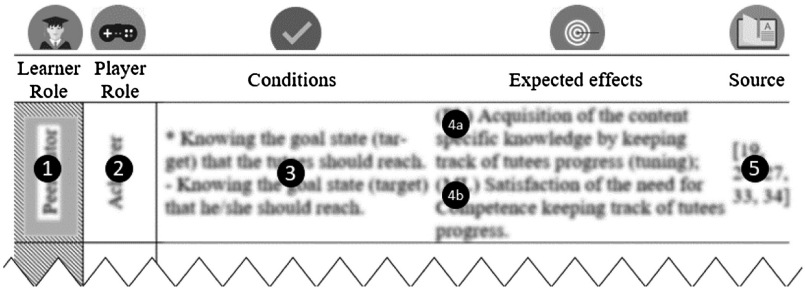

Fig. 2. Basic structure of the conceptual framework (adapted from [10, 35])

In the next subsection, we will demonstrate the viability of our framework using the Peer Tutoring theory. It is worth emphasizing that we have been working on other learning theories and instructional strategies, for instance: Anchored Instruction, Cognitive Apprenticeship, and Cognitive Flexibility. However, due to space constraints we will not present all schemes developed.

4.1 Conceptual Framework Using Peer Tutoring Theory

We filled out Tables 5 and 6 following our learner-player schema as illustrated in Fig. 2. We chose Peer learning as an example because it is a well-known theory [37], therefore minimizing our effort to explain both the learner roles and the player roles, as well as the interplay between the roles and the learning theory. Peer tutoring has being widely investigated and there are many useful techniques organized under such taxonomy [38], however it is not our intention to explore all these techniques. For simplicity's sake, we will consider Peer tutoring as a technique in which both tutor and tutee can gain benefits from their interactions.

Table 5. Peer tutor role, Player roles, Prerequisites, and Expected effects

Learner role	Player role	Conditions	Expected effects	Source
Peer Tutor	Achiever	* Knowing the goal state (target) that the tutees should reach - Knowing the goal state (target) that he/she should reach	(PL) Acquisition of the content specific knowledge by keeping track of tutees progress (tuning); (ML) Satisfaction of the need for Competence keeping track of tutees progress	[25, 27, 29, 35, 36]
	Conqueror	* Knowing the goal state (target) that the tutees should reach * Knowing the tutees' confidence level * Having the pedagogical expertise to maximize the impact of its interventions	(PL) Acquisition of the content specific knowledge by unsettling the tutees (tuning) (ML) Satisfaction of the need for Competence unsettling the tutees	[25, 29, 35, 36]
	Humanist	* Knowing the goal state (target) that the tutees should reach * Feeling connected with the other tutees - Knowing the tutees difficulties	(PL) Acquisition of the content specific knowledge by helping to solve the problems faced by the tutees (tuning); (ML) Satisfaction of the need for Relatedness though helping others to solve the proposed problems	[25, 30, 35, 36]
	Explorer	* Knowing the goal state (target) that the tutees should reach * Knowing how to discover new content that the tutees should learn - Not familiar with all system content	(PL) Acquisition of the content specific knowledge by progressively discovering new content while helping the tutees' (tuning); (ML) Satisfaction of the need for Autonomy by having new experiences along with the tutees	[25, 26, 35, 36]
	Creator	* Knowing the goal state (target) that the tutees should reach * Knowing how to choose which tasks the tutees should do - Knowing the tutees difficulties	(PL) Acquisition of the content specific knowledge by customizing the tutees' tasks (tuning); (ML) Satisfaction of the need for autonomy by having choices	[25, 26, 35, 36]

Essentially, the tutor is a more knowledgeable individual and the tutee is a less knowledgeable individual. However, tutor and tutee are learners who do not have an in-depth knowledge about the content. Therefore, by facing difficulties in teaching, the tutor needs to acquire more knowledge in order to teach and organize his thoughts in an understandable manner; and through the tutoring process, the tutee will acquire or construct his/her knowledge as well [36, 37, 39].

Any learner can play the role Peer Tutor, since he or she fits the specified conditions. In addition, since we are considering that learners have different game preferences, it is necessary to discover and map such preferences to be able to choose appropriate player roles for each learner. In our research, we carry this out by performing a cross-cultural adaptation of the original Motivations to Play Scale [25]. The scale was adapted to Brazilian Portuguese, so we can use it in real-world educational environments with Brazilian Portuguese native speaker students. In Table 6, we

Table 6. Peer tutee role, Player roles, Prerequisites, and Expected effects

Learner role	Player role	Conditions	Expected effects	Source
Peer Tutee	Achiever	* Knowing the goal state (target) that he/she should reach	(PL) Acquisition of the content specific knowledge progressively (accretion); (ML) Satisfaction of the need for Competence by keeping track of his/her progress	[27, 29, 35, 36]
	Conqueror	* Pushing the tutor by expressing his/her ideas in a convincing manner	(PL) Acquisition of the content specific knowledge by unsettling (flustering) the tutor (accretion) (ML) Satisfaction of the need for Competence by unsettling the tutor	[29, 35, 36, 40]
	Humanist	* Feeling connected with the tutor	(PL) Acquisition of the content specific knowledge by being assisted by the tutor (accretion); (ML) Satisfaction of the need for Relatedness through being helped to solve his/her problems	[30, 35, 36]
	Explorer	* Knowing how to discover new content - Not familiar with all system content	(PL) Acquisition of the content specific knowledge by progressively discovering new content (accretion); (ML) Satisfaction of the need for Autonomy by having new experiences	[25, 26, 35, 36]
	Creator	* Knowing how to choose tasks to do * Tweaking the system along with the tutor	(PL) Acquisition of the content specific knowledge by being able to choose the necessary tasks to reach the learning goal (accretion); (ML) Satisfaction of the need for Autonomy by having choices	[25, 26, 35, 36]

indicate examples of necessary and desired conditions defined in order to allow an instructor/designer choosing the appropriate game design elements that will help a peer tutor to reach the sought learner goals. Table 6 also lists examples of necessary and desired conditions defined in order to allow an instructor/designer to choose the appropriate game design elements that will help a peer tutee to reach the planned learner goals.

4.2 Case Study: Who Can Play the Peer-Tutoring Role, and Which Player Role is Appropriate?

We will demonstrate the viability of our framework using the Peer Tutoring theory [36]. Assume two students, one playing the Peer tutor role, while the other plays the Peer tutee role. Both learners take a test, and by the results of the Motivations to Play Scale, we set up their players' profiles. Assume the results indicate that the hypothetical learner, playing the tutor role, scored high as *achiever*, while the other hypothetical student, playing the tutee role, scored high as a *creator*. Checking information from Tables 5 and 6, we combine the pairs of learners as follows:

- Learner role: *Peer tutor* – Player role: *achiever* > ***Tutor-Achiever*** *role*
- Learner role: *Peer tutee* – Player role: *creator* > ***Tutee-Creator*** *role*

In Table 7, we present both roles extracted from Tables 5 and 6, respectively. We indicate the necessary and desired conditions in order to reach the learner goals planned for both learners. In Table 7, we suppressed the column "Source" due to space constraints. We filled out the column "Game" elements based on the information shown in Table 3. The game design elements presented are all related to each player role, consequently, all capable of influencing the psychological needs of each player role.

Table 7. Peer tutor-achiever, and peer tutee-creator roles

Learner role	Player role	Conditions	Expected effects	❻ Game elements
Peer Tutor	Achiever	* Knowing the goal state (target) that the tutees should reach * Knowing the goal state (target) that he/she should reach	(PL) Acquisition of the content specific knowledge by keeping track of tutees progress (tuning); (ML) Satisfaction of the need for Competence keeping track of tutees progress	*Progress bars, points, medals, achievements, honor system, currency, virtual goods, quests, leaderboard*
Peer tutee	Creator	* Knowing how to choose tasks to do * Tweaking the system along with the tutor	(PL) Acquisition of the content specific knowledge by being able to choose the necessary tasks to reach the learning goal (accretion); (ML) Satisfaction of the need for Autonomy by having choices	*Custom interface, progress map, knowledge map, avatars*

Based on information found in Table 7, designers/instructors can choose, more easily, ❻ game design elements that will support the necessary and desired conditions.

Setting up a gamified CL session:

1. Establish the desired learning groups;
2. Provide the ways to evaluate individual Motivations to play and Psychological needs for each learner. The results may have more than one scenario, which can help internalize the motivation and satisfy the psychological needs.
3. Set the Player roles for each learner based on the results from Step 3;
4. Check if each learner has the necessary and desired conditions to play the player roles for the CL scenarios defined in Step 1 (If the learner does not fulfill all conditions, our approach will not be useful).
5. Set the individual gameplay for each learner. This task is completed by the selection of proper game elements for each learner.
6. Set the group gameplay for each group. This task is carried out by selecting proper game elements for each group.

Explaining how to use/implement each game element is beyond the scope of this work. In Fig. 3, we present an example of a customized pop-up with instructions, tailored to fulfil psychological needs of both hypothetical peer learners described in our example working as a group. ❶ Each learner has a description of his or her task. The example is based on the Note-Taking technique [41]. We choose such technique to keep the example simple, while at same time still capable to illustrate our viewpoint. In ❷ we present two different kinds of rewards for fulfilling the proposed tasks. We choose which game element to emphasize checking the information provided by Table 7. In ❸ we illustrate the rewards of completing tasks using graphical elements more capable to appeal to each player role.

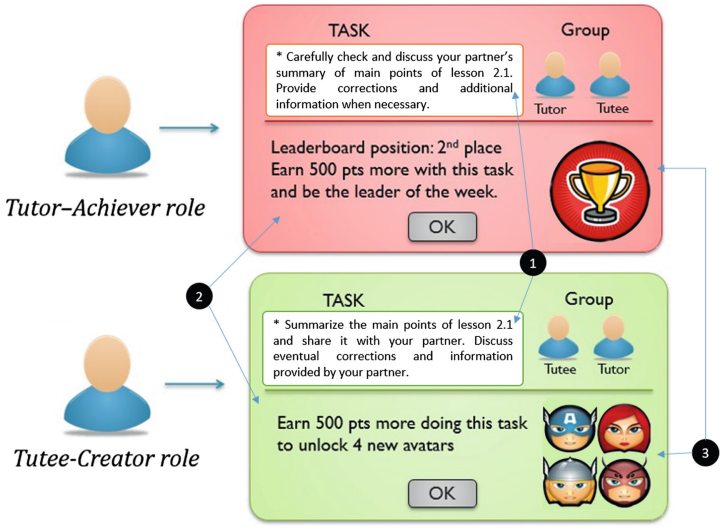

Fig. 3. Two versions of a gamified pop-up with personalized instructions

5 Concluding Remarks and Future Work

Currently, we have been gathering supportive theories from gamification and education. We outlined ways to relate player roles found in the game design and gamification literatures and possible ways to connect these player roles to CL learner roles in a systematic way. We posit that is possible to improve learners' experience by providing personalized gamified situations, thereby contributing to minimizing some potentially harmful aspects of gamification, such as being disruptive or unattractive to several users. By identifying learners' motivations to play, we can easily choose appropriate player roles for each learner in different gamified learning scenarios. Furthermore, instead of classifying learners in a static, brittle manner, we devised roles that can be played in order to satisfy not only temporal constraints related to the learning objectives but also constraints associated with the gamified CL environment. In this chapter, we presented one example of how our framework could be instantiated in a peer-tutoring scenario.

Although many studies have investigated the use of gamification in different education contexts, most studies do not explicitly provide a rationale to back up the pedagogical basis of such research efforts and these studies rely on ad hoc choices [15, 41]. The absence of some sort of rationale makes it difficult to reproduce or evolve these solutions [42]. A potential benefit of our approach is to provide replicable and scalable learner-player interactions. As future work, we plan to further investigate how gamification-related rewards can be linked to learner activities as well as design an adaptive reward system that takes into account intrinsic and extrinsic loadings. Currently, we are working on the implementation of a prototype that will provide the necessary computational support to evaluate the effectiveness of our proposal.

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