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Gamification

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Contents

List of Figures

List of Tables

Chapter 1

Introduction

This thesis aims to introduce the concept of gamification, the framework of gamification and the use of gamification in increasing user retention rate on MOOCs platform.

As we have seen, nowadays video games are popular and have become one part of our daily lives. A lot of players are engaged in playing video games and have gained many enjoyments from playing games. Being inspired by the success of video games, it's suggested that game mechanism should be used in a broader range of activities such as business, education and health care etc. to create higher loyalty and engagement of users. Serious games and gamification are considered as two possible ways to realize this idea.

A serious game is a game designed for a primary purpose other than the purpose of pure entertainment. Although serious games can be entertaining, their main purpose is about training/educating users, marketing and advertisement etc.

Different from serious games, gamification commonly uses only game design elements in so-called non-game contexts in attempts to increase user engagement in certain system or improve the user experience of certain services. A gamified system is not a complete game but a redesigned system integrating game elements.

The researches of gamification refer to different fields such as educa-

tion/learning, commerce, crowdsourcing and sustainable consumption etc., most of which focus on the effectiveness of gamification in changing user behavior and improving user engagement, and also on how to use game elements to gamify a specific system. The research results mostly indicate that gamification is effective in improving user engagement. Although there are also some negative results from the researches, the analyses of these results show us that they are caused by the incorrect understanding and an improper implementation of gamification. Moreover, the effectiveness of gamification is validated not only in theory; in practice, there are a lot of successful instances of gamified system, for example, Nike+ (fitness), Duolingo (education) as well as Khan Academy (education).

The above-mentioned contents will be introduced deeply in chapter 2.

The effectiveness of gamification in changing user behavior and improving user engagement can be explained from a psychological perspective. According to psychology theories, behavior can be explained by "motivation" which represents the reasons for people's actions, desires, and needs. Motivation is mainly divided into two different theories known as Extrinsic (external) motivation and Intrinsic (internal) motivation.

Extrinsic motivation means an activity is done in order to attain some separable outcome. It focuses on the external outcomes produced by activity other than the activity itself. Rewards are a typical example of extrinsic motivation.

Intrinsic motivation refers to the doing of an activity for its inherent satisfactions rather than for some separable consequences. It is driven by an interest or enjoyment of the activity itself rather than relying on external pressures or a desire for rewards.

From the behaviorism perspective, behavior can be analyzed by observing people's response to certain stimulus and motivation results from the past positive and negative reinforcements, which would influence the future behavior. Behaviorism indicated that people are likely to be motivated if gamification offers rewards, that is to say, gamification can engage people by

fostering extrinsic motivations.

Meanwhile, another psychology theory, cognitivism, proposes that the internal processes such as people's minds, expectancies, and thinking etc. play a major role in influencing user behaviors and motivation. From cognitivism we can know that behavior can be influenced not only by external factors such as rewards and punishments but also by internal minds. Furthermore, self-determination theory summarizes three basic internal psychological needs and demonstrates that satisfaction of the three needs can foster intrinsic motivation, and consequently influence people's behavior as well as improve user engagement.

The details of motivation related theories will be introduced in chapter 3.

A variety of gamification frameworks are proposed to introduce gamification mechanism, how to gamify systems and how gamification activates user motivation. One popular framework is proposed by Kevin Werbach and Dan Hunter. They identified what game elements can be used in gamification and divided them into three categories - components, mechanics and dynamics. And then they explained how these three parts could be used together to gamify a specific system and to create enjoyable experience. From this framework we can find that gamification addresses motivational mechanisms and thereby fosters both extrinsic motivation and intrinsic motivation at the same time, so gamification can effectively motivate user and improve user engagement. Besides, among the various game elements, the mostly used elements in gamification are points, badges and leaderboards, which are known as the PBL system. The PBL system acts as a reward system, and it can foster extrinsic motivation and cause behavior changes immediately. However, the PBL system can only foster extrinsic motivation and its effects are not long-lasting. Despite its limitation, the PBL system could be a good start point to gamification. In chapter 4 I will explore the gamification framework and the PBL system deeply.

Since gamification can create enjoyable experiences and improve user en-

gagement, it can be used to solve some problems faced by MOOCs platforms. MOOCs are "Massive Open Online Courses" and web-based that can be accessed by large number of participants without entry qualifications. Although many participants may enroll in a certain MOOC, only a small part of them can complete the whole course successfully. High drop-out rate and low participation are some of the challenges faced by MOOCs platforms; therefore, MOOCs platforms have a need to motivate their users and improve user engagement. In this case, gamification is considered as a good choice.

Researches propose several game elements that can be used on MOOCs platforms and demonstrate in theory that the drop-out rate of MOOCs would decrease significantly after MOOCs platforms are gamified. Furthermore, two successful gamified MOOCs platforms - openHPI and Khan Academy - also show us the availability and potential of gamification in reducing drop-out rate and improving user engagement on MOOCs platforms. The chapter 5 aims to introduce the notion of MOOCs and discuss how to solve the problem faced by MOOCs platform by using gamification.

Since gamification is somehow a novel concept, and is still in development, more researches and applications of gamification will arise in future.

Chapter 2

Games and Gamification

In this chapter I will introduce some game-related contents and the concept of gamification.

In the first section, I will present the definitions of games and elaborate the distinction between game and play. And then we will have a brief look at popular video games and serious games.

The second section is about gamification. I will explain what gamification is and show the difference between gamification, serious games and play. Then a general overview on the related empirical studies on gamification will be given.

In the third section, some examples of gamification will be given for showing how gamification can be used in practice.

2.1 Games

In the past decades, digital games have arisen and achieved success in the commercial entertainment industry. Nowadays digital games are popular everywhere. We play digital games on various terminals like smartphones, PSPs, tablets as well as PCs when we are travelling, relaxing, or even at work, simply to seek enjoyable experiences for ourselves [RPK+15]. Although digital games are a relatively new invention, games arose as early as 3100

BC[1]. Games exist in human culture as tools for entertainment, relationship-building, training, and arguably survival [McG11]. According to Huizinga[2] games have played an important role in the formation of culture. In [Hui70], he discusses the importance of games of culture and suggests that games were the fundamentals of all cultures. Therefore games are a universal part of human experience and are deep-rooted in human culture [SF15].

Up to now, games are used not only for entertainment but also for education, scientific exploration, health care, engineering, etc. They are also called serious games and their main purpose is to teach, train or advertise [Mun11].

Despite the long history and popularity, there is not a definite definition of games. As games can be used in different activities of different fields, there are many definitions of games. Before talking about some of the definitions of games, I want to firstly distinguish two notations - game and play.

2.1.1 Game and Play

Although there is a clear distinction between games and play in English, not all languages separate the two concepts [SZ04]. There are many ways to define games and play in different languages, but I will take advantage of the difference afforded by English to consider games and play as two separate notions with related, but distinct meanings.

In game studies, the distinction between games and play is usually tied to Caillois'[3] concept of *"paidia"* and *"ludus"* as two poles of play activities [CB61]. Paidia (or "playing") means *spontaneous play*. It denotes a more

[1]Senet (or Senat) is one of the oldest known board game from Prehistoric Egypt and ancient Egypt. The oldest hieroglyph representing a Senet game dates back to around 3100 BC.

[2]Johan Huizinga was a Dutch historian and one of the founders of modern cultural history.

[3]Roger Caillois was a French intellectual whose idiosyncratic work brought together literary criticism, sociology, and philosophy by focusing on diverse subjects such as games, play as well as the sacred.

free, expressive, and improvisational behavior, like children creating rules in real time at the backyard [DDKN11]. Ludus (or "gaming") means *controlled play*. It denotes playing structured by explicit rules and competitive conflict toward discrete goals or outcomes [DDKN11]. According to Caillois, paidia and ludus are not separate genres but independent "principles" that form two opposite ends of a continuum on which all games are located [Jen13]. In [WP03], Eskelinen and Tronstad distinguish between games and play in stating that *"Both play and games will contain paidia rules, but only games will have the additional ludus rules"*.

Moreover, Katie Salen[4] and Eric Zimmerman[5] suggested two possible relations between games and play - games as a subset of play, and play as a component of games [SZ04]. If we think about all of the activities we could call play, we can find that most forms of play are looser and less organized. However, some of them may be formalized, and these forms of play can be considered as games. In this sense, games are a subset of play. In other sense, play is one of the ways of looking at and understanding games. By playing a game we can gain the experience of it and get to know about it, thus the play of the game represents one aspect of games. In this sense, play is a crucial component or element of games [SZ04].

In short, play can be considered as the broader, looser category, containing but different from games and playing denotes a more free form recombination of behaviors. Instead, game and gaming are characterized by specific rule systems and the internal competitions of those systems are designed for different goals or outcomes [DDKN11].

[4]Katie Salen is a game designer, animator, and educator. She is a professor in the DePaul University College of Computing and Digital Media.

[5]Eric Zimmerman is a game designer and the co-founder and CEO of Gamelab, a computer game development company based in Manhattan.

2.1.2 Comparing Definitions

As I said before, there isn't an encompassing definition of game, because game has so many uses. I will introduce 2 definitions to shed light on the understanding of games.

2.1.2.1 Definition 1 - Tracy Fullerton with Christopher Swain and Steven S. Hoffman

In [Ful14], which Tracy Fullerton[6] co-edited with Christopher Swain and Steven S. Hoffman, the authors present a definition of game: *"A game is a closed, formal system that engages players in structured conflict and resolves its uncertainty in an unequal outcome"* [Ful14].

The key elements of this definition are:

- **Closed**: there are boundaries of game systems, which separate game systems from the rest of the world [Sch14]. When we play games, we will abide by the rules of the game and set the rules of real life aside. However, these rules have no real consequences outside the game [Ful14].
- **Formal**: game is clearly defined by formal elements with explicit rules [Sch14, Ful14].
- **System**: game is made of interrelated elements that work together [Ful14, Sch14].
- **Engages players**: the entire purpose of game is to engage players. Without players, games have no reason to exist [Ful14].
- **Structured conflict**: the conflict structured by game elements is the way used to engage player [Ful14].

[6]Tracy Fullerton is a game designer with more than two decades of experience developing games that push the boundaries of expectations . She is also the director of the Game Innovation Lab at USC (University of Southern Calfornia).

- **Uncertainty**: a fundamental part of gameplay is that it is uncertain. At the end of a game there should be a winner but at the beginning it's uncertain who is the winner [Ful14].

- **Unequal outcome**: games are not the experiences designed to prove we are all equal [Ful14]. Different outcomes will be assigned to players according to their efforts.

2.1.2.2 Definition 2 - Jesse Schell

Although there are some debates on the above-mentioned definition, it gives us a general understanding of game. That definition shows us some qualities of game such as rules, conflicts, and engaging players. Furthermore, in [Sch14] Jesse Schell[7] has summarized a list of game qualities picked out from various game definitions[8]:

1. *"Games are entered willfully."*
2. *"Games have goals."*
3. *"Games have conflict."*
4. *"Games have rules."*
5. *"Games can be won and lost."*
6. *"Games are interactive."*
7. *"Games have challenge."*
8. *"Games can create their own internal value."*

[7]Jesse N. Schell is an American video game designer, an acclaimed author, CEO of Schell Games and a Distinguished Professor of Carnegie Mellon University's (CMU).

[8]In addition, in [Juu10] Jesper Juul has also listed a number of game definitions and further extracted and summarized some common points of games such as rules, quantifiable outcomes as well as player effort (the player invests effort in order to influence the outcome) etc.

9. *"Games engage players."*

10. *"Games are closed, formal systems."*

These ten points show almost all aspects of game. Jesse Schell proposed a definition covering all these ten qualities:

"A game is a problem-solving activity, approached with a playful attitude" [Sch14].

Jesse Schell explained that when we are trying to solve a problem, one of the first things we do is to state the problem, that is, define a clear goal (2). Next, we determine the problem's boundaries and what methods we are allowed to use to solve it; that is, determine the rules of the problem (4). In a sense, we are establishing a closed, formal system (10) with a goal. We then work to approach the goal, which is usually challenging (7), because it involves some kind of conflict (3). In the process of approaching the goal, we need to interact (6) with the system. And if we care about the problem, we will become engaged (9) in solving it. Since we focus on solving the problem, it becomes important to us, and then elements in the problem space quickly gain an internal importance (8). Finally, we defeat the problem, or are defeated by it, thus winning or losing (5). Moreover, problem-solving activity can also refer to work, and the difference between a game activity and a work activity has nothing to do with the activity itself, but with one's motivation and attitude to do the activity. Thus *"approached with a playful attitude"* (1) is used to emphasize that problem-solving activity is about game rather than work [Sch14].

There are also many other definitions of game. Although the definitions of games are different, there are more commonalities than differences in these definitions. I don't think we need to study all of them because we can have a general understanding of games with these two definitions. Moreover, as David Parlett[9] suggested that *"The word game is used for so many different*

[9]David Parlett is a games scholar from South London, who has studied both card games and board games.

activities that it is not worth insisting on any proposed definition" [SZ04], it's true that we don't need to insist on certain definitions since games definitions vary according to different game genre and fields. We just need to understand what games are and what qualities they have. From these definitions and the game quality lists proposed in [SZ04, Juu10] we can find that the common characteristics of game are:

Games have rules, goals, conflicts and quantifiable outcomes.

Games are entered voluntarily, and players decide whether to play a game and a good game will engage players.

2.1.3 Video Games

In digital age, video games have achieved a great success. A lot of people like playing video games. The yearly report [AI+15] published by ESA [10] shows that:

- *"155 million Americans regularly play video games."*
- *"42 percent of Americans play for at least three hours per week."*
- *"Four out of five American households contain a device used to play video games."*

A video game is an electronic game specially created for entertainment, based on the interaction between a person and a video device where the videogame is executed [ZSG+09]. The word video in *"video game"* traditionally referred to a display device like TV screen or computer monitor, but it now implies any type of display device that can produce two- or three-dimensional images[11].

[10]The Entertainment Software Association (ESA) is the U.S. association representing companies that publish computer and video games.

[11]Extracted from Wikipedia-Video Game.

It's clear that video games are well liked by people. A good example is World of Warcraft (WoW). WoW is a massively multiplayer online role-playing game (MMORPG)[12] created in 2004 by Blizzard Entertainment[13]. As of July 2012 it has already grossed over 10 billion dollars [14]. In January 2014, Blizzard Entertainment announced that more than 100 million accounts had been created since the game's debut in November 2004[15]. Although its subscription has declined in recent years, WoW is still the world's mostly subscribed MMORPG with 7.1 million subscribers as of May 2015[16]. Players are engaged in the virtual world of WOW and enjoy the fun it provides. All WoW players have spent the time of more than 5.93 million years on playing WoW [McG11].

The success of video game in the commercial entertainment industry has boosted researches about its effects and motivated its adoption for pursuits beyond entertainment [SF15]. The most mentioned field that games can be used to is education. James Paul Gee[17] stated that good video games are learning machines. They get themselves learned and learned well by people, so that they get played long and hard by a lot of players. He argued that schools, workplaces, families, and academic researchers have a lot to learn from good video games. Such games incorporate a lot of fundamental learning principles that can be used in other settings [Gee03]. He also suggested that games and game technologies can be used to enhance learning, furthermore, he believed that the use of game for learning will be pervasive [Gee03].

[12]Massively multiplayer online role-playing games (MMORPGs) blend the genres of role-playing video games and massively multiplayer online games, potentially in the form of web browser-based games, in which a very large number of players interact with one another within a world.

[13]Blizzard Entertainment is an American video game developer and publisher.

[14]See "Here Are The 10 Highest Grossing Video Games Eve".

[15]See "World of Warcraft: Azeroth by the Numbers".

[16]See "Why World of Warcraft Lost So Many Subscribers".

[17]James Gee is a researcher who has worked in psycholinguistics, discourse analysis, sociolinguistics, bilingual education, and literacy.

Since video games are highly motivating to a lot of people, we can learn from them how motivation is created and sustained, and further, we can use them as a motivational tool of human behavior [Gee03, McG11]. Serious game is considered as one of the ways to realize this idea.

2.1.4 Serious Games

There are many available definitions of serious games because except used for education and training, they can also be applied to a number of other fields such as military, scientific exploration, corporation, and healthcare etc. But, most definitions agree on a core meaning that *"serious games are (digital) games used for purposes other than mere entertainment."* [SJB07].

Serious games have a "game" dimension combined with a "serious" dimension, that is to say serious games are complete games and at the same time have serious intentions [Mun11, DAJ11]. The word "serious" doesn't mean that the contents of serious games aren't entertaining, enjoyable, or fun. It's used to indicate that except pure entertainment, serious game has other purpose (e.g. learning or training) [MC05].

Serious games can capture players' attention and motivate them to perform a desired action. Research shows that the effectiveness of serious games is beginning to accumulate [MC05]. However, serious games are complete games, and if we want to use only game elements to motivate users but not want to create a complete game, we should do it in another way - gamification.

2.2 Gamification

Gamification is a term originated in the digital media industry. The first documented use was at 2008 in a blog posted by Bret Terrill [Ter08], but the term was not widely adopted before the second half of 2010 [DDKN11]. Gamification uses the motivational properties of games in order to improve user engagement, persistence and achievement [RRR15, CWR15]. The dif-

ference between gamification and serious game is that gamification is not about turning system, service or activities into a game, but to redesign them with game elements and mechanisms for a fun, enjoyable and motivating experience [Lan14, CWR15].

Nowadays gamification has gained a lot of attentions among practitioners and game scholars and it has become a popular technique used in a variety of contexts to engage people in particular targeted behaviors [Lan14, HH12]. For example, education (Khan Academy), tutorials (RibbonHero), health (HealthMonth), task management (EpicWin), sustainability (Recyclebank), crowdsourced science (FoldIt), and user-generated content for programmers (StackOverflow) [Det12].

Before discussing gamification deeply, let's have a look at the definition of gamification.

2.2.1 Definition

Although gamification still has some diverse meanings, I decide to select *"the use of game design elements in non-game contexts"* which is defined by Sebastian Deterding and Dan Dixon in [DDKN11] as the definition in this thesis and it is also the most commonly used definition in literatures. The following section will decompose this definition and explain it in detail.

2.2.1.1 Game

The first point that we need to pay attention is gamification relates to games, not play. That is to say, gamification focuses on design elements that for rule-bound, goal-oriented play [DDKN11, Gro12].

Then for further discussion, two new terms will be introduced: gamefulness and gameful design, where gamefulness is defined as the experiential and behavioral quality of gaming, and gameful design is defined as the designing for gamefulness (typically by using game design elements) [DDKN11, Gro12]. Gamification will usually coincide with gameful design. The difference between gamification and gameful design is which aspect they take in accounts

more, that is, gamification emphasizes the design strategy of using game design elements, and gameful design is the design goal of designing for gamefulness [DDKN11, Gro12].

2.2.1.2 Elements

Though gamification relates to games, a gamified system is not a game; it only uses some elements of games.

However, which elements are included exactly in the set of "game elements"? According to Sebastian Deterding and Dan Dixon, none of the elements such as avatars, feedback, levels and competition etc. would be considered simply as game elements, because they can be taken in isolation and found also outside the games [DDKN11, Gro12].

In order to identify game elements, a solution *"to treat game elements as a set of building blocks or features shared by games"* was proposed by Sebastian Deterding and Dan Dixon, and they explained that when we use this approach to identify these elements, in order to avoid producing a very constrained or a boundless set, we should not focus only on the elements that are unique to games neither accept any element that appears in any game. A suggested mode is restricting gamification to the characteristic and significant elements that are found in most of the games [DDKN11, Gro12]. For example, points, badges, levels, leaderboards and avatars etc.[18]

2.2.1.3 Design

"Design" is used to emphasize that instead of game-based technologies or practices, gamification refers to the use of "game design". In practice, in [DDKN11] Sebastian Deterding and Dan Dixon summarized five levels of game design (Tab.2.1) that should be included in the definition.

Level	**Description**	**Example**

[18] In section 4.2 readers can find a detailed game elements list.

Game interface design patterns	Common interaction design elements and solutions for a known problem, including prototypical implementations	Badge, leaderboard, level
Game design patterns and mechanics	The design of a game that is relative to gameplay	Time constraint, limited resources, turns
Game design principles and heuristics	Guidelines used to resolve a design problem or evaluate a given design solution	Enduring play, clear goals, variety of game styles
Game models	Conceptual models of the components of games or game experience	MDA [19]
Game design methods	Game design specific practices and processes	Play centric design, value conscious game design

Table 2.1: Levels of game design elements

These 5 levels of game design are ordered from concrete to abstract, and they also imply how the game elements will be used in the design process of a gamified application.

2.2.1.4 Non-game Context

Gamification is not used for the purpose of entertainment; the main use of gamification is improving user experience and engagement by gameful design and the consequent gameful experience. Gamification could be used to many diverse contexts and domains such as education, training, business etc. "Non-game context" is only used to *"exclude the use of game design*

[19] In section 4.1 reader can find more information.

elements as part of designing a game, since that would simply be game design, not gamification" [DDKN11].

2.2.1.5 Summary

In short, the aforementioned definition of gamification can be explained as: the use (rather than the extension) of game (rather than play or playing) design (rather than game-based technology or practices) elements (rather than full games) in non-game contexts (rather than entertainment game) [DDKN11]. At last, gamification is all about using game design elements to change the way in which specific activities operate; mainly for users to have more fun and greater engagement in what they are doing [CWR15].

2.2.2 Gameful Design, Serious Game and Playful Design

To avoid possible confusion, I make a distinction between gamification and another similar but different term - serious game. The difference between serious game and gamification is that serious game is a real full game; however gamified application uses only some game design elements.

Furthermore, Fig.2.1 presents how to distinguish gamification from other concepts. Through the dimension gaming/playing, we can find that both gameful design (or gamification) and playful design use partial elements of game; however, gamification is about gaming, while playful design is about playing. Through the dimension whole/parts we can find that the difference between (serious) games and gamification is in what degree the system is occupied by game properties. Gamification uses only some game elements but serious games are entire games.

2.2.3 Empirical Studies of Gamification

As a powerful tool of increasing user engagement, gamification is used in various domains. Researches and empirical works have been made to explore

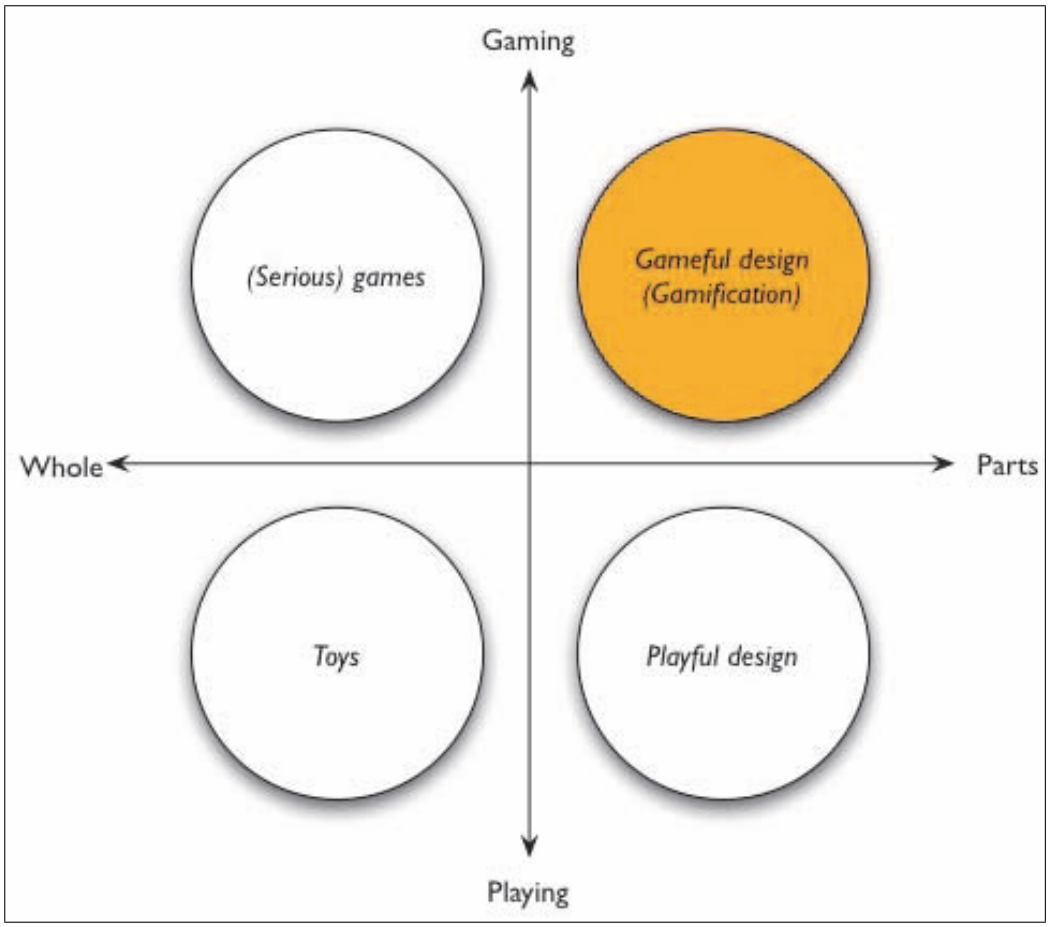


Figure 2.1: Gamification between game and play, whole and parts

how gamification can be used in different contexts and what behavioral and experiential effects it has. In [HKS14] and [SF15] Juho Hamari and Katie Seaborn made a survey separately based on a cluster of theoretical papers and applied researches about gamification. These two surveys aim to explore the current research focus of gamification. The findings indicate that the top fields for gamification research are education or learning, health and wellness, online communities/social networks, crowdsourcing and sustainability [SF15, HKS14], which in some ways demonstrate the wide range of the application of gamification.

The most commonly stated objective of using gamification is to encourage

user participation and stimulate user behavior change. According to the surveys, most of the reviewed papers reported positive results in motivating user. However there were also an amount of mixed results, in other words, following positive results there were also negative or neutral results [HKS14, SF15]. Moreover, results could be either negative and positive, or positive and neutral at the same time, that is, gamification would increase motivation and performance in certain aspect but decrease performance in other aspect at the same time [SF15].

In some cases, individual and contextual differences exist. The effects of gamification varied among users, and some studies showed that demographic variables and the expectations attached to those variables had an impact on the effectiveness of gamification [SF15]. Survey also indicated that the reasons appear to be context-specific which means the similar implementations of gamification in different domains do not necessarily impact users in the same way [SF15]. In a word the effects of gamification can be influenced in practice by different factors such as the motivations of users, social environment, demographic variables, genders, ages and familiarity with gaming of the target users etc. [SF15]

The survey of [SF15] also points out that the theoretical foundations are inconsistently referenced and interpreted because gamification theory is somewhat novel and is in the process of development. Another issue is the gap between theory and practice where applied research is implemented without reference to theory and without the use of gamification framework, thus theoretical considerations are not empirically examined [SF15].

All these findings and issues help us to understand better the current state of gamification research and application. There may not be an ideal gamified system which optimally combines game elements and works always. Gamified systems need to be selectively designed according to the nature of context, user characteristic and even social environment [SF15].

Due to this thesis concerning gamification in education or learning context, here I present the related survey findings about this subject indepen-

dently. According to the surveys, education or learning is the most common context that gamification is applied [HKS14, SF15]. All of the studies in education or learning contexts considered gamification as mostly positive in increasing motivation and engagement in the learning tasks as well as enjoyment. However, at the same time, the studies also pointed out some negative outcomes such as the effects of increased competition and task evaluation difficulties etc. which need to be paid attention to [HKS14]. In the latter chapter I will explore this topic further.

2.2.4 Examples of Gamification

Because of the potential of using game elements to achieve something beyond playfulness, gamification now is used widely as a way to promote education, training, business, productivity, healthcare, and sustainability etc. I will introduce 3 instances of gamification in this section to better understand the application of gamification in practice.

2.2.4.1 Windows Language Quality Game

Windows language quality game[20] is developed by Microsoft for motivating Microsoft employees to examine the translation of each dialog within Windows 7 system.

The Windows 7 system needed to be translated into many languages because it was released globally. Usually, a specific language vendor would perform translation work for Microsoft, and then a secondary vendor would assess the quality. But for some languages and locales, it's difficult and costly to find two vendors. In order to solve this problem, the Language Quality Game was developed to encourage native speaking employees to do a final qualitative review of the Windows 7 system interface and help to examine any remaining language issues [SBM].

Game elements like levels and leaderboards are used to attract employees

[20]See Language Quality Game - Player Instructions on Microsoft website.

and help engage them to participant in this work. The dialogs are divided into groups and presented as "game levels". Once players review all the dialogs of one level they will move to the next higher level and are presented with a new set of dialogs. A leaderboard is used to show the current game level and how many dialogs the employees have reviewed. The leaderboard allows each employee to assess their relative effort, and provides the possibility of some friendly competitions [SBM].

This game is successfully applied in different counties. More than 900 employees have participated in this work, and all of the 36 languages that have been sent out for linguistic review have received feedback. An average of 71% dialogs were found to be correct and 170 bugs are found across all 36 languages [SBM].

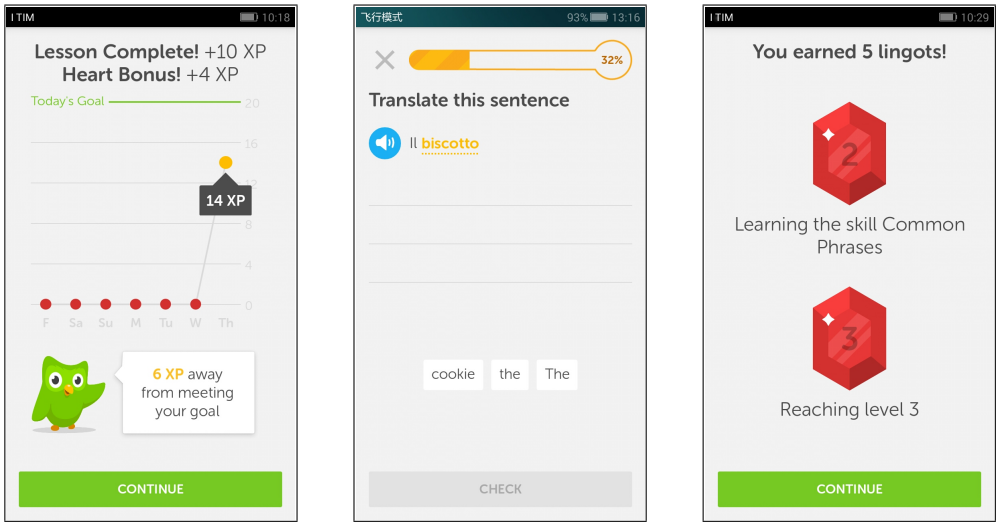
2.2.4.2 Duolingo

In education area, the language learning website Duolingo offers learners a great education gamification experience with the game elements such as points, levels, virtual currency and progress.

At the beginning learners can get access to only some basic exercises, and new higher exercises will be unlocked after finishing a number of less higher exercises. Points will be assigned to learners after finishing a set of exercises and accumulating enough points will lead to level up (Fig.2.2(a)). From a progress indicator a learner can monitor his learning process clearly (Fig.2.2(b)). Moreover, the learner can earn *"lingot"* (the Duolingo virtual currency, can be used in lingot store) through some specific activities like leveling up and finishing a skill (Fig.2.2(c)). The more you learn on Duolingo, the more lingots you'll receive.

At the same time Duolingo[21] also provides smart application on Android, iPhone and Windows Phone platforms. The gameful design promotes those

[21]Duolingo is a free language-learning platform that includes a language-learning app along with a crowdsourced text translation platform and a language proficiency assessment center.



(a) Points (b) Progress Bar (c) Virtual Currency

Figure 2.2: Overview of Duolingo

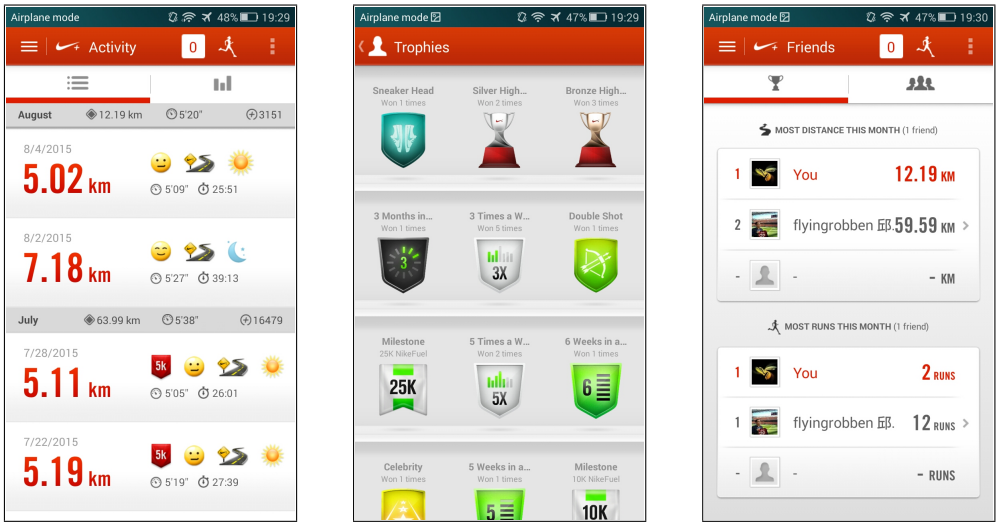
applications to become the most downloaded education apps in Google Play in 2013 and 2014 [22].

2.2.4.3 Nike+

In fitness area, NIKE has developed a gamified application named Nike+[23], which allows people to track, share, and compare exercise results with friends. It features a point system, badges, challenges, leaderboards, and visual progress to monitor each running. Nike+ records every running of users and a number of "Fuel Points" will be assigned to users according running miles (Fig.2.3(a)). Users can be rewarded by badges for some special activities (Fig.2.3(b)). And users can also compare their miles with friends (Fig.2.3(c)). Nike+ helps NIKE company serve their consumers better by developing more relevant experiences for them. Due to its interesting user experience and motiva-

[22]See "Google announces 2014's most popular apps, games, movies and music on the Play store".

[23]Nike+ is an activity tracker device, developed by Nike, Inc., which measures and records the distance and pace of a walk or run.



(a) Running Record (b) Badges (c) Leaderboard

Figure 2.3: Overview of Nike+

tional design, Nike+ are used by approximately 18 million people[24]. It acts as an important driver in the increase of revenues in the running category for NIKE.

2.3 Conclusions

In this chapter, I have introduced related concepts of games and gamification.

Games have rules and are goal-oriented. They are entered willfully and a good game can engage players. Inspired by games' motivational properties, serious game and gamification are proposed to improve people's motivation and engagement in a system or activities. Serious game is a complete game which will not work without game experience.

Different from serious games, gamification uses only game elements in a non-game context rather than create a game. Even if gamification elements

[24]See "Nike+ now has over 18m members tracking their exercise with a FuelBand, SportWatch or fitness app".

are removed from a gamified system, the remaining system will still work.

The effectiveness of gamification is validated in many empirical studies. There are also many successful application of gamification in practice. However, like anything else, gamification can be done well or poorly. As shown in related empirical studies, if gamification is used in an improper way, then the results will not meet our objectives. Besides, considering the possible individual and context differences, there is not a gamfication template that can fit for all different situations. In order to successfully gamify a system, designers must also be concerned about the broad context of deployment and the user's requirements [RTG14, Bez11]

In the next chapter I will explain why gamification is able to engage people from psychological perspective.

Chapter 3

Gamification and Motivations

In this chapter I will introduce the factors that would influence user engagement and the reason why gamification is effective to increase user engagement.

In the section 3.1 I will introduce *"motivation"* which would induce us to perform actions.

Section 3.2 aims to analyze human behavior patterns by using behaviorism. In one sense, extrinsic motivations such as rewards or punishments will influence individual's behaviors.

In section 3.3, cognitivism is used to understand individual's mind and self-determination theory summarizes three basic needs of intrinsic motivation. Further, self-determination theory demonstrated that satisfying these three needs can foster intrinsic motivations.

3.1 Motivations

Before using gamification as a way to inspire user behavior changes, firstly it's better to know why user behavior would change, which factors can result in behavior changes and in which pattern the behavior will change.

In the psychology field, motivation represents the reasons for people's

actions, desires, and needs[1]. Motivations are usually considered as the drive of specific behaviors, and if we can know well about people's motivations, it will help us to predict people's behavior directions and patterns.

Gamification is connected closely with motivation, because gamification causes behavior changes by creating motivations for individuals. In the current studies, motivation can be divided into two primary cases: intrinsic motivation and extrinsic motivation. In the following sections, I will introduce two kinds of psychology theories focusing on human behavior analysis and then these two motivations will be introduced deeply.

3.2 Behaviorism

Behaviorism is a behavioral approach to psychology that combines elements of philosophy, methodology, and theory. Behaviorism neglects peoples' cognition and emotion, and proposed that psychology should only concern itself with observable events. Behaviorism observes the subject as a black box which gives output (response) to certain input (stimulus) [BIZ]. The key elements of behaviorism are the stimulus, the response, and the association between the two (or more general, the connection between the action and result). From the association of stimulus and response an individual can know the consequence of a certain performance which will be used to determine his future response to stimulus [EN93, BIZ]. For example, teachers tend to give a higher grade to the students that positively answer questions during class. Therefore, when students quickly learn the association between stimuli (be given higher grade) and answering questions, they will give their response - answering questions during class. According to behaviorism, people are describable by observing their behaviors and responses to certain stimuli.

This theory can explain how we are affected by rewards. When people find the connection between an action and rewards, and then they will tend to perform that action in order to achieve rewards [BIZ], that is to say, behavior

[1]Extracted from Wikipedia-Motivation.

is induced to change. Using this concept of behaviorism gamification can influence participant's behavior and create engagement, because the points, badges and some other game elements used in gamification can be considered as a kind of reward. However, except for earning rewards, participants may not know other reasons why they are engaged, because rewards are essentially an extrinsic motivation which may not influence internal passions.

3.2.1 Extrinsic Motivations

Extrinsic motivation refers to *"an activity is done in order to attain some separable outcome"* [RD00a]. Usually extrinsic motivation is used to attain outcomes that a person wouldn't get from intrinsic motivation. Rewards and punishments are common extrinsic motivation examples. In addition, competition is also an extrinsic motivation because it encourages people to win by competing with the others, not simply to enjoy the internal enjoyment of the activity. Extrinsic motivation focuses on the external result brought by activities rather than the activity process. For extrinsically-motivated people, they like the external outcome other than the action or behavior itself.

Focusing only on the external outcome may ignore the enjoyment of the activity itself, but for some people what they want is just the enjoyment occurred in the process rather than the final outcome. Therefore the extrinsic motivation - rewards - may not meet people's real needs well [WH12]. It is not enough to influence human behaviors by adopting only external stimulus which is based on behaviorism. Therefore, to better improve user's motivation and further change people's behavior, we should also attempt to influence peoples' behavior internally.

3.3 Cognitivism

Different from behaviorism which ignores what happens in a person's brain, congitivism is concern with people's feeling, mind and how decisions

are made [BIZ]. Cognitivism focuses on the internal mechanisms of human thought and the processes of learning. Behaviorism acknowledges the existence of thinking, but it is identified as a behavior. However, cognitivists argued that the way people think would impact their behaviors and therefore cannot be a behavior itself. Congnitivism is not a complete negation of behaviorism, but is an expansion that accepts the existence of mental states[2]. From cognitivism we can find that behavior can be impacted not only by external factors such as rewards or punishments but also by internal thought. About this point, self-determination theory has made a deep and clear exposition.

3.3.1 Self-Determination Theory

Self-Determination Theory (SDT) is a theory of human motivation and personality focusing on people's inherent growth tendencies and innate psychological needs [RD00b]. According to this theory, innate psychological needs are the basis for self-motivation and it discusses three psychological needs: autonomy, competence, and relatedness [RD00b].

Autonomy: are *"the universal need to control one's own life"* [Gro12]. Autonomy refers to the sense of ownership of one's behavior [RRR15, AVSM12]. If an activity is performed by a personal will then the perceived autonomy will be high. Providing opportunities for people to choose and using positive expression rather than order can improve the autonomy, because it will make people feel they can handle the situation and select which action to perform by themselves [AVSM12, DR00].

Competence: are *"the universal need to be effective and master a problem in a given environment"* [Gro12]. Competence refers to the ability to produce desired outcomes [RRR15, AVSM12]. Succeeding in completing a task, learning a new skill or wining in a competition can improve the experience of competition. Competence can also be activated by completing a challenge, and it is suggested that when individuals have become more ex-

[2]Extracted from Wikepedia-Cognitivism.

pert, the difficulty of challenge should be raised to prevent doing things less challenging [Gro12].

Relatedness: are *"the universal need to interact and be connected with others."* [Gro12]. Although it is found that autonomy and competence are the most powerful influences on intrinsic motivation and relational supports are not the necessary factors in maintaining intrinsic motivation in some situation (e.g. hiking in insolation), theory and research suggest that relatedness also plays a role in the maintenance of intrinsic motivation [DR00]. Relatedness can be activated by interacting or comparing with others.

Studies of SDT have shown that the satisfaction of these three basic psychological needs can foster intrinsic motivation which will be introduced deeply in the next section.

3.3.2 Intrinsic Motivations

Intrinsic motivation is defined as *"the doing of an activity for its inherent satisfactions rather than for some separable consequence"* [RD00a]. It means when somebody is intrinsically motivated to do an activity, it is simply because of the interest or enjoyment of the activity itself, rather than its external rewards or punishments. Moreover, efforts to build this kind of motivation often focus on the behavior subject rather than external rewards or punishments[3].

Intrinsic motivation is the self-desire to seek new things or perform an activity, so it can be long-lasting and self-sustaining. SDT indicates that people engage more in an activity when they are intrinsically motivated [SWL15].

As mentioned before, studies of SDT have shown that the satisfaction of those three basic psychological needs can improve intrinsic motivation and then increase enjoyment, consequently improve user engagement [RRR15, SWL15]. Conversely if these needs are not met, intrinsic motivation will decrease. Fig.3.1 depicts the linkages between the concepts derived from SDT [SWL15].

[3]For more information, see Wikipedia-Motivation

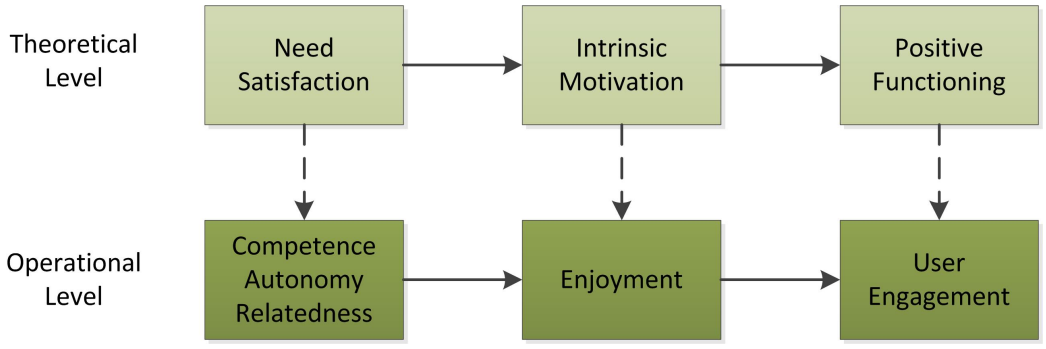


Figure 3.1: Baseline model driven by self-determination theory

However, intrinsic motivation also has disadvantages. Intrinsic motivation exists in the relation between individuals and activities. People may be intrinsically motivated by some activities but not by others, and not everyone will be intrinsically motivated by a particular activity [RD00a], so various approaches may be needed to motivate different persons. In addition, efforts at fostering intrinsic motivation may be slow to affect behavior [4].

Therefore, different from the viewpoint of many researchers that intrinsic and extrinsic motivations are the two separable and opposite motivations, SDT encompasses both intrinsic and extrinsic motivations on a continuum [RRR15].(However, in this thesis I will only focus on the intrinsic motivations of self-determination theory.)

Studies have also demonstrated that games are doing well in satisfying those three needs [RRR15, Gro12]. Games can be considered as a good example used to interpret SDT, as shown in Tab.3.1, by providing avatar selection, configurable interface and alternative activities, people can have an experience of autonomy; the proper challenges, positive feedback and competition foster feeling of competence; feeling of relatedness can be supported through group, community, collaborative task and chat system etc. [SF15].

Due to the similarity to game, a gamified application can also be used as a tool to improve extrinsic and intrinsic motivation through the selective use of game elements [SF15]. Actually, as SDT encompass both extrinsic motivation

[4]Extracted from Wikipedia-Motivation.

Autonomy	Competence	Relatedness
profiles, avatars, configurable interface, alternative activities, privacy control, notification control	positive feedback, optimal challenge,intuitive controls, progressive information, points, badges, leaderboards	teams, community, messages, chat, connection to social networks, cooperation

Table 3.1: Game elements by self-determination theory

and intrinsic motivation, gamification also combines these two motivations: using external rewards like points or badges to improve extrinsic motivation, meanwhile producing the feeling of autonomy, competence and relatedness to consequently improve intrinsic motivation and enjoyment [RRR15, RTG14]. In section 4.4 I will introduce this topic deeply.

3.4 Conclusions

In this chapter, I have introduced the notion of motivation and two primary kinds of motivation - extrinsic motivation and intrinsic motivation. Two psychological theories, behaviorism and cognitivism, have also been introduced. These two theories explain separately how extrinsic and intrinsic motivations impact people's behaviors from different perspectives.

Although people are most likely moved by extrinsic motivations such as rewards, punishments, grades etc., extrinsic motivations usually neglects the internal enjoyment of the activity and cannot meet people's real needs. The intrinsic motivations are not necessarily externally rewarded or supported, and the intrinsically motivated people will take an action simply because of the interest or enjoyment of the activity itself. Intrinsic motivations can be long-lasting and engage people more. However, efforts at fostering intrinsic motivation may be slow in affecting behaviors.

Furthermore, self-determination theory summarized three basic psycho-

logical needs - autonomy, competence and relatedness, and it also demonstrated that satisfying these needs can foster intrinsic motivations and consequently increase user engagement.

Gamification succeeds in combining extrinsic motivations and intrinsic motivations. Some game elements like points and badges act as rewards to activate extrinsic motivation. By satisfying the three needs, gamification can foster intrinsic motivations. In the next chapter, I will discuss how gamification activates motivations deeply.

Chapter 4

Conceptual Framework of Gamification

This chapter aims to introduce gamification design framework and how this framework can be integrated with self-determination theory. The related game design framework and detailed game elements used in gamification will also be presented in this chapter.

Game design framework will be introduced in section 4.1.

Following the game design framework, section 4.2 will focus on the structure and components of the gamification framework and section 4.3 on a very important part of gamification framework - points, badges and leaderboards system.

In the last section of this chapter, section 4.4, how gamification affects people will be analyzed through integrating gamification framework with self-determination theory.

4.1 MDA Framework for Game Design

MDA framework (i.e., Mechanics, Dynamics, and Aesthetics) is proposed by Robin Hunicke, Marc LeBlanc, and Robert Zubek and is defined as *"a formal approach to understanding games - one which attempts to bridge the gap*

between game design and development, game criticism, and technical game research"[HLZ04]. It provides a valuable model for us to understand how game works. The MDA framework divides a player's consumption process of game into three parts: rules, system, and fun.

Those three parts correspond with the three design counterparts: mechanics, dynamics, and aesthetics [HLZ04].

Mechanics *"describes the particular components of the game, at the level of data representation and algorithms"* [HLZ04]. It refers to the various atomic components, actions, tools, techniques, behaviors and control mechanisms of the game [SWL15, HLZ04]. They are the building blocks of a game [SWL15]. Together with the game's content the mechanics supports the overall gameplay dynamics [HLZ04]. The game rules, settings, the basic actions a player can take, and the algorithms and data structures all belong to the category of game mechanics. For instance, the mechanics of shooters includes weapons and ammunition, but things like sniping is an example of dynamics [HLZ04].

Following this logic, we will come to the definition of **dynamics**. It *"describes the run-time behavior of the mechanics acting on player inputs and each other's outputs over time"*. To put in a different way, it refers to the run-time behavior of a game and its interaction with players. Dynamics is the most important part that creates and supports aesthetic experience [HLZ04]. By creating dynamics, game elements will result in individual behavioral

change but dynamics will be deduced by players rather than being written in the rules of game.

Aesthetics *"describes the desirable emotional responses evoked in the player, when s/he interacts with the game system"* [HLZ04]. In MDA framework, aesthetics is all about making games fun. Robin Hunicke and Marc LeBlanc have listed 8 different kinds of fun as a more directed vocabulary of describing game aesthetics, to name just a few: Fantasy (Game as make-believe[1]), Narrative (Game as drama), Challenge (Game as obstacle course[2]), and Discovery (Game as uncharted territory) [HLZ04]. Depending on the game dynamics, each game may have multiple aesthetic experiences of different degrees, that is to say, individual players may have a number of emotional responses. This explains why different games appeal to different players, or to the same players at different times [SWL15, HLZ04].

MDA model provides us with the possibility to view the game from both the designer's and the player's perspective at the same time, which is shown in Fig.4.1

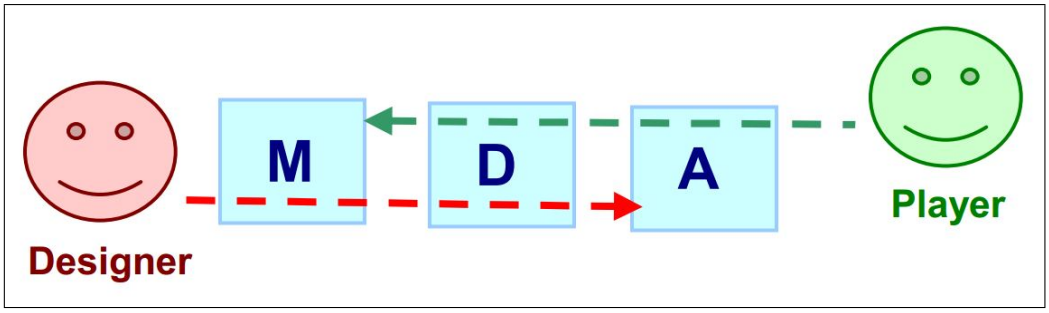


Figure 4.1: The different perspective of designer and player

From the designer's perspective, mechanics refers to various player ac-

[1] "Make believe" is a loosely structured form of role-playing that generally has no rules except to stay in character, and requires no specific props.

[2] An "obstacle course" is a series of challenging physical obstacles an individual or team must navigate usually while being timed. Obstacle courses can include running, climbing, jumping, crawling, swimming, and balancing elements with the aim of testing speed and endurance.

tions and control mechanisms, dynamics refers to the game design principles that allow for the interaction between game mechanisms and players, and aesthetics refers to the ultimate emotional response they intend to evoke in the player through the game dynamics and game mechanics, that is to say, mechanics causes dynamic system behavior, which then leads to particular aesthetic experiences [HLZ04].

Whereas from the player's perspective, mechanics is experienced as the rules of a game, dynamics acts as the system that creates the desirable game experience, while aesthetics functions as the goal of gameplay the players to achieve. For the player, aesthetics decides their final emotional reaction and is created by the perceptive dynamics, and eventually by the operable mechanics [HLZ04].

MDA model contributes a lot to game design in that it allows us to reason in an explicit way about design goals, reveals their supporting dynamics, and determines the range of our mechanics [HLZ04]. This model also sheds lights on the gamified design. This and how game elements can be used in gamified design will be presented in the next section. A model about gamified design will also be proposed based on the MDA model.

4.2 A Framework for Gamification

Although there are many successful examples of gamification in practice and more and more large companies and organizations tend to have gamified applications, there are warnings that the most of these gamified application may fail to meet their objectives due to the inappropriately gamified process [RPK+15]. From the literature review presented in [HKS14], we can see that although most of the outcomes of gamification are positive, there are also many negative outcomes which imply the risk of failure. A possible reason for this is a lack of understanding of what gamification is and how to design an appropriate gamification experience that motivates users and leads to desirable outcomes [RPK+15]. Some companies tried to copy the success of

Duolingo or Nike+ etc. by imitating their systems of points, badges or levels, without a deep understanding of the framework of gamification and a basic knowledge of how to gamify a system. This will very likely lead to failure.

In order to understand how to design a gamified system, researchers also proposed several gamification frameworks based on MDA game design framework. In [RPK+15] a new framework named MDE (mechanics, dynamics, emotions) is proposed by Karen Robson and Kirk Plangger. The MDE framework is most similar to the original MDA framework except for the consideration on *"aesthetics"*. In MDA framework *"aesthetics"* is different in different games, however, the MDE framework uses *"emotions"* to generalize the common outcomes that the users may attain from a gamified system.

In [WH12] Kevin Werbach and Dan Hunter have proposed a more specific framework for gamification. This framework gives us a sense of how different kinds of game elements can be applied in different ways in a gamified system. It is a pyramid structure which is shown in Fig.4.2 and it has three levels: components, mechanics and dynamics (be named as DMC system) [WH12]. Components are in the lowest level and are the most concrete elements, while dynamics are in the highest level and are the most abstract elements. Lower levels tend to implement one or more higher-level concepts [WH12]. Each of them includes some game elements and all of these three categories are considered as the key parts of gamification. However, they are not the entire gamification system, and around them is the overall experience. A critical part of experience is aesthetics. Though there are a number of diverse game aesthetics like fantasy, discovery or narrative etc., the key about aesthetics in gamification system is improving the user experience and user engagement. This is realized by using components, mechanics, and dynamics properly.

4.2.1 Dynamics

These are the most high-level conceptual elements in a gamified system, and are the macro concepts that need to be considered. They include conceptual elements that provide the framing for the game [WH12]. However they

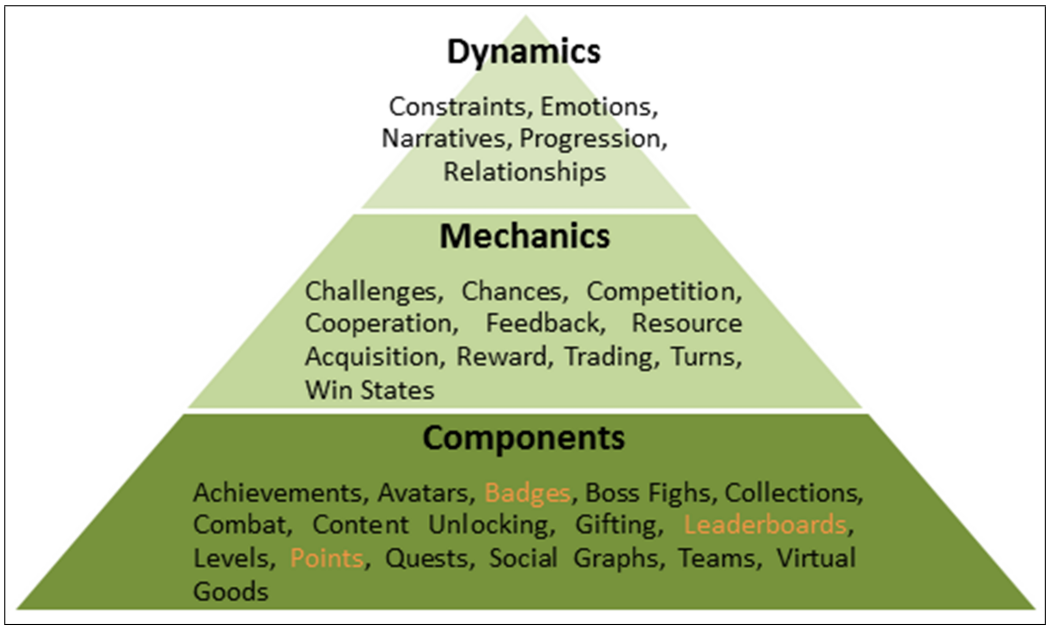


Figure 4.2: Key elements of gamification and PBL system

cannot be inserted directly in a gamification system, but are incentivized by the components and mechanics [CWR15]. They can be considered as the hidden structure that makes the experience somehow coherent and regular in pattern; therefore Kevin Werbach linked them as "grammar" [WH12].

The most important dynamics elements include:

- **Constraints**: are important elements in game and gamification system, in some sense the fun derives from the existence of constrains and the possibility of breaking constraints.

- **Emotions**: the feeling that users can experience from system, including the sense of curiosity, competitiveness, setback, or happiness etc. Emotions can be harnessed and designed to achieve the desired outcomes of the system [CWR15].

- **Narratives**: are consistent and ongoing narrations of storylines. They provide context and meaning for user interactions and adventures.

- **Progression**: provides visualization for the user to see their progress in a specific activity. It shows users growth and development and can prevent the user from becoming frustrated when they do not know what to do next.

- **Relationships**: emotions such as friendship, status and altruism that are created by social interaction.

4.2.2 Mechanics

Kevin Werbach defined mechanics as *"the processes that drive actions forward"* [WH12]. These are various tools that can be used to figure out how to move the action forward. They relate to how users interact within the framework and define their potential actions, the states of the users, possible reactions of a certain event, and how the system progresses [CWR15]. The gamification mechanics remain constant for all players and they do not change from one player to the next. [RPK+15]. Kevin Werbach linked mechanics to "verbs" which help player to play games. In [WH12] Kevin Werbach proposed 10 mechanics, some examples of them are:

- **Challenges**: are some quests that require user's efforts to complete, and are composed of a list of objectives to be fulfilled.

- **Competition**: arises between players or teams, usually only one player or one team wins and the others fail. Competition gives players a chance to prove themselves against others. Psychology researches suggest that players are motivated toward a better performance by a competitive environment [SWL15]. It can be a way to win rewards, and it can also create new connection and interaction between players.

- **Rewards**: are benefits of some actions and accomplishments. Rewards can promote a lot of activity when used well.

- **Cooperation**: players work together to achieve an objective that is not possible for an individual player. Overcoming a game challenge through cooperation can often motivate players and foster teamwork.

- **Trading**: trade of resources between users or through a medium. Trading helps to build relationships and generates the feeling of value.

- **Feedback**: is information about how player performs. Feedback allows players to know how they are doing and gives user the direction of next step. It can be provided through leaderboards, messages, or other visual, vocal or informational displays.

- **Chances**: randomness and stochastic element which can provide user a sense of uncertainty, and subsequently provide users unexpected fun or surprise.

As discussed previously, each lower level element can implement one or more higher-level concepts, so mechanics will activate one or more dynamics. For instance, the existence of stochastic elements, can give rise to curiosity and interest which belong to emotion; and cooperation can make users act together and improve social interaction thus leading to the sense of relationship.

4.2.3 Components

Components are considered as the basis of dynamics and mechanics. Components include the atoms that can be used to create mechanics, dynamics, and eventually implement the whole gamified system. In [WH12] Kevin Werbach proposed 15 components, not all of which are necessary for a specific gamified system, and the selection of components is related to the intention and purpose of the system and the target user group [CWR15]. Elements belonging to this level could be avatars, PBL system, gifting, levels, and quests etc. The whole list of elements can be found in Fig.4.2. And

integrating with the game elements' descriptions in [US14, CWR15] and on some game wiki[3] I list the commonly used component elements as follows:

- **Achievements**: are a virtual or physical representation of having accomplished the pre-defined goals.
- **Points**: *"are a running numerical value given for any single action or combination of actions"* [US14]. Points present the progression in the form of numbers and can also be used to unlock new contents.
- **Badges**: are used to indicate the mastery of skills and accomplishments. Badges maybe given to users after they complete a specific goal or master a certain skill, and they are generally known in advance to motivate user to achieve the corresponding goals.
- **Leaderboards**: display people's relative or absolute ranking in a competition. Commonly used to show how someone compares to others.
- **Avatars**: are unique visual representations for players. Avatars usually represent a customizable picture to represent the player inside games. Avatars can create emotional connection between the player and the game.
- **Content unlocking (Unlockable Content)**: is available in video games but not accessible at the beginning and it can be accessed unless something is performed by the player [4].
- **Quests**: are meant to be a journey of obstacles the user must overcome. Quests give users a pre-defined goal to achieve. Usually some rewards will be given to the player after they complete a quest.
- **Level**: is a rewarding system for the accumulation of points. Levels indicate player's progression in game and show where player can go

[3]See 1.GamificationWiki - Game Mechanic. 2.Gamification wiki - Game Design. 3.Gamification wiki - Game Features. 4."47 Gamification elements, mechanics and ideas".

[4]Definition extracted from Wikipedia-Unlockable Content.

next. When players progress to higher levels, usually they will receive rewards and unlock new contents.

- **Virtual Goods**: virtual assets that are perceived to be valuable, usually they confer an advantage to users. Virtual Goods help to build virtual economy and a sense of ownership.

- **Gifting/Sharing**: means the opportunity in which the players could exchange or share resources.

- **Team**: is a group of players working for a common goal.

- **Social Graph**: is player's social network in the game world.

4.2.4 Summary

Components and mechanics are the foundational elements of a gamified experience. They create the structure that the gamified experience exists, determine what the system looks like and how the users interact. However, only components and mechanics are not enough to create an experience that will motivate behavior changes. The dynamics that emerges from this structure are the key elements that will cause the desired behavior change [RPK+15]. Dynamics, such as constraint, narratives, and progression play important roles in motivating individuals' intrinsic motivation by influencing needs satisfaction [SWL15].

Gamification relies on the careful design and application of the key DMC elements. Furthermore, the aesthetics and objectives of gamified system need to be clearly decided in advance, and the design and use of DMC elements should focus on the desired outcome. Just as game designer needs to view a game system not only as separate elements but also as a whole in play [Ful14], gamification succeeds only if the key elements join and run like a unity according to the aesthetics and intention as depicted in Fig.4.3 [CWR15].

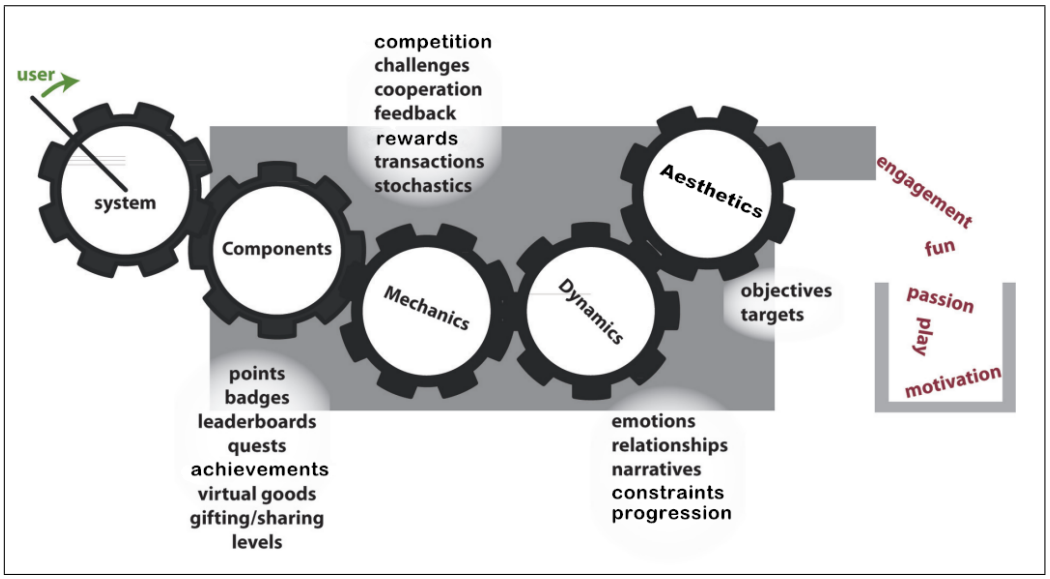


Figure 4.3: Overview of gamification elements

4.3 The PBL system

There are three elements, points, badges, and leaderboards (shortly called "PBL system"), commonly used in gamified system. From a survey made in [SF15] we find that the top mentioned gamification elements in researches are points, badges, rewards, leaderboards, challenge, and status etc. [SF15] which is an evidence of the popularity of PBL system.

Some people even have the misunderstanding that gamified system is all about PBL system due to their popular application. We shall admit that they are effective in encouraging individual participation in some circumstances of a gamified system; however, they are not the totality of gamification though they can be considered as the typical characteristics of gamified system [WH12]. Additionally, we shall realize that they also have some defects and limitations. As a starting point to gamification design it is necessary to understand their advantages, disadvantages and how they can be used.

4.3.1 Points

Points are considered usually as a flexible form of feedback and the tool to motivate user to complete some tasks, but as shown in [WH12] they can be also used in other aspects:

- **Keep score**. This is the typical function of points in gamified system. Points can tell user how they are doing and be used to distinguish users' ranking.
- **Determine win states**. The points can be used to determine which player wins in a competition.
- **Connect to external rewards**. Points can be used to redeem some tangible or virtual rewards. This mode has been already used in marketing for a long time, for example, redeeming an airplane ticket with flight miles (points).
- **Provide feedback**. Explicit and frequent feedback is a key element in most good game designs, and points provide feedback quickly and easily, and then players can see their gains of each activity.
- **Display of progress**. Points can be used to show how players progress in game.
- **Data for game designer**. The points achieved by players can be tracked easily by game designer, and from the analysis of the data the game designer could understand how game operates and which part of it needs modification in order to provide better experience.

By understanding the nature of points, we can use them to achieve our objectives of gamified system. They could be used to encourage certain behavior of people by collecting them, however, the limitation of points are also obvious: they are abstract and simplex, thus it is only a simple approach serving to motivate those people who like collecting things. The element

used to compensate the limitation of points is badge. Usually they are used together.

4.3.2 Badges

Badges represent specific achievements such as finishing a series of related quests, or acquiring a new skill, etc. within games or gamified systems. They create loyalty and raise exit barriers as they are generally associated to specific system [RRR15]. A badges system has five motivational characteristics.

- Provide goals and directions for the user.
- Give users certain guidance, make users know how the system is realized and what they can do within the system.
- Signal of users' interests, through analyzing the popularity of different badges we can know what interests the users more.
- Serve as publicly visible status symbols, a form of affirmation for their journey in game or gamified system.
- Tribal markers, serve as a simple means of identification, users will have a sense of identity when they find other people also have the same badges and thus feel connected in a game.

Badges are highly flexible. There are several options for designing badges. Based on different users' interests we can design different badges, and in this mode badges could be attractive to various users. This is what points cannot provide due to their simplicity, though playing the same game or using the same gamified system, users can have different personal badges. Badges are more personal and usually not exchangeable, while points operate as means of exchange and can be exchanged for things of value, be virtual or tangible [RRR15]. Badges are good motivators, and many users are inclined towards collect badges.

4.3.3 Leaderboards

Leaderboards show players rankings and performances publicly and give players feedback of where they stand in comparison with their peers. Leaderboards are the most difficult elements to use in gamification. Players often want to know how they perform compared to the other players. If performance is important for players then leaderboards can be powerful motivators. However, leaderboards can also demotivate users when they find other players are too far ahead for them to catch up, and then they maybe interrupted or quit the game. An available solution is using leaderboards in various dimensions and ranking players from different aspects or properties, rather than using them only as static scoreboards or tracking players only in one aspect [WH12].

4.3.4 Disadvantages of The PBL system

A PBL system is easy to implement in a gamified system. But what we need to pay attention to is that the PBL system is not the only choice for gamification and is not always suitable for all of the projects. Indeed the PBL system is considered as a reward-based gamification system which influences users' motivation through external reward.

Rewards can be used to establish status and create connections among users; furthermore, other game mechanisms can be made more enjoyable by integrating rewards[WS11]. Designing a reward-based gamification system is relatively easy. The designer of the gamification system decides which actions are desired and assigns points for those actions. These points can then be used in a leaderboard to encourage competition between users. And badges are also adopted as a way of publicly displaying users' successes and achievements within the reward-based gamification system [Nic15].

Reward-based gamification is suitable in certain situations. For some really boring, monotonous and repetitive tasks, we have no way to develop intrinsic motivation to encourage user participation. In this case the reward-

based gamification could be helpful to engage people, and external rewards can create an immediate and short-term change in user engagement. As long as rewards are supplied continually, the behaviors will continue aiming towards earning the rewards. However, once the rewards are terminated then the behaviors will stop too [Nic15, Nic12]. Furthermore, if the participants are motivated by rewards from the very beginning, when their performance increases subsequently they will expect an increase in rewards, and this maybe a never-ending process once begun [Nic15].

On the other hand, if rewards are used to encourage a behavior that someone already has some intrinsic motivation to engage with, after a time the participants will be accustomed to feeling that the rewards are deserved and in the end the behaviors will continue only to earn rewards, that is to say, the participants' intrinsic motivation will decrease and will be replaced by external rewards [WH12, Nic12, DR00].

Although reward-based gamification is commonly used to motivate people to do certain things when they have no other reason to do it [Nic15], designers of gamification need to be aware of the limitations and pitfalls of rewards and need to know what the rewards can do and what they cannot do. Therefore, for acquiring a more valuable gamified system it is necessary to surpass the reward-based system - the PBL system.

4.4 Integration of Self-Determination Theory and Gamification Framework

Self-determination theory theorizes what factors influence people's intrinsic motivations. And DMC gamification framework theorizes how to gamify a system and increase user engagement, so self-determination theory is relevant to understanding user's engagement in gamified systems. And based on the integration of self-determination theory and MDA framework proposed in [SWL15], we can integrate self-determination theory with DMC gamification framework like Fig.4.4.

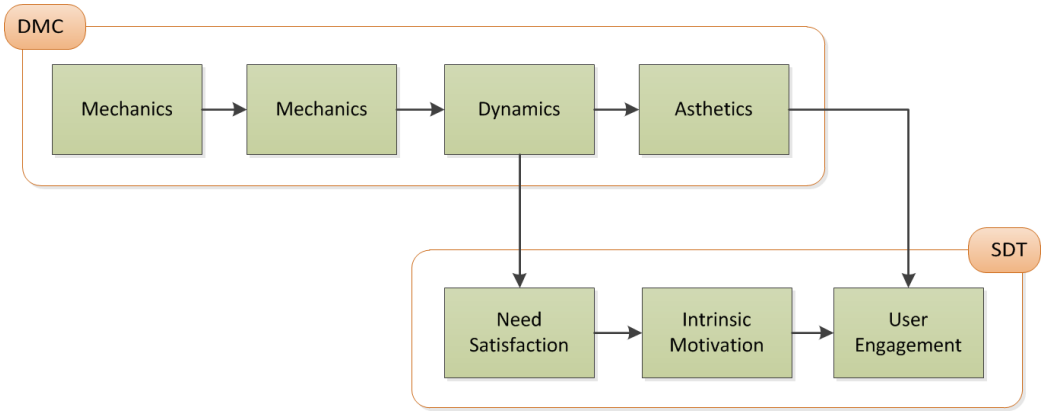


Figure 4.4: Integration of SDT and DMC

According to SDT, satisfaction of individuals' autonomy, competence, and relatedness increase their intrinsic motivation, and then increase their engagement in activities. On the other hand, that game elements will result in individual behavioral change by creating gamification dynamics, which in turn induce the psychological responses of users. As discussed previously, users' psychological responses to game are strongly associated with needs satisfaction, so we link gamification dynamics with needs satisfaction. According to SDT, enjoyment increases users' engagement. Given that gamification aesthetics refers to improve user experience and consequently increase user engagement, so linking gamification aesthetics with user engagement.

From Fig.4.4 we can see clearly how gamification influences user motivation and consequently improve user engagement. At the same time, we can find that gamification dynamics are effective mechanisms for satisfying the three basic needs and consequently influence user engagement through the mediation of needs satisfaction. However, an analysis made in [SWL15] indicated that different game dynamics have different impacts on user engagement. It is the same in gamification system. For example, progression positively influences the user's competence and autonomy, and relationships primarily influence relatedness. This implies that in order to make users engage deeper, diverse gamification dynamics should be implemented by gam-

ification mechanics and components.

4.5 Conclusions

In this chapter, I introduced MDA game design framework and DMC gamification framework. And PBL system is also introduced.

MDA is a formal approach to understand games. It allows us to consider a game from both designer's perspective and player's perspective. And it can help us to understand each game element better.

DMC gamification framework refers to dynamics, mechanics, components as well as aesthetics. With this framework we can have a clear understanding of each gamification elements (or game elements that can be used in gamification) and how they can be used to gamify a system. In order to create a complete gamification experience, it is necessary to use dynamics, mechanics and components together rather than separately. Besides, designer should also consider the specific context and user requirements, and then wisely select which game elements should be used to gamify the system.

PBL system is a commonly used system in gamification. It can engage the user, however the effect of PBL system will not be long without other game mechanics and elements. It should be used with other game elements to create a better user experience.

By integrating SDT and DMC, we understand better how gamification activates users' motivations and improves their engagements.

Chapter 5

Gamification of Massive Open Online Courses (MOOCs)

In this chapter I will introduce related concepts and classification of MOOCs, the use of gamification of MOOCs, and two practical examples about the use of gamification of MOOCs.

In section 5.1 I will introduce the definition of MOOCs and explain the meaning of each of those 4 letters in the acronym MOOC. After that I will describe two different types of MOOCs and make a brief comparison between them. The last part of this section is about the challenges that MOOCs face, and the ways of dealing with some of the challenges by using gamification.

Section 5.2 aims to explore the gamification of MOOCs. I will elaborate such topics as which elements of gamification can be used to improve user engagement in MOOCs, how they can be used and the consequent impacts.

In Section 5.3 I will present two practical examples about the use of gamification of MOOCs, and analyze the impact brought by gamification.

5.1 Massive Open Online Courses(MOOCs)

MOOCs (Massive Open Online Courses) are recently very popular in the field of online learning. MOOCs are not only another e-learning[1] courses; they have different and specific characteristics, such as informal and social learning, openness of access and massive participation etc. [GNnB14], and they can be considered as a solution to the lack of access to education in developing world because MOOCs remove chronological and spatial boundaries in education and provide learning opportunities to a massive number of learners from anywhere as long as they have an internet connection [CGG14]. With MOOCs learning can occur anywhere and not necessarily only in classrooms, thus enabling continual learning of knowledge and skills [VG14].

The term MOOCs was originally coined by Alexander and David Cormier when they referred to the famous course *" Connectivism and Connective Knowledge"*[2] developed by two Canadian scholars: Stephen Downes and George Siemens in 2008. In 2011 another course *"Introduction to Artificial Intelligence"* was published by Sebastian Thrun and Peter Norvig from Stanford University, which attracted great media attention because of its large number of subscribers(160,000 people) [FMG15]. In 2012 MOOCs had become a popular mode of learning, and after that many MOOCs providers or platforms had emerged. Now MOOCs have been widespread all over the world.

5.1.1 Definition

There are diverse definitions of MOOCs and it is also observed that each letter (M, O, O and C) of MOOC is negotiable as is shown in Fig.5.1. The authors of [WBL+14] defined MOOCs as *" web-based online courses for an unlimited number of participants held by professors or other experts."*, in

[1] A type of computer-supported collaborative learning system that developed with the emergence of Web 2.0.

[2] See "Connectivism and Connective Knowledge" on CCK11 or CCK12.

[JS15] the definition of MOOCs is *"online courses designed for large numbers of participants, that can be accessed by (almost) anyone anywhere as long as they have an internet connection, are open to everyone without entry qualifications, and offer a full/complete course experience online for free"* [JS15] and in [MSSC10] the definition of MOOC is *"an online course with the option of free and open registration, a publicly shared curriculum, and open-ended outcomes"*.

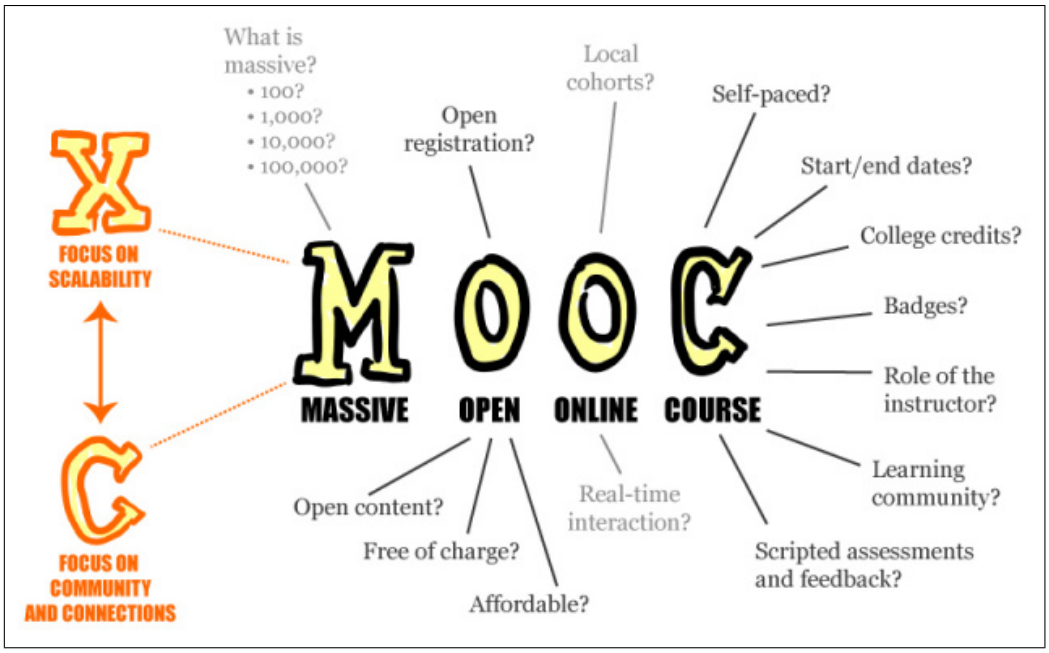


Figure 5.1: MOOC: Every letter is negotiable

Although the definitions are different, the core concepts of MOOCs focus on 4 dimensions: M (Massive), O (Open), O (Online), C (Course). In order to better understand these four dimensions and the context where gamification will be used, I will make a detailed explanation about these different dimensions of MOOC. After that the answers to the questions in Fig.5.1 will be clear.

5.1.1.1 Large Number of Participants - Massive

Like the definition in [WBL+14], there are some definitions refer *"massive"* to *"unlimited number of participants"*, but we should be cautious about this. If a course doesn't allow for unlimited participants, we cannot consider it to be less massive. When the course is offered, the number of participants cannot be unlimited due to the limited resources, and a maximum number of participants should be set according to the available resources[JS15].

It's better to say that there is no precise number to define *"massive"*, and *"massive"* is only used to emphasize that the number of MOOCs participants is larger than that of traditional class or distance learning course participants [WBL+14, JS15].

On the other hand *"massive"* also means when the number of participants increases, the efforts of all services (instructional materials, instructor or staff) of the course will not increase significantly [JS15].

5.1.1.2 Open Accessibility - Open

In order to understand the course contents of MOOCs, some prior knowledge or skills are required but are not tested beforehand; in addition, people who are not qualified or do not possess suitable diplomas can also participate in the online course[WBL+14, JS15].Therefore, even if the people don't know anything about the course, they can also participate in the course. There is an exception that some MOOCs providers may block the participants younger than 16 or from sanctioned countries, but most MOOCs providers do not put any limit to participants. In short there are few limitations for participation in MOOCs[WBL+14, JS15].

In [JS15] there is another interpretation about *"open"* that refers to *" Open as in freedom of place, pace and time"*. If we have a look at the current popular MOOCs platforms, we can find this statement is negotiable, because some MOOCs nowadays have a fixed start and end date and the course can be accessed only between the start and end date [JS15]. For

example, the MOOC *"Game Theory"* [3] of Stanford University on Coursera[4] was opened from 14.Oct.2013 to 12.Dec.2013 and could not be accessed after it was finished; if somebody wants to access this course again, he should wait for the next session opened from 11.Ste.2015 to 8.Nov.2015.

People should also pay attention to another viewpoint that *"Open"* refers to *"Course can be completed for free"* [WBL+14, JS15]. It's true that most of the MOOCs are often free of charge and users can participate in the entire courses without any costs. Participants may only need to pay for some additional services such as additional tutoring or formal certification, because these services require academic staff and other resources [WBL+14, JS15]. However, not all of the MOOCs are free for participation. For example, MOOCs of Udacity[5] are not free, and a fee about 200 dollars per month is required for participating in the course. In fact, whether MOOCs are free depends on the business model of MOOCs providers[6]. Based on this fact, we can't simply state that all MOOCs are free.

5.1.1.3 Digitization - Online

All aspects of course such as learning materials (video, audio, text, simulation, animation etc.), teaching process, homework assignment, social interaction of participants as well as the participants' examination should be delivered online, thus MOOCs are not location-dependent [WBL+14, JS15].

[3] See "Game Theory" on Coursera.

[4] See Coursera website.

[5] Udacity is a MOOCs provider and platform.

[6] Some MOOCs providers like Coursera and Udacity are set up as for-profit companies and have received millions of dollars as funds from venture capitalists, and they get profit from the certification fee or service fee. Other providers, such as edX(a MOOCs provider and platform) are set up as non-profit organizations which are funded by the institutions themselves, so they can be used as a vehicle for research and the alternative education models.

5.1.1.4 Didactical Concept - Course

The learning content is structured according to a didactical concept. The introduction of knowledge follows pre-defined learning objectives and the teaching process follows a course scheduling.

The course design elements may include study guide (instructions about how you may learn from the presented course), social learning interaction (interaction among peers or with academic staff, forums, blogs or learning community), and test or examination of educational objectives etc. [WBL+14, SWRM14, JS15]. Additionally, a MOOC is a unit of study so the length of the course should not be too short [WBL+14, SWRM14].

Though MOOCs are characterized and defined from 4 dimensions, the realizations of MOOCs could be different. In fact, as is shown in Fig.5.1, there are two types of MOOCs with different emphasis: xMOOC and cMOOC. In order to avoid potential confusion, I will next make a brief comparison between these two types.

5.1.2 xMOOC vs cMOOC

MOOCs have developed into two distinct directions: the first is the connectivist MOOCs (cMOOC) which are based on a connectivism [7] theory that invites learners to engage in a self-organized and social learning process. The second is content-based MOOCs (xMOOCs) which follow a traditional didactical approach and use the standard lecture mode [CGG14, GMTW13].

cMOOCs were the first MOOCs, the course *" Connectivism and Connective Knowledge"* mentioned in section 5.1 is cMOOCs, but xMOOCs have attracted more attention. Most of MOOCs platforms we visit like Courseras and EdXs are xMOOCs. cMOOCs and xMOOCs differ in the openness of the learning content and the learning process.

The contents of cMOOCs are open and adaptable. cMOOCs use open

[7] Connectivism is a network-based theory focusing on the learning that occurs through the connections made among learners and learning objects [YHDB13].

educational resources and are sensitive to the requirements of their learners. cMOOCs allow learners to co-construct the learning process through their interactions, while xMOOCs tend to use materials with restricted licenses and courses are learned following a relatively fixed, predefined schedule [GMTW13, SWRM14].

xMOOCs are considered essentially as technology-enriched traditional Teacher-Centered instruction which rely on traditional lecture mode. The courses are designed similar to university courses, which have fixed time ranges and cover presentation of didactical lectures (video, audio, texts, slides etc.), interactive exercises, frequent quizzes and assignments, computer-marked assessment, feedback (can be automatically generated by platform, or by peers, or from academic staff), final exam and some kind of recognition like badges or a certificate of completion etc. [GMTW13, CGG14, FMG15]. xMOOCs focus on the transmission of information, and there is almost no direct interaction between individual participant and the instructor. Usually xMOOCs are hosted on platforms and have a web page based on a learning management system that supports automation of key transitions between participants and learning platform. If learners want to study some academic courses that meet a specific interest, xMOOCs will be the right choice.

Conversely, cMOOCs use non-traditional teaching approaches, and provide opportunities to study in an online community rather than in traditional classroom. cMOOCs are considered as Learner-Centered instruction where learners learn from each another. cMOOCs emphasize connected and collaborative learning, and the courses are developed in a community built by the similar-minded learners with the same interest in a particular field. In the cMOOCs environment, participants act as both teachers and students, all participants make contributions and share contents after the organizer raises the course subject, participants will start to discuss or debate on this subject and make active contributions in the form of tweets, blog posts, comments on blog posts, and wikis etc., and the related findings will be shared with other course participants through daily newsletters, emails or other digital form.

By studying with each other, learners are able to understand and extend their knowledge [CGG14, SWRM14]. An instance of cMOOCs is etMOOC[8]. Generally, cMOOCs are not funded or sponsored by higher education entities; however, xMOOCs usually have one or more higher-educational entities or in some cases, a for-profit company behind them.

Therefore, cMOOCs primarily use a network approach to share the knowledge generated by the community, and there are no predefined curriculum. In cMOOCs there is no formal teacher-student relationship and participants of cMOOCs learn from the contributions made by each other. Different from the aim of xMOOCs which focuses on information delivery, cMOOCs guide theirs participants to generate and share their own contents.

To conclude this section, the differences can be summarized as Table.5.1 [9].

xMOOCs		**cMOOCs**
Scalability of provision	Massive	Community and connections
Open access - Restricted license	Open	Open access and license
Individual learning in single platform	Online	Network learning across multiple platform and services
Acquire a curriculum of knowledge and skills	Course	Develop shared practices, knowledge and understanding

Table 5.1: Summary of the differences between xMOOCs and cMOOCs

In this thesis, our discussion of using gamification on MOOCs is referred to the xMOOCs. In the following section, for the sake of brevity the term

[8] etMOOC is a cMOOC website.
[9] Extracted from [YPO14].

MOOC will be used as a synonym of xMOOC.

5.1.3 Challenges

In the pasted several years, many MOOCs platforms have emerged like OpenCourseWare[10], OpenLearn[11], Coursera[12], Udemy[13], edX[14], openHPI[15], Udacity[16], Khan Academy[17], and many others. Despite their popularity, the platforms face some challenges such as high dropout rates and poor user participation. In fact, in [PGA15] the authors have selected 19 (almost the whole) popular MOOCs platforms all over the world, and made an analysis of these MOOCs platforms. The analysis indicates that high rate of abandonment is a common phenomenon of these platforms - the dropout rate ranges between 75% and 90% on average. In addition, another more in-depth study indicates that only 10% of the learners have complete the course, and 3% have participated in the open discussion forum of the course [PGA15]. In some other papers such as [VG14, SWRM14, Tan13, FMG15, MTB+14] the same conclusion can be reached though the drop rates are more or less different. This means while many learners enroll in the courses, only few of them successfully complete the courses. Furthermore, many of them will quit even before finishing the first assignments [FMG15].

Various causes of this phenomenon are reported by different studies based on different scenarios; after all, the users of MOOCs are more various than the students in traditional classroom, so their motivations are also diverse and even significantly different in different courses. The reasons can be summarized in 9 cases as follows:

[10] `http://www.ocwconsortium.org/` USA
[11] `http://www.open.edu/openlearn/` UK
[12] `https://www.coursera.org/` USA
[13] `http://www.udemy.com/` USA
[14] `https://www.edx.org/` USA
[15] `https://open.hpi.de/` GER
[16] `http://www.udacity.com/` USA
[17] `https://www.khanacademy.org/` USA

1. *Lack of enough time to follow the course* [GNnB14]
2. *Interested only in a specific part of the course* [GNnB14]
3. *Not aim to take the tests and assignments but joined in only for knowledge* [VG14]
4. *Different level of the course than expected* [GNnB14]
5. *Ineffective assessment and limited feedback* [FMG15]
6. *Feelings of isolation* [KMPW15]
7. *Lack of interactivity* [KMPW15]
8. *Courses were too long and challenging and students discontinued due to decaying interests* [VG14]
9. *Students are not engaged, motivated and committed enough (therefore they find it easy to simply not complete the course)* [FMG15]

Aiming to deal with these 9 different cases, researchers have proposed corresponding solutions to resolve the problems of high dropout rate and poor participation, such as *correct difficulty level personalized to student, quizzes and immediate feedback etc.* [FMG15]. However, in this thesis we are interested only in the cases that can be resolved by gamification[18], that are the cases 6, 7, 8, 9[19]. If we analyze the reasons 6, 7, 8, 9 deeply, we can find that they can be divided in two classifications: the first two are about social interaction and the last two are about interest and enjoyment. In view of this situation, by making the platform more interactive and interesting, retention rate can be raised, that is to say, drop-out rate can be decreased. Naturally, gamification is a good choice to do this.

[18]We should realize that gamification is not a solution adaptive for all cases and problems; and as is shown in the above, gamification, like other solutions, has its own scope of application also.

[19]We have to admit that some drop-out or poor participation cannot be improved, because this is up to an individual, for example case 1, 2 and 3.

5.2 Improving Engagement and Retention With Gamification

As discussed before, gamification is a mechanism that has recently been successfully used to improve user motivation and participation. A concept of gamifing the MOOCs platform has been proposed by some researchers and many experiments are made to examine the impact of gamification on MOOCs. In practice, some of those proposals have already been implemented in several MOOCs platforms such as openHPI and Khan Academy.

At the same time, due to the massive participants and wide spreading, MOOCs are also a good domain used to verify and experiment the efficiency of gamification.

5.2.1 Related Researches

Many researches have been made in order to investigate whether gamification is useful in raising retention rate of MOOCs platform, to explore the possible gamification elements and the pattern which can be used, and also to find out the corresponding results of using gamification in MOOCs design. An overview of these researches can be found in Tab.5.2. In a word, all the results of these researches are positive, which have proved the availability of gamification in raising engagement and retention on MOOCs platform.

Papers	**Research or Experiment**	**Result**
A Playful Game Changer: Fostering Student Retention in Online Education with Social Gamification[KMPW15]	Investigated the potential of gamification with social game elements for increasing retention and learning success of MOOCs, and a controlled experiment with 213 students was conducted	The result indicated that gamification can increase retention and the final scores of course, further, the effect would be more significant if social elements were added

Engaging with massive online courses [AHKL14]	Focused on the use of gamification element - badge on MOOCs forum, and an experiment was conducted	The result indicated that forum engagement can increase after making badges more salient
Gamification in MOOC: challenges, opportunities and proposals for advancing MOOC model [GNnB14]	Evaluated some methods of increasing retention, user motivation and participation throughout MOOC, and proposed a model to motivate MOOC's students based on gamification	The model pointed out a possible way to use gamification on MOOCs
Towards social gamification: implementing a social graph in an xMOOC platform [SWRM14]	Demonstrated the possibility of using gamification to increase relatedness from psychological perspectives, and introduced an implementation of a social graph using gamification on a MOOC platform - openHPI	1.Demonstrated the possibility of using gamification to increase relatedness on MOOCs platform. 2.Poninted out a possible way of using gamification on MOOCs
Designing and executing a gamified hands-on MOOC for technology enthusiasts [CQL14]	Designed a MOOC for technology enthusiasts and made an experiment on the effect brought by e-learning technologies such as cloud services, gamification, real time assessment tool etc	Gamification successfully alleviated the retention problem, and higher motivation and retention were achieved in the experimental course

Motivating the Masses-Gamified Massive Open Online Courses on openHPI [WFM+14]	Made an overview on suitable gamification elements that are applicable to MOOCs platforms and explained how these learning platforms can benefit from game elements in a number of ways	Successfully gamified openHPI MOOCs platform and thus made users keep staying with the course
Towards a MOOC game [Tan13]	Presented the opinion that a MOOC game can alleviate some shortcomings like lacking engagement and provided a discussion on how it can be achieved	A design framework for an MOOC game is proposed based on the statement that MOOC game would increase the engagement of students
Will MOOCs transform learning and teaching in higher education Engagement and course retention in online learning provision [FMG15]	Provided a review and case study of MOOC provision and explored how course retention can be improved in online provision	One of the results of this paper is game-like elements would have a significant positive impact upon retention, although this needs to be tested through a more robust study design
BrasilEduca: An open-source MOOC platform for Portuguese speakers with gamification concepts[MTB+14]	Described the need of Portuguese speakers on MOOCs platforms, and how to motivate and engage more students than the usual MOOC platforms	Explained how gamification can be used for educational purposes, and a platform tied up with gamification is proposed to motivate users

Gamification of MOOCs for increasing user engagement[VG14]	Designed a gamified course and made an experiment among 100 candidates on studying if a gamified platform can increase user engagement	The results showed that if the learning platform was gamified, it would not only significantly increase the user enrollment but also increase user engagement in the course

Table 5.2: Researches about gamification on MOOCs platform

From the researches we can find that social interaction (students participation with very little or no involvement of the teachers) is an important aspect of MOOCs, and the nature of massive participation in MOOC provides opportunities for enhancing the social dimension of learning. In practice, many flexible MOOCs have associated themselves with external social virtual communities, which, has increased retention and participation rates, but the completion rates are still not considered as optimal. So it is proposed in [KMPW15, GNnB14, Rom13] that gamification elements should be used to strengthen social interaction.

On the other hand, although the primary aspect of MOOCs is their course contents, the most engaging experiences don't always come from the "best" MOOCs taught by "star" professors of the famous universities, even if these courses are hosted on well-known MOOC platforms; instead, they may come from the MOOCs that can offer the most interesting and engaging MOOC experiences [Lau14].

In [Rom13] based on the concept of "game based learning" the author proposed a new trend of MOOCs: MOOC includes serious game, which means combining MOOC with serious game or furthermore restructuring MOOC content as a serious game. This method can change the lecture-

based approaches adopted in most of the MOOC platforms, increase the enjoyment of course, and make learning environment more interesting. The author also proposed the possibility of using gamification in content design, that is to say, gamify the content of MOOC [Rom13]. Unfortunately, we can't spread this method on MOOCs platforms, not because this method is ineffective, but because it is too difficult to gamify every different course content in a personalized mode considering there are so many courses on MOOCs platforms. However, the mode of the course presentation and the platform interface can be gamified and they are also important factors for successful retention. As is shown in [VG14, GNnB14], if the learning platform is gamified, a significant increase in the user retention, participation, and motivation throughout the course can be achieved.

Considering all the results found in [KMPW15, VG14, GNnB14], we can use gamification to improve users' engagement from two aspects:

- Making MOOCs more interesting by gamifing the presentation of the course, the interface of platforms and the forum.

- Increasing relatedness by using social gamification elements between learners thus increasing interaction and drawing learners to establish more connections with each other.

These two aspects are not absolutely separate, in fact, an experiment in [KMPW15] has not only demonstrated the effect of gamification in increasing retention rate but also indicated that the social gamification elements can amplify this effect significantly. So in the following part of this chapter, readers will find that in the process of gamifing MOOCs platforms, these two aspects will be considered and handled together.

Next I will explain how to gamify MOOCs platform and introduce the gamification elements that can be used on MOOCs platform.

5.2.2 Gamifing MOOCs Platform

In related researches, many gamification elements are proposed to gamify MOOCs platform. The challenge of gamifing MOOCs is how to apply the right elements in a beneficial way; the elements should increase user motivation and must not harm the learning experience. The most mentioned gamification elements are points, badge, and leaderboard (PBL system, see section 4.3), and some other elements like progression bar, avatars, time limit and unlockable contents have also been proposed in some studies. As is described in section 4.3, PBL system is a reward-based gamification which is only a part of gamification, and a whole gamification experience can only be achieved with the integration of other gamification elements like avatars and feedback etc.. Therefore, though these elements are less mentioned in researches, they are also important and will make the gamification experience more complete. Next I will make a detailed presentation of the elements proposed to gamify MOOCs platform from diverse researches.

5.2.2.1 Points

Points are the most generic reward, and they can be used to reward many activities. Because MOOCs platform is an interactive environment, users always need to interact with the platform, so many activities can be valued and then rewarded [WFM+14].

Gaining points from activities often immediately provides motivation to users. Points are flexible hence can be widely used on MOOCs platform. Moreover, points are the bases for using many other gamification elements such as badges, levels, leaderboards or content unlocking, so points are essential for gamifing MOOCs platform.

In the MOOCs environment, to gamify the platform we can use points to reward user activities such as logging in website, watching lectures, doing exercise, completing assignment, asking or responding a question in course forum etc. [GNnB14, WFM+14].

5.2.2.2 Badges

Badges are small rewards that users will earn after achieving a certain goal. They symbolize the accomplishment in a game. Badge is persistent, hence once a user earns a badge, he will never lose it.

Badge can appear in the user's profile and may be shared through social media. It is useful to motivate users if badges can be viewed by others, because badges represent a status and reputation, especially when the MOOCs platform has massive participants and it is social enough to make badges matter. If no one notices your badges, then motivational drive will lose [WFM+14].

In [AHKL14], researchers have designed an experiment to deeply study the impact of badges on increasing user engagement in MOOCs forum. A significant increase of engagement was observed after deploying badges in forum, and further, the researchers also found that when badges were made more salient (for example, displaying a student's current set of badges next to his or her name for others to see), a more significant increase would be observed. This means except massive participants, higher visibility is also a helpful factor to amply badges impact on motivating user engagement [WFM+14].

In the MOOCs environment, to gamify the platform, we can assign badges to users when they reach some milestones such as completing the whole course, answering a number of quizzes correctly, taking a number of lessons, voting a number of response in forum, or being ranked among the top ten students of a lesson or the entire course etc. [WFM+14, KMPW15].

5.2.2.3 Leaderboards

Leaderboard is a list of students ranked by their points or scores. It is a good tool of motivating students to earn points regularly because it compares the points of a certain user to the points of other users. Leaderboards are a gamification element that has to be handled carefully, because it can create competition between students [VG14], which may lead to demotivation. For

example, when users find that the disparity between them and the excellent students is so large that they have no chance to get to the top list, they may feel demotivated [SWRM14, WFM+14].

Leaderboard is an element that has social property. If leaderboard can be used properly, it will be useful to increase relatedness and social engagement [KMPW15]. Moreover, an experiment made in [VHC14] has shown that the competition generated by the leaderboard will not only increase interaction among students, but also push the good students to make more effort to be the best.

In MOOCs environment, leaderboards come along with different forms; the difference is which users are included in the list and which are not [SWRM14]. Some common forms are:

- **Global leaderboards**, *"simply show all users of all courses calculating the sum of the achieved points from all courses"*, are easily implemented but have a risk of demotivating users [SWRM14].

- **Relative leaderboards**, *"show only those users that are within a predefined range of points compared to the current user either within a course or a platform context"* [SWRM14]. In other words, relative leaderboards show a number of users above and below the current user based on the current user's ranking. In general, those users are more or less random are not related to the current user. For some users who like to see the challenge ahead of them, relative leaderboard could be meaningless, because it just show the users who are doing the same as they have done.

- **Social leaderboards**, show *"only friends of the current user"*. As the users in the list have relationships with each other, the social leaderboard gains significance and relevance and is considered to be more motivating, because it shows a competition only among friends other than random strangers [SWRM14].

There are still some other types or variants of leaderboards (for example, leaderboards that are global, but take only the points of a particular course into account); in order to avoid possible demotivation, the type of the leaderboard has to be chosen carefully according to the characteristic of MOOCs platform.

5.2.2.4 Progress Bars

Progress bars display how many activities are completed by users and how many yet to be completed, or in other words, indicate the completion rate of a goal or task in a visually appealing way [MD14, GNnB14, WFM+14]. Progress bars give users a way of making a quick visual self-assessment [FdBFM14].

The automatically-generated progress bar of each user is an individual motivation to keep users motivated to engage in a course [GNnB14], which can enhance the attractiveness and effectiveness of learning platform. In fact, the progress bars have already been widely applied on a lot of MOOCs platform such as openHPI and Khan Academy, furthermore, the progress page is one of the most frequently visited page on openHPI platform [WFM+14].

In MOOCs environment, progress bars can be used to display and monitor the users' personal progress throughout the course. Through progress bars the users can view their current progress at any time, and know how many efforts needed to complete the course. The authors of [WFM+14] have shown that *"if there is a defined set of simple steps users can perform to fill the progress bar, it is very likely that they will complete the tasks"*.

5.2.2.5 Levels

Levels are considered as a measure and an indicator of experience of platform and course, and can also represent the reputation (for example, user's expertise in a course subject) of a user [WFM+14]. A long progress can be divided into multiple smaller portions and each portion corresponds to a level. When users complete a portion then they can reach the next level

and every level-up will give users some rewards or at least a psychological reward of accomplishment [WFM+14].

Considering that the length of MOOCs is not short and MOOCs usually require a number of weeks to be completed, *"if the only actual reward is the certificate of participation at the end of the course, that goal might be too far away in the beginning"* [WFM+14]. In this case, courses can be divided into smaller portions and we can use each of the portions to provide temporary and intermediate goals.

In MOOCs environment, diverse levels can be designed to motivate users: a global level based on the total points earned from all the courses, or a local level based on a certain course subject or based on the quality of user's answers in forum. Levels can also be displayed on the user's profile just like badge; on a social platform, this offers a way for users to compare their progress and reputation with other users' [WFM+14].

5.2.2.6 Unlockable Content

Unlockable content refers to content that is only available when something is performed by the user (e.g. gathering enough points or reaching a certain level). It acts as a reward for keeping going ahead and makes the process more interesting because the novel content can bring new challenges or choices whichd will stimulate the user.

In MOOCs environment, unlockable content could be additional features as well as additional learning materials or bonus exercises[20] [Rom13]. We also need to pay attention that due to the openness of MOOCs, these unlockable contents should not be too difficult to be unlocked by most users; otherwise, users will lose motivation to unlock them.

5.2.2.7 Avatars

Avatars are virtual representation of users, which usually represent users with pictures or icons. Generally avatar customization is allowed and this

[20]Extra exercises with bonus for voluntary users.

would create deep emotional attachment between users and their avatars. A bond will be created after the user customizes or decorates his avatar and then avatar could be considered as an extension of himself.

Avatar can be applied with other gamification elements such as points, levels or content unlocking etc. For example, users can unlock new selections of avatar after collecting a number of points[21]; or users can use points to acquire different gadgets such as hats or other items to customize their avatars as shown in [KMPW15].

In MOOCs environment, by adding a selection of avatars (where users choose from a list of pictures or upload picture by themselves) a sense of ownership and deeper attachment to the MOOCs platform will be created, and consequently users will not abandon course readily.

5.2.2.8 Time Limit

A time limit is a concept that ranges from 1 second to various minutes; its basic purpose is to notify the users of how much time is allotted to complete a level or task[22]. Time limit induces tension to a task thus makes the task more challenging; this will give direct incentive to users because users could be stimulated by proper challenges[23].

In MOOCs environment, time limit can be attached to quiz or homework assignment as shown in [KMPW15, WFM+14]. Once a user starts a quiz, it cannot be paused and should be completed within a certain amount of time. When time is up, the quiz will no longer be accessed again. A possible risk of using time limit is the decrease of quiz accuracy, that is to say, when time is nearly running out, the user may make mistakes due to the lack of thinking. So this element should be used carefully.

[21] In the section 5.3.2.1, readers can find that Khan Academy precisely adopts this mode.
[22] Definition extracted from Mario Wiki and Giant Bomb.
[23] See section 3.3.2.

5.2.2.9 Acknowledgement

Acknowledgement is an expression of appreciation for any kind of accomplishment or activity such as watching some instructional videos or completing a quiz; it acts as a short-term motivation and intends to motivate especially those users who desire more confirmation [WFM+14].

In the MOOCs environment, the authors of [WFM+14] have proposed to implement a short text message shown in a dialog as an acknowledgement. This acknowledgement can be shown at any time without rules that users can intuitively understand, which makes acknowledgement more like a surprise when users gain it unexpectedly.

Compared with other rewards such as points and badges, acknowledgement is more flexible [WFM+14]. Look at this case: a user is losing interest or motivation, and also his test scores are decreasing; if MOOCs platform can recognize this impending user dropout, it can notify the user with an acknowledgement (*"Congratulations! Only 15 percent of all users have made it this far - keep going!"*)[24]. When some other rewards are not available in some situations then acknowledgement is a good alternative.

5.2.3 Summary

This section focuses on the theoretical study about the use of gamification on MOOCs platform. The effectiveness of gamification is shown in theory, and it still needs to be tested in practice. So in the next section, I will introduce two gamified MOOCs platform practices: OpenHPI and Khan Academy. Some above-mentioned gamification elements have already been implemented in those two instances; readers can find how gamification is used in practice and what its impact is.

[24]This example is extracted from [WFM+14].

5.3 Two Examples - openHPI and Khan Academy

On some MOOCs platform, gamification has already been implemented to increase user experience and motivation. In order to understand better the current situation of the use of gamification on MOOCs platform, I will present two practices openHPI and Khan Academy in this section[25]. openHPI has already introduced points, progress bar, time limit and avatars to its platform, and some other elements like unlockable contents are being planned to implement in future. Khan Academy uses avatars, progress bars, points, badges and unlockable contents to gamify its platform.

5.3.1 openHPI

openHPI is a platform for MOOCs in the field of Information/Communications Technology and Computer Science. It is launched by the German Hasso Plattner Institute (HPI)[26] in September 2012. openHPI is open to everyone, and everybody can register and enroll in its courses without any costs and prerequisites. Each course is split into six weekly units, and each unit includes learning videos, interactive self-tests, tutorials, practical exercises and homework. When the course is finished, these learning materials are still available to users except the homework and final examinations with deadlines. Learning progress is assessed by self-tests, weekly homework and final examination. Discussion forums are set up each week and are conducted by the teaching team. Moreover, users can create a new collaborative learning group or join an existent group[27].

5.3.1.1 Homepage

The homepage of openHPI is shown in Fig.5.2. After logging in website with an account, user can get access to all the pages of the website such as

[25]edX also introduced progress bar and points to its platform.

[26]Hasso Plattner Institute is a German information technology university college, affiliated to the University of Potsdam and is located in Potsdam-Babelsberg nearby Berlin.

[27]Information derived from openHPI website and Wikipedia-openHPI.

dashboard page, profile page, setting page, or enter course etc.

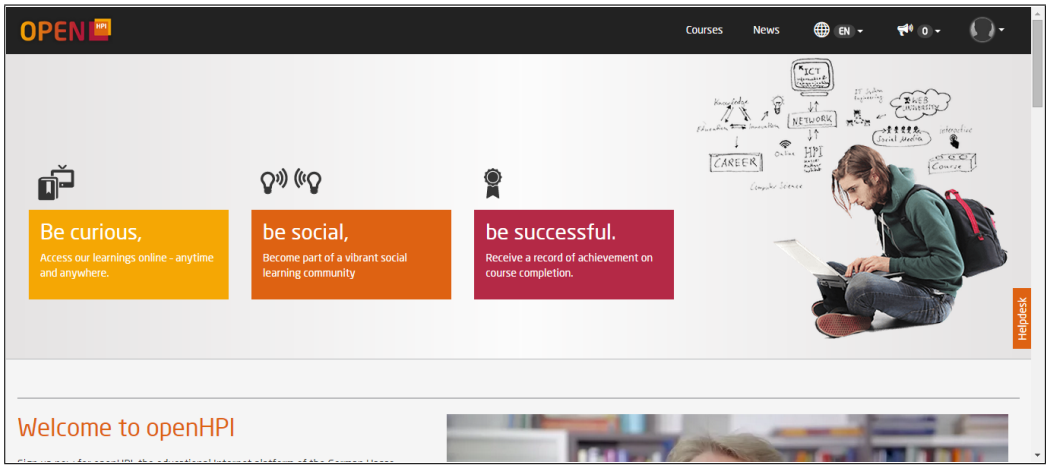


Figure 5.2: Homepage of openHPI

5.3.1.2 Profile page - Avatars

After logging in user can enter the profile page (Fig.5.3) where user can find that a default image is used as avatar. If user clicks this image then he can select a picture from his computer and upload it as his customized avatar; otherwise avatar will stay default as shown in Fig.5.3.

Although openHPI adopts avatars on its platform, from member the list of some collaborative learning group we can find that in practice few people customized their avatars as shown in Fig.5.4 .

This phenomenon indicates that users have few interests in customizing their avatars, which indicates that users are not attracted by avatars. In my opinion, this problem may not be caused by the avatar element but by the mode the avatar is used. The using mode of avatars on openHPI has at least 2 deficiencies:

- The customization of avatars is optional, which implies that avatars are not important, so most users would think it unnecessary to customize them. Most of time, users would prefer to do nothing than to upload a picture. Thus most of the avatars stay default.

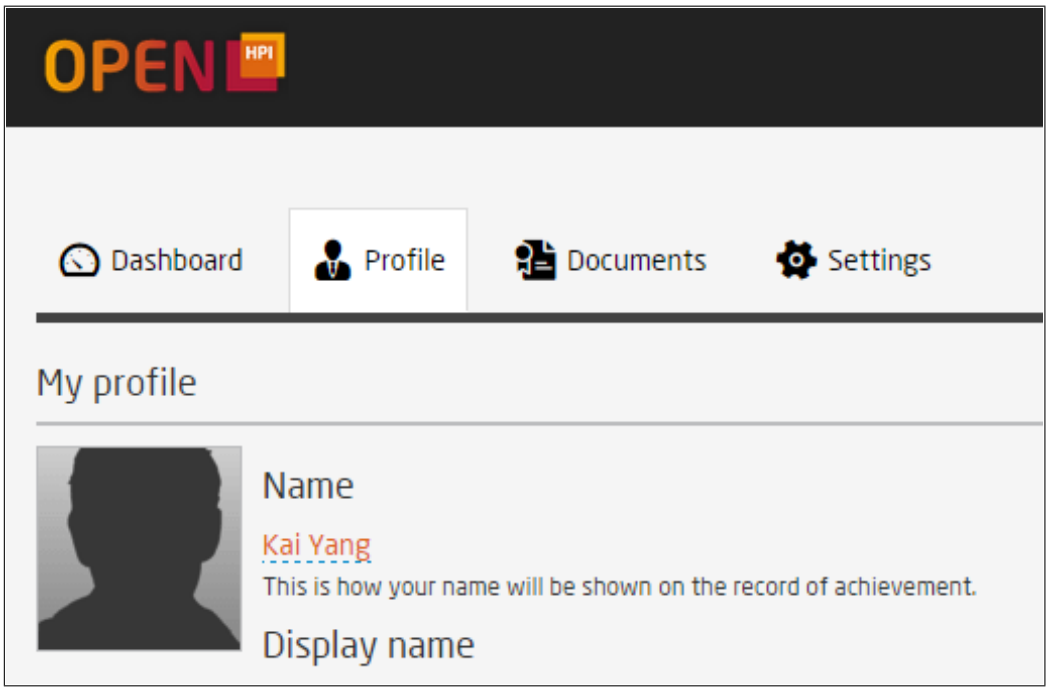


Figure 5.3: User profile page

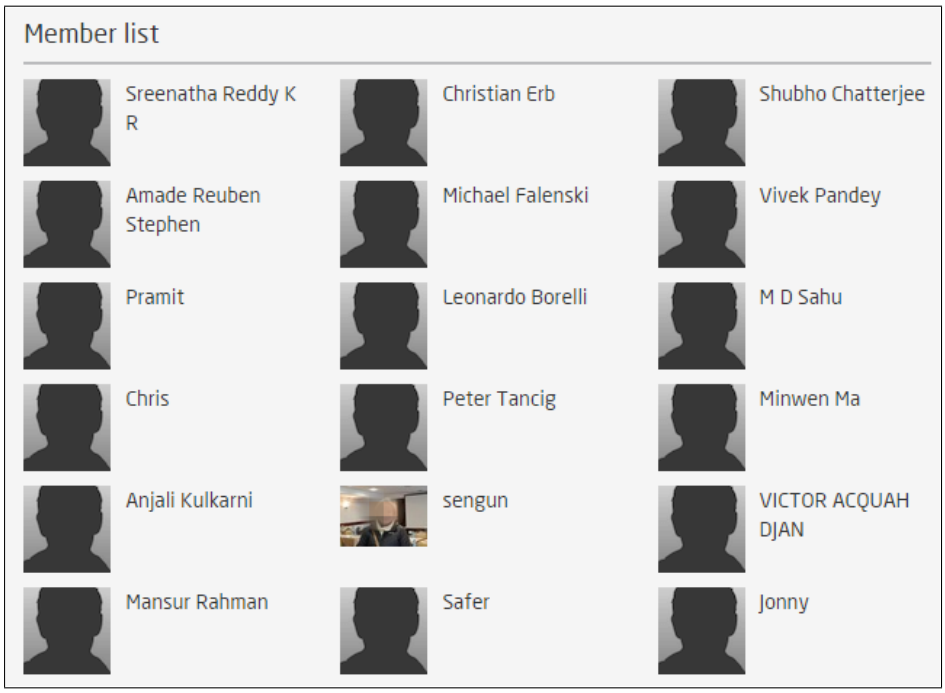


Figure 5.4: Member list of a collaborative learning group

- The avatar used on openHPI isn't interesting at all, because it only acts as a simple representation of users which does not bring any fun to its users.

Therefore, although openHPI introduces avatars to its platform, they do not cause a significant impact. To improve this situation, firstly avatars should be set indispensable and at the same time provide a list to users where they can choose a preferable avatar. Secondly, avatars can be added with long-term incentives, for example, when users reach a higher level they can have some new choices of avatars or when they complete some challenging tasks they can unlock an advanced avatar. In fact, these are exactly what Khan Academy is doing. Readers will see more details in section5.3.2.

5.3.1.3 Course Progress Page - Progress Bars

openHPI progress page is a very characteristic page which contains weekly progress of the course and the progress indicator is appealing as shown in Fig.5.5. In Fig.5.5, there are four categories of course contents in the horizontal direction, and in the vertical direction there are the time units grouped by week. openHPI progress indicator uses diverse icons to represent different course materials, and uses two colors (orange and green) to represent different learning status (a legend can be found in Fig.5.6). Moreover, there are also percent bars for diverse course materials (self-tests and assignments).

When users hover over each icon, the corresponding subject will appear above the icon (see Fig.5.5). By clicking each of these icons, users will get the access to the corresponding detailed page.

Therefore with progress page users can monitor their personal course progress and manage their learning activities easily. In fact, researchers[28] of Hasso Plattner Institute said that progress page *"is one of the most frequently visited page on the openHPI platform"* [WFM+14]. Progress indicator gives a clear learning sequence for completing the course and splits the course

[28] Almost half of the researchers are also the team members of openHPI platform.

contents into smaller parts which user can complete easily, which makes the whole course become not so difficult to be completed and thus gives users incentives to keep learning on the platform.

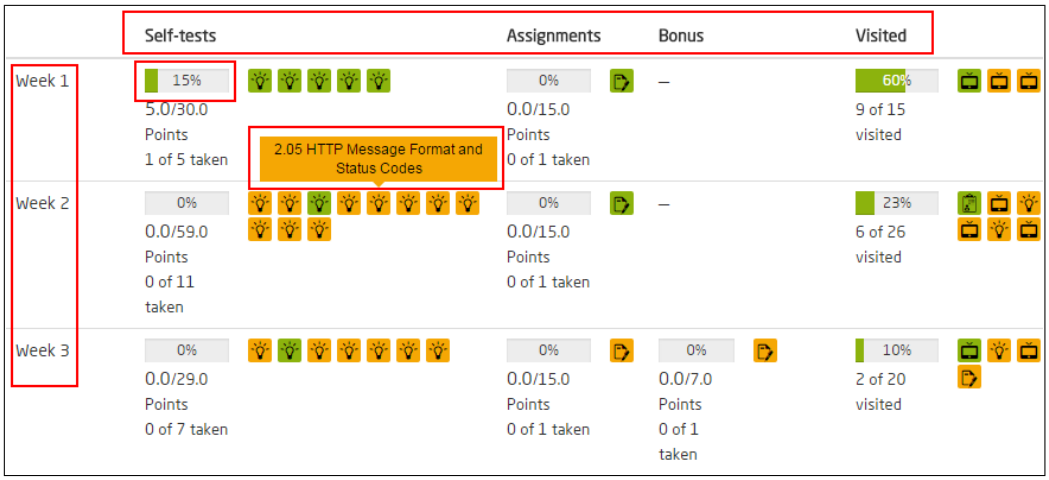


Figure 5.5: A part of progress page

5.3.1.4 Self-tests, Assignments and Bonus Quiz Page - Points

Another widely used gamification element on openHPI is points system, with which users can gain points after completing self-tests, assignment and additional bonus quizzes. Points primarily appear on self-tests page (Fig.5.7) and assignments page, and they are also used on the progress page to show overall scores (see Fig.5.5, under the percent bars).

A self-test contains some questions, each of which is allotted with a certain number of points. Points appear on the right side of the question, and the total points of self-tests are displayed in the "quiz details" area. When users complete all the questions and submit their results, the total points will be calculated and shown automatically by platform (Fig.5.8). Similarly, the assignment and bonus quiz page use the same points system.

Besides, users cannot acquire points by watching instructional video, but how many videos are watched will be recorded by platform and the progress will be shown on the progress page.

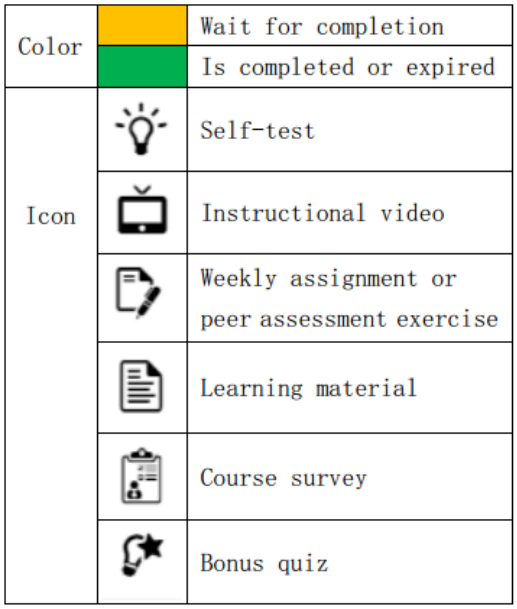


Figure 5.6: Legend of icons and colors

As I have described before, points are considered as a reward, so points can give users some incentives. However, only short-term motivation is far from enough. Points should be used combining with other elements such as badges, levels, progress or leaderboards etc.; otherwise, points will have little effect and significance to users. On openHPI, points are associated with two certificates: record of achievement and confirmation of participation[29].If users meet the requirements of these two documents, they can download their personal certificates as soon as a course is finished. In this mode, points not only act as a frequent short-term reward, but also will bring a long-term benefit. Thus users motivation can be kept during the course progress.

[29] *"User is qualified for a graded Record of Achievement if his score exceeds at least 50% of the overall maximum score from homework assignments and final examination. User can download his Confirmation of Participation if he works through more than 50% of the learning material".* See my course documents on openHPI.

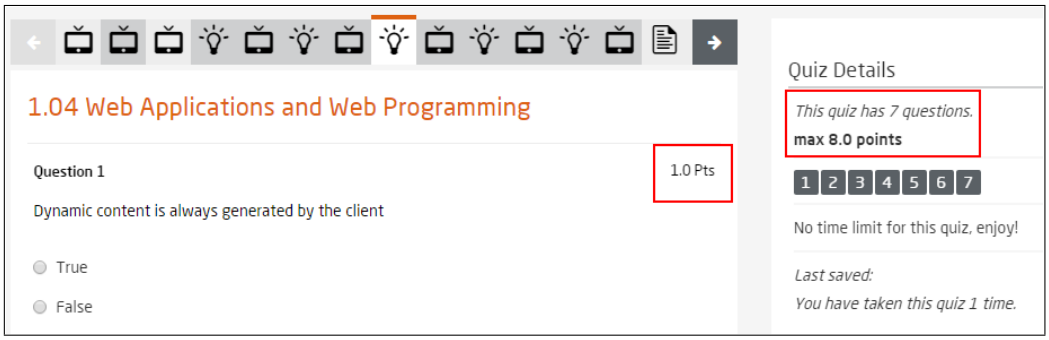


Figure 5.7: Self-test page

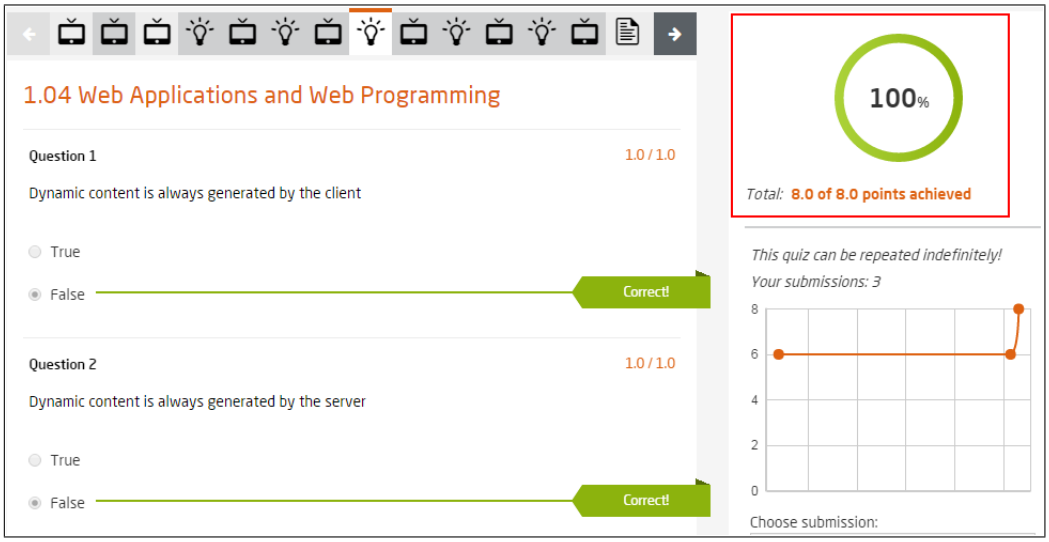


Figure 5.8: Results and total points of a set of self-tests

5.3.1.5 Other Elements and Proposals

Except the above-mentioned elements, another gamification element, time limit, is also implemented on openHPI. Weekly assignments of openHPI are associated with time limit - each of them should be completed before the next Monday and they can only be submitted once. Time limit makes the completion of assignment more challenging. Besides, researchers of HPI have proposed that combining time limit with points - if user submits assignment earlier then he will gain more points. This can make the learning experience more interesting and attractive.

In [WFM+14] researchers of HPI have also proposed to use points to encourage users to be active in the forum and answer questions. For example, when a user asks or answers a question, he will gain some points; moreover, if his answer is accepted by the questioner, he will gain more points. Although researchers have concluded that points are suitable for gamifing forum, in practice this has not been implemented yet.

Other elements such as levels, badges, leaderboards, unlockable contents and acknowledges have also been discussed by the researchers of HPI in [SWRM14, WFM+14], and they have concluded that all these elements are suitable for gamifing openHPI, however, nowadays none of them have been implemented yet.

5.3.1.6 Summary

From the above sections, we can find that the gamification implemented on openHPI has both advantages and disadvantages.

Progress bars and points are two main elements successfully used on openHPI platform. Points make the learning process more attractive by providing short-term incentives and long-term benefit. Progress bars split course contents into smaller parts and give users possibility to monitor learning progress in a clear and interesting way which is useful to keep users learning the course. Both of these two elements make openHPI platform more playful and more fun to use, and thus make positive impact on user experience.

However, the disadvantages are also obvious:

- openHPI are partially gamified and few gamification elements are used on this platform. More elements can be introduced to this platform.
- The implementation of avatars is too simple and the potential of avatars has not been well explored.
- Improvement of social engagement has not been considered. Low participation in forum and collaborative learning group still exists on openHPI platform.

Now, openHPI team are still working to improve the platform for further growth and researchers of HPI have also studied on this matter. Moreover, in [SWRM14, WFM+14] they have already shown the effectiveness of gamification in theory. In the future, more gamification elements will be implemented as a way to raise motivation and improve the learning experience[30].

5.3.2 Khan Academy

Khan Academy is a non-profit educational organization created in 2006 by Salman Khan[31]. It aims to provide *"a free, world-class education for anyone, anywhere"*. All resources are available for free to anyone around the world[32]. There are more than 6000 videos on Khan Academy, and thousands of them are translated into many other languages[33].

Khan Academy offers instructional videos[34], practice exercises, and a personalized learning dashboard that helps users to study at their own pace and monitors all of their data and activities on the platform (e.g. learning progress, badges achieved, projects, questions, answers and comments). It also contains a web based on self-assessment mechanism which generates questions to users based on their skill levels and past performances. Moreover, various tools for teachers are also offered by Khan Academy.

To engage the students, Khan Academy uses external motivators such as points, badges and quests. It also takes the advantage of intrinsic motivators by allowing users to select their own quests which provide a sense of autonomy to the users. And users can know his progress towards the goals by real-time feedback [RTG14].

In 2010 Khan Academy introduced points and badges into the environ-

[30]See "Hasso Plattner Institute: MOOC Learners at openHPI Show a High Success Rate".

[31]See Salman Khan on Wikipedia.

[32]See Khan Academy-about.

[33]See Wikipedia-Khan Academy.

[34]The videos show step-by-step doodles and diagrams on an electronic blackboard. All videos are hosted via YouTube.

ment, and other elements such as avatars, progress bars and unlockable contents are also used to promote gamification of learning. Now Khan Academy is a typical gamified MOOCs platform because it is *"full of game mechanics"* [MD14].

5.3.2.1 Welcome Page - Avatars and Unlockable Contents

Although people can access course contents and learning materials on Khan Academy even without creating accounts, users are suggested to log into website with a personal account, otherwise they can't save their progress or accumulate points.

User needs to select an avatar[35] from a given list if this is his first time to log into Khan Academy. At the beginning most of the avatars are locked and only three types of avatars are available (Fig.5.9). Locked avatars can be unlocked when relevant conditions are met (e.g. earning a certain number of points or completing a certain task). User can preview the avatar by clicking it. From avatar's preview page (Fig.5.10) we can find that each avatar has various styles, and only the basic style is available at the start and other styles need to be unlocked by earning points or completing task. Moreover, user can also select a background for his avatar; the same as "style", most backgrounds are unlockable. When user hovers over avatars or backgrounds, he can see how these elements can be unlocked (Fig.5.9, Fig.5.10).

Compared with openHPI, Khan Academy uses a more complete avatars system which combines avatars, points and unlockable contents together (cumulative points can unlock new avatars) which makes the learning process more playful and interesting. From the discussion area (many users discuss together, so it is easy to find many avatars for analysis), I found that a lot of users were using the unlocked avatars which were not the initial three

[35] On Khan Academy, *"avatars are the icons used to identify Khan Academy users. Different avatars are available at different energy point levels from Leaf avatars at 0 energy points to others at 250,000 energy points, or by mastering/finishing math tasks"*. See Khan Academy Wiki-Avatar.

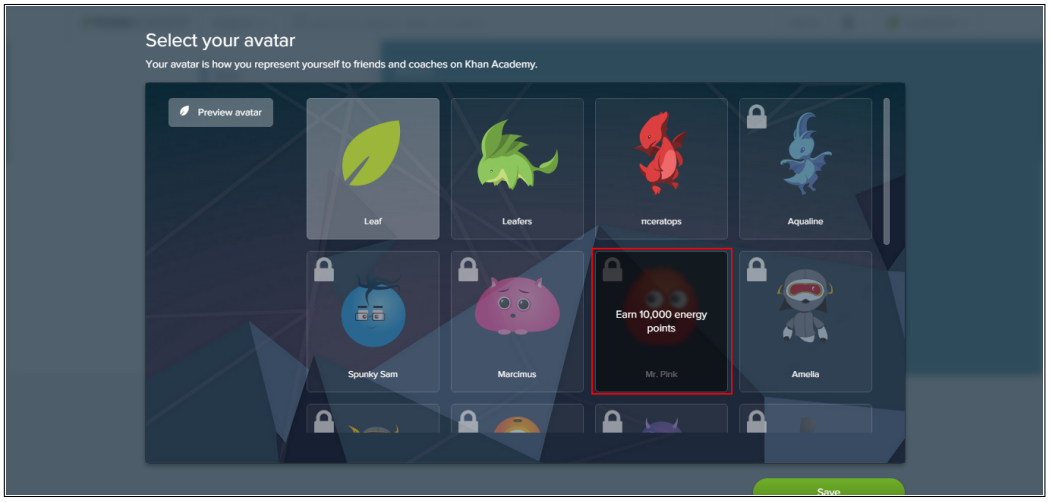


Figure 5.9: All avatars

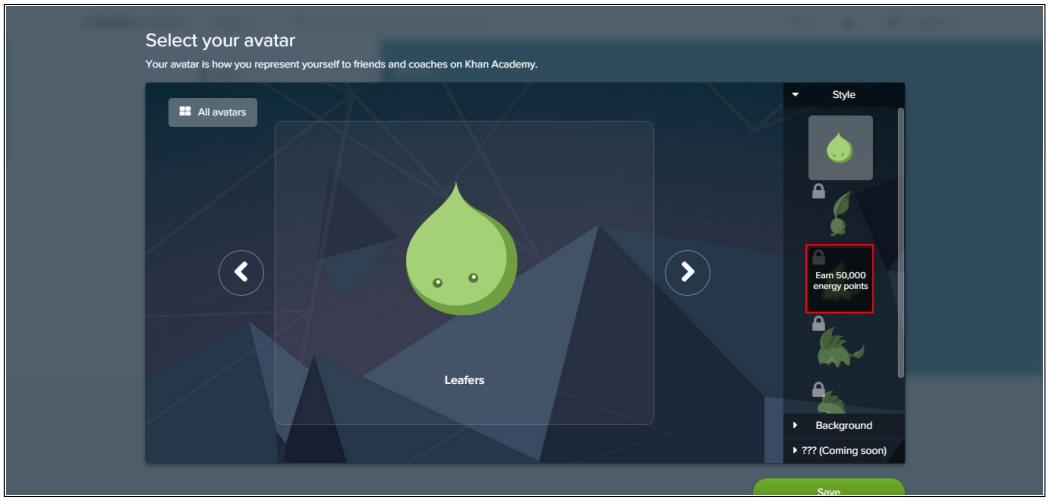


Figure 5.10: Previewing avatars

avatars mentioned above. This means avatars are popular among users and users attach much importance to them.

5.3.2.2 Lecture Videos, Practice Exercises Page - Energy Points

Energy points are an incentive on Khan Academy, which will be given to the users during and after their watching lecture videos(Fig.5.11), completing practice exercises, completing skills, completing programming challenges and some other tasks. When the user hovers over the name of someone who has made some comments or goes to his "user profile page", he can see the total earned points of the one who has made comments[36].

Figure 5.11: An example of energy points

Different from openHPI, Khan Academy does not provide any certificate, so points has no correlation with scores. If points system has no deeper meaningful connection with users, then just earning points is not enough to motivate the users to learn [MD14]. Khan Academy combines energy points with avatars and badges. Most avatars and a variety of badges can only

[36]See Khan Academy Wiki-Energy Points.

be unlocked when the user earns a certain number of points. In this case, avatars and badges act as a further reward which gives the user a long-term goal to keep active in accumulating points persistently.

5.3.2.3 Badges Page - Badges

Khan Academy implemented a powerful and attractive badges system. The badges represent the achievement of different levels. They appear in the user's profile (Fig.5.13) and can be shared through Facebook and Twitter. There are 6 different types of badges (Fig.5.12) and the total number of badges is more than 200[37]. Users can find all the badges as well as how to earn them on the badges page (Fig.5.12). Some of them are common and easy to earn[38], and some are rare and difficult to earn[39]). These badges cover all kinds of courses and activities on Khan Academy, and are well designed to meet different users' needs.

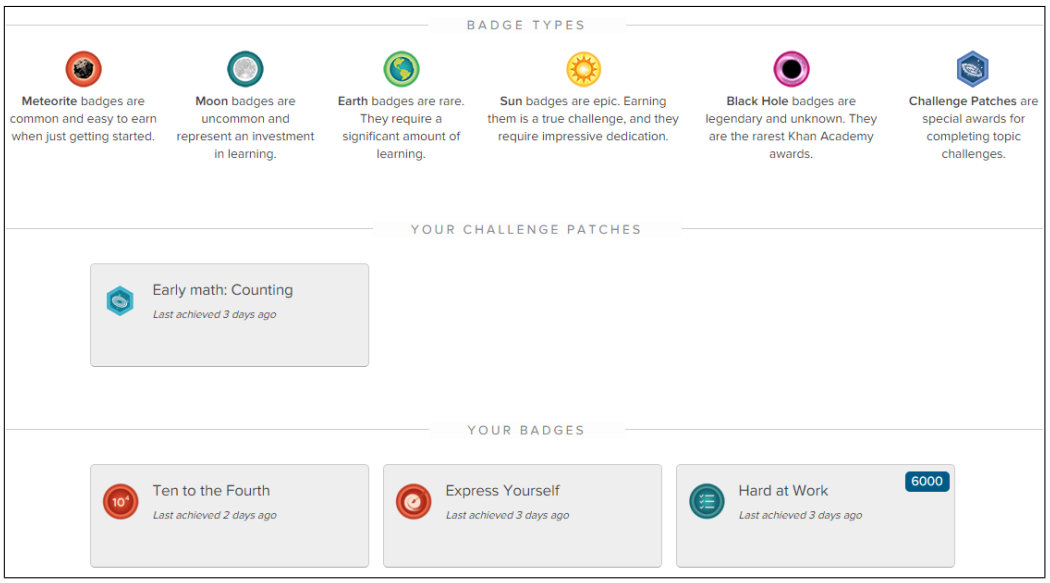


Figure 5.12: Badges page

[37]See Bages page of Khan Academy.

[38]E.g. when completing a practice task user can get a badge named "Makes Perfect".

[39]E.g. for earning a badge named "Da Vinci" user should achieve mastery in 500 unique skills.

In the next section, I will describe how avatars, points and badges are used together on Khan Academy.

5.3.2.4 Profile Page - Avatars, Points and Badges

Khan Academy successfully combined avatars, points, badges and unlockable contests together. On the user profile page, we can find that the user's avatar, total earned points and all achieved badges are displayed on the top bar[40] (Fig.5.13). In fact, avatars, points and badges often appear together on Khan Academy. For example, when the user hovers over the name of someone who has made comments, a popup will appear with these three elements (Fig.5.14).

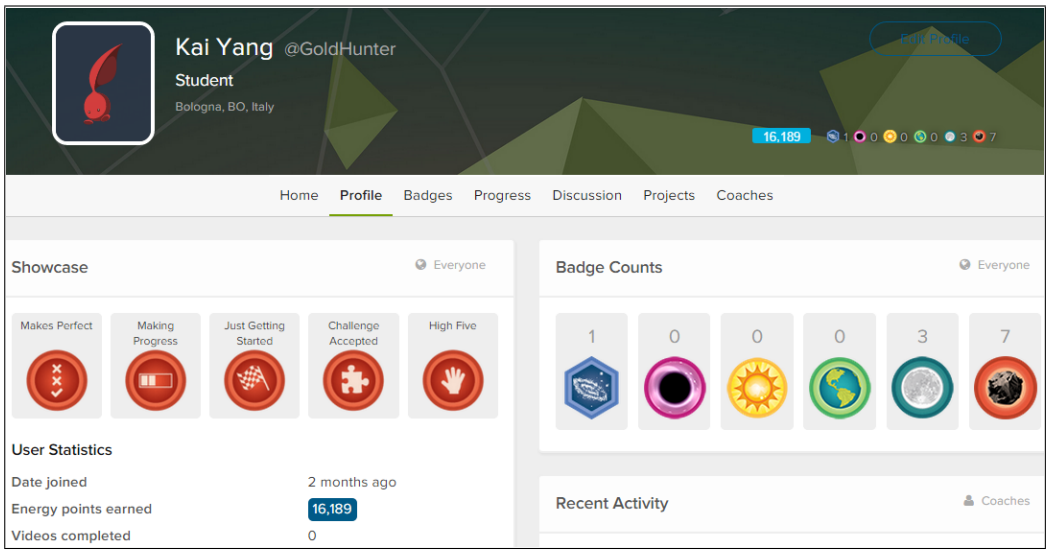


Figure 5.13: Profile page

The combination of these three elements acts as an agent of user's reputation and status, and on a highly social platform the fact that it may

[40]This bar appears also on other pages such as progress page, badges page or projects page etc. The only shortage of this bar is the icons of badges and points are too small. As I described in section5.2.2.2, if badges are made more salient, then user motivation will increase more significantly. So in order to amplify the impact of points and badges, I suggest enlarging these icons.

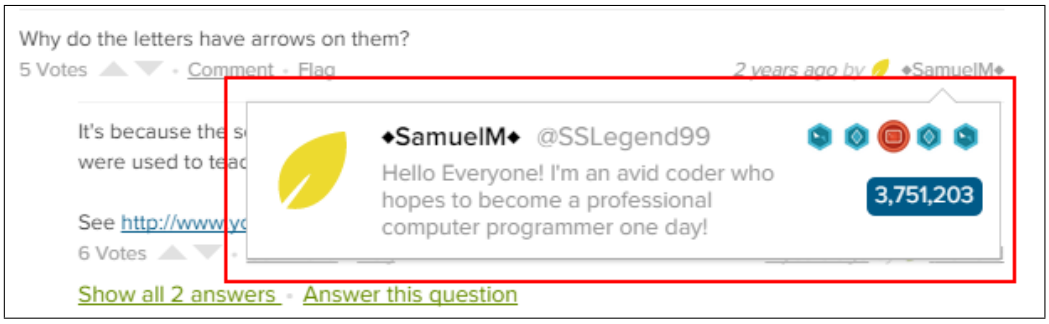


Figure 5.14: Viewing user profile

be viewed by others on the users' profile involves a competition between users[GNnB14]. Moreover, the frequent appearance of these three elements highlights the importance of the three elements. Motivational theory suggests that if one believes the importance of acting in certain ways, then he will act according to his beliefs [MD14]. Therefore, emphasizing the importance of the three elements is useful to motivate users to make more effects to earn points and badges and unlock higher avatars.

Besides, on user profile page, we can also see badge accounts on the right side under the top bar[41] (Fig.5.13). Since users may earn many badges, and it's not possible to show them all at once, so Khan Academy uses a showcase on the left side to show 5 most valuable badges selected by users (Fig.5.13). Users would also express strong interest in this badges showcase, because it is a main window used to show users' most valuable badges to others, and these badges represent users' highest reputations.

5.3.2.5 Progress Page - Progress Bars

Khan Academy provides 4 powerful progress indicators to show different types of progress information to its users. The 4 progress indicators display skill progression, watched videos, performed activities, and focus information to users.

[41] In addition, the number of total earned energy points appears on the left side along with the number of the completed videos.

A bar indicator is used to display how many skills have been attained and how many have yet to be attained (Fig.5.15). Watched videos and the amount of time spent on watching videos each day are displayed in a list ordered by time (Fig.5.16). A bar graph is used to indicate performed activities and the amount of earned energy points within a specific time period (Fig.5.17). Focus information is displayed through circle graph (Fig.5.18). There are two circle graphs, one for videos and another for skills. The graphs display the amount of time spent on different skill areas and videos for selected time units (past 24 hours, past week, past month, etc.).

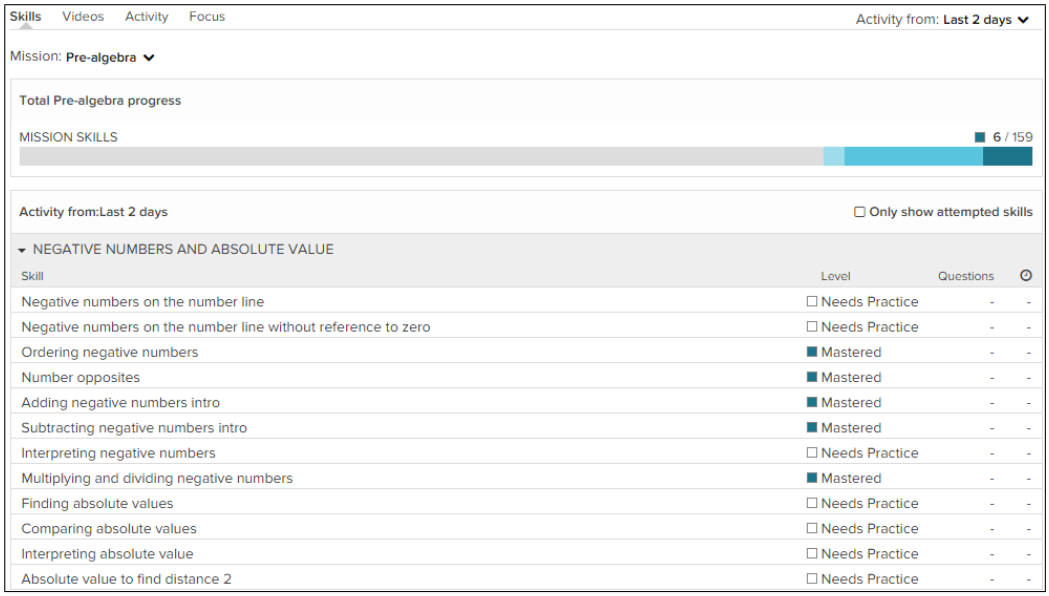


Figure 5.15: Skill progress bar

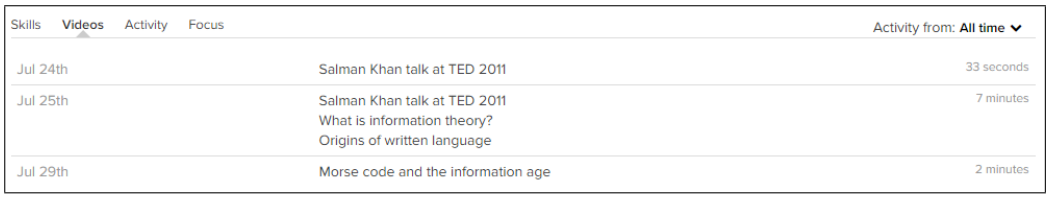


Figure 5.16: Videos list

Different from openHPI, Khan Academy not only shows simple progress

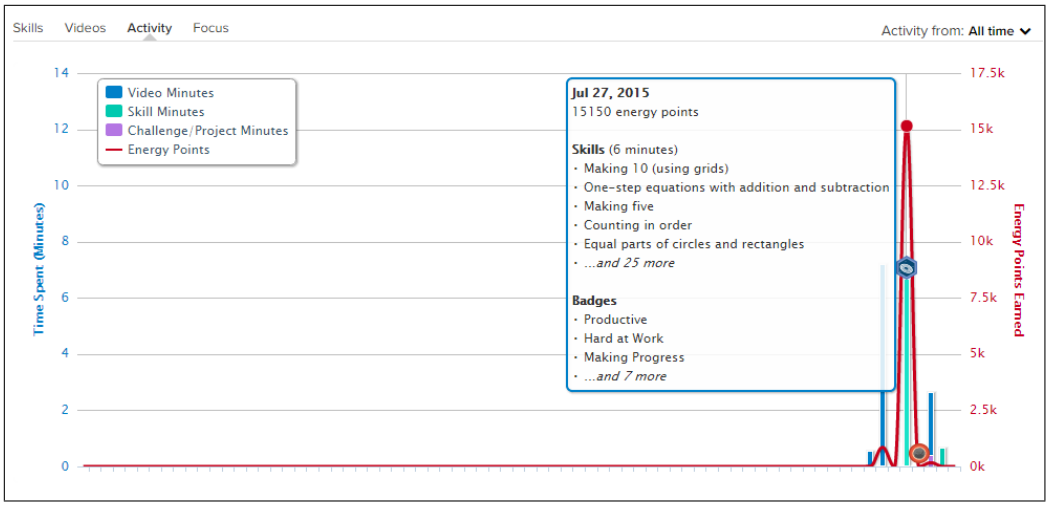


Figure 5.17: Activities bar graph

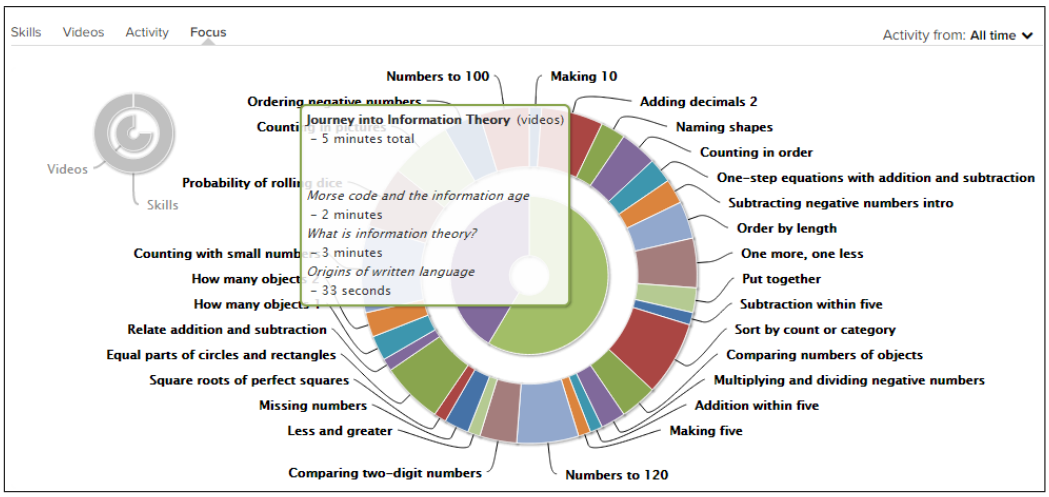


Figure 5.18: Focus cycle graph

information, but also makes statistics about user's accomplishments. Users should feel pride in their accomplishments, because from accomplishments users know they have completed or mastered the skills. The sense of pride will provide internal motivation to users (the sense of pride satisfy the need of competence) [MD14] which will increase user engagement. Moreover, [MD14] proposed that showing accomplishments to others will also motivate users and increase users' external motivation, because this demonstrates to others that they are competitive and skillful. However, it is difficult to share accomplishments with other users on Khan Academy, which limits the increase of external motivation.

5.3.2.6 Mission Page - Quests, Progress and Goal

Quests are the tasks that players may complete in order to gain a reward[42]. A quest gives a player the direction of what can be done or what they should do in a gamified system. A clear quest can give guidance to players and help to keep players engaged[43].

On Khan Academy quest is implemented in the form of "mission"[44] (Fig.5.19). Each mission contains a set of skills to be mastered and related specific instructions on how to attain these skills. Users can also choose some skills from a skill list and add them into the mission. Each skill may take a few minutes or hours to complete, while a whole mission may take several days or weeks to complete. Therefore, mission can be considered as a long-term goal while skill be considered as a short-term goal which is easy to understand and can be readily achieved. When a skill is mastered, the user will earn a set of points. Since specific short-term goals can enhance motivation well [MD14], the use of skill will make learning process more motivational.

Moreover, Khan Academy also provides a mission progress (Fig.5.19) to

[42]See Wikipedia-Quests.

[43]See Enterprise Gamification-Mission.

[44]Now on Khan Academy mission is implemented only on the topics of math.

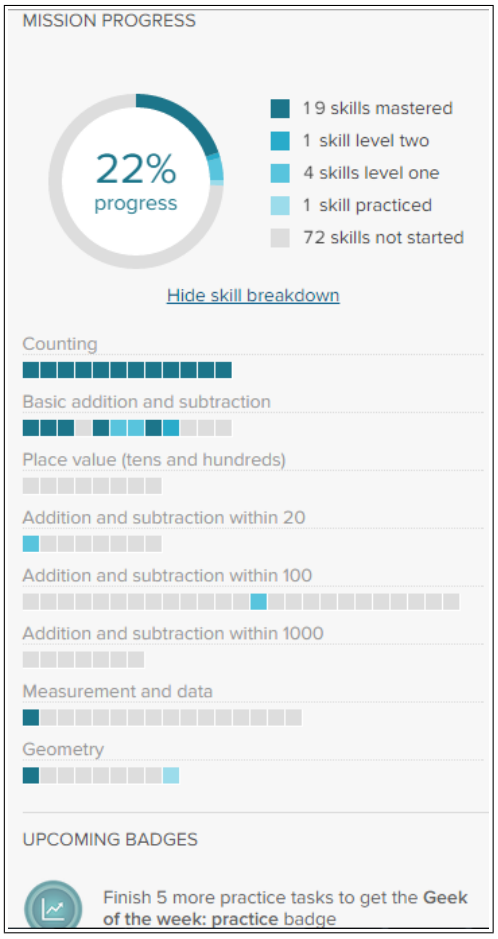


Figure 5.19: Mission progress

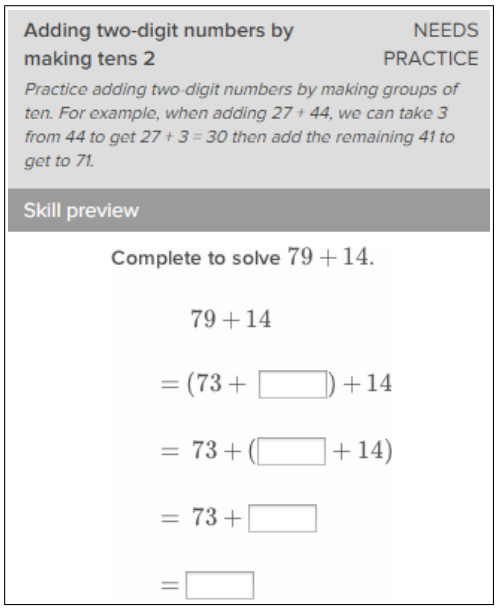


Figure 5.20: Skill preview

monitor how many skills are mastered and how many have yet to be attained to complete the whole mission. Further, users can find out which type of practice exercise set is going to be presented from skill preview (Fig.5.20). With mission progress and skill preview users can estimate approximately how much effort is required and how much time it will take to complete the mission. This self-evaluation of the effort needed to attain goals is also important and effective in increasing motivation [MD14].

Though short-term goals are important, making long-term goals salient is also valuable in motivation. People will be more willing to take energy on a more difficult goal than on an easy one [MD14]. Noticing the goal difficulty is

useful to make a goal apparent. Despite the difficulty of mission is reflected on Khan Academy, it's far from enough. Therefore, to increase better user motivation, it's proposed that *"allowing 'level testing' to move through lower level achievements quickly"* And *"this will serve as a formative assessment to gauge where participants should start for challenging yet achievable levels"* [MD14].

5.3.2.7 Summary

In this section I have introduced how Khan Academy has incorporated gaming elements into its platform. We can find that Khan Academy has implemented a relatively complete gamified system. However, some critics argue that Khan Academy's videos and software *"encourage uncreative, repetitive drilling - and leave kids staring at screens instead of interacting with real live teachers"* [Tho11].

Despite these criticisms, Khan Academy has become extremely popular. As of February 2014, Khan Academy has over 10 million unique visitors per month [MGK+14]. Moreover, a number of schools use Khan Academy as a supplemental educational resource to support teacher-led whole-class instruction or to facilitate small-group instruction[Tho11, MGK+14]. 71% of the students reported that they enjoyed using Khan Academy and students' engagement level was generally high [MGK+14]. And some teachers were surprised by how powerfully the rewards motivated their students [Tho11].

It is clear that Khan Academy motivated users to study on the website and successfully helped them to master skills of different subjects [Tho11, MGK+14]. Since I cannot get access to its user data of Khan Academy, I cannot definitively state that all these effects are caused by the game elements. However, from the teachers' and students' feedback in [Tho11, MGK+14] I can conclude that at least a number of students are motivated exactly by the game elements.

Although Khan Academy is popular, it also has the problem of lack of social connection. As I introduced before, users can share a single badge

to Facebook and Twitter, but they cannot share their accomplishment with others. A user is a solitary unit within Khan Academy who cannot establish direct social relation with others. Thus there are no direct social comparisons between users.

In order to increase social comparisons, [MD14] proposed that *"showing your progress against others in your class/cohort and the amount of time each spent studying, completing level"*, that is to say, implementing a leaderboard. Some other researchers like [KMPW15, SWRM14, VHC14] have also proposed that; meanwhile, a number of users also expressed their desire to use leaderboard to Khan Academy team[45]. Khan Academy may provide better and more long-term impact on motivation by expanding the social aspects of gamification elements.

5.4 Conclusions

In this chapter, I introduced related notions of MOOCs and the problems faced by xMOOCs. In order to solve the problems, gamification elements are introduced to motivate users. Although there are many researches and experiments on this topic, from both openHPI and Khan Academy practices we can find that there is a gap between the theoretical researches and the practices. Some elements proposed in researches [SWRM14, WFM+14, FdBFM14, MTB+14] are not implemented or tested yet in practice, and the element - quests used on Khan Academy is not mentioned in the literatures about gamification of MOOCs.

Besides, few experiments are made based on a real MOOCs platform with massive participants. Though Khan Academy has successfully improved user engagement in practice, we can't definitely state that the effect is caused only by game elements due to the lack of experimental validation and quantitative analysis of this system. However, from the teachers' and students' positive feedback on game elements we can affirm that in any case gamification is

[45]See help center of Khan Academy.

useful to improve user motivation in practice.

From both academic researches and practical MOOCs platforms, we can also find that the use of game elements on MOOCs is mostly applied in the outcomes, including points, badges or progress, but the learning process is treated as a separate portion of the experience. If learning process is also gamified, the experience could be more playful and motivational. Of course, gamifing learning process will be more challenging. Since gamification acts as a tool, it can be used in many different ways by the users and not necessarily limited to the ways mentioned above.

Chapter 6

Conclusions

This thesis has introduced gamification-related concepts, framework and how to use gamification to increase retention rate on MOOCs platform.

Gamification uses game design elements to redesign system, service and activity. Since game elements are matched with motivational mechanisms, thus a good gamified system also has motivational property like games. Thanks to the motivational property, gamification is considered as a powerful tool to motivate users in various domains. And the effectiveness of motivating user and improving user engagement has already been demonstrated by both the theoretical studies and the practical applications.

In a gamified system, the improvement of user engagement is achieved by fostering both extrinsic motivation and intrinsic motivation. However, we should realize that the abuse of rewards will cause harm to an enjoyable and motivational user experience, because an improper use of extrinsic motivation will decrease user's intrinsic motivation. In some sense, we should pay more attention to the fostering of intrinsic motivation, because it can influence user internally and improve user engagement for a long time. According to self-determination theory, to foster intrinsic motivation, gamification should satisfy the three basic psychological needs - autonomy, competence and relatedness.

The gamification framework proposed by Kevin Werbach and Dan Hunter

provides us the guideline to gamify a system. The desired aesthetics of gamification can be achieved by unifying components, mechanics and dynamics properly. However, there is not a common template of gamification which can fit all different contexts and users, so the game elements used to gamify a certain system should be selected wisely based on the consideration of specific context and target users.

Gamification is mostly used in education and learning field and it's proposed that gamification can be used to solve the problem of high drop-out rate on MOOCs platform. The effectiveness of gamification in decreasing drop-out rate on MOOCs platform is validated by theoretical researches and empirical experiments. Devious solutions are proposed by literatures, and different game elements are selected to gamify MOOCs platform.

In practice, openHPI and Khan Academy have implemented gamification on their platform and the gameful design is well liked by learners. However, quantitative researches of the influence of gamification on a real MOOCs platform with large number of participants are lacking.

As gamification is used as a tool and is still in the process of development, the pattern of using gamification on MOOCs platform or in other fields is not invariable, and game elements can be selected and used flexibly and can also be removed due to the actual need.

Besides, gamification is also widely used in common e-learning course and in traditional classroom. This is also an interesting topic which deserves to be explored deeply, however, due to the limitation of time, this topic isn't discussed in this thesis.

To make a conclusion, this thesis makes a thorough analysis on the current studies on gamification and deeply explores the application of gamification on MOOCs. As the development of gamification, more applications of it will arise in practice which needs further studies.

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