

# Proposing a Theory of Gamification Effectiveness

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## ABSTRACT

Gamification informally refers to making a system more game-like. More specifically, gamification denotes applying game mechanics to a non-game system. We theorize that gamification success depends on the game mechanics employed and their effects on user motivation and immersion. The proposed theory may be tested using an experiment or questionnaire study.

## Categories and Subject Descriptors

D.2.0, D.2.10 [Software Engineering]: General; Design.

## General Terms

Management, Design, Human Factors.

## Keywords

Gamification, Motivation, Psychology, Theory-Building.

## 1. INTRODUCTION

*Gamification* is “the use of game design elements in non-game contexts” [5] to make systems or processes “more fun and engaging” [20]. Gamification has attracted much attention among practitioners and in the media but little rigorous research. Specifically, little research has addressed how and why some gamification initiatives succeed while others fail.

In practice, gamification is closely related to software engineering (SE). Many of the systems we attempt to gamify are predominantly software (e.g. web or mobile apps) [20]. When we gamify physical processes, we develop software to implement game mechanics (e.g. points, leaderboards) [12]. Software development and management tools have been gamified. For example, RedCritic Tracker uses game mechanics including badges to reward developers for good work while Stack Overflow uses game mechanics to reward experts for answering questions.

## 2. RELATED WORK

Software developer motivation is an important antecedent of productivity and software quality, but is often marginalized in SE research [2, 14]. Developer motivation may be divided into intrinsic motivation (internal to the work) and extrinsic motivation (external factors which affect the work) [6].

In motivational psychology more generally, Self Determination Theory (SDT) suggests that intrinsic motivation more effectively

increases engagement and performance than extrinsic motivation. [17]. Intrinsic motivation is associated with *flow*, the mental state where an individual experiences high levels of focus, energy enjoyment and absorption in an activity [3]. Flow is also a sign of successful game design [18].

## 3. GAMIFICATION EFFECTIVENESS THEORY

Based on our research into motivation, digital games and gamification, we propose a framework for understanding gamification effectiveness (Figure 1). The framework suggests that gamification is effective to the extent that the gamified system is used, contributed to any explicit goals of the system and contributes to the goals of its users. The framework posits four main drivers of effectiveness: intrinsic and extrinsic motivation, game mechanics and immersive dynamics.

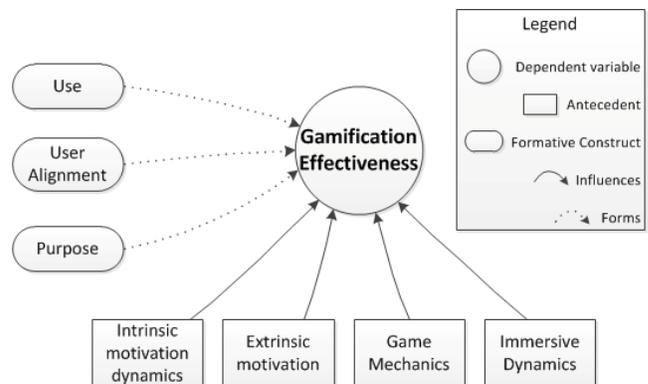


Figure 1: Gamification Effectiveness Theory

### 3.1. Formative Constructs

Here, gamification effectiveness is modeled as a multidimensional construct and *formative* constructs refer to its dimensions.

Use is defined as the consumption of a system output [4]. To engage effectively with the gamified system, the software developer must receive and process feedback, e.g., reports given to the user after certain inputs. Poor feedback can lead to reductions in user participation and even failure of a gamification platform [19].

If the system has an explicit purpose, gamifying it is effective to the extent that it contributes to this purpose. For example, FoldIt was developed to help research protein structure prediction. This was effectively embedded within the system by representing protein structures as puzzles [9]. Gamifying FoldIt was effective as it led to more compelling discoveries related to protein folding.

User alignment is defined as the process of aligning the purpose of the gamified system with the goals of the user. For example, SPARX is digital game developed to treating clinical depression

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ICSE'14, May 31 – June 7, 2014, Hyderabad, India

in adolescents. Initial studies demonstrated that SPARX is just as effective as conventional therapy for treating depression (purpose). SPARX also exhibits user alignment – its users desire a the reduction in depression symptoms that it provides [11].

### 3.2. Antecedents

Here, antecedents are the factors that cause gamification effectiveness. Antecedents may be organized in many different ways (e.g. at different levels of abstraction). The proposed framework, however, posits four main antecedents of effective gamification – intrinsic motivation dynamics, extrinsic motivators, game mechanics and immersive dynamics.

Intrinsic motivation depends on feelings of autonomy, competence and relatedness [16, 17]. Suppose we were gamifying the software development process. Autonomy for software developers has been cited by several researchers as a vital factor for developer motivation [5, 5]. Autonomy can be realized by allowing developers to choose their own tools and self-assign tasks [1, 18]. Meanwhile, we can support competence by providing developers with challenging work and encouraging further training and relatedness by encouraging communication and collaboration within teams, as in daily stand-up meetings [10].

Meanwhile, digital games employ numerous extrinsic motivators including points, levels, badges or trophies. We can link in-game extrinsic motivators to developers' real-world extrinsic motivators by, for example, but giving tangible prizes to developers who receive virtual trophies. However an over reliance on extrinsic motivators may decrease performance [13].

Game mechanics, including space, objects, actions, rules and skills, are the core of a game [18]. Space is defined as 'the play area' – be it physical, virtual or both. Objects are the tools used by the player. Actions are ways of interacting with objects within the game space. Rules are laws that govern the space. Skills are a set of abilities required by the player to fulfill an objective. As gamification entails the addition of game mechanics, gamification effectiveness depends on the effectiveness of these mechanics.

Immersive dynamics are factors that affect the player's immersion in the gamified system or activity. Two examples are story and aesthetics [9, 15]. Aesthetics refers to the emotions engendered in a player by a system [9] while story refers to a narration of the player's progress [8].

## 4. CONCLUSION

Gamification is an emerging phenomenon that is receiving increasing attention from both practitioners and researchers. However, little theoretical or empirical research has investigated how or why gamification works. We therefore propose a theory of gamification effectiveness, based on existing research on motivational psychology and digital game design. This theory posits that gamification is effective when it contributes to system use and to the purposes of the system and user. It further suggests that effectiveness is driven by intrinsic and extrinsic motivation, game mechanics and immersive dynamics. Of course, the proposed theory needs empirical testing to determine its veracity. Future work may therefore include experimental or questionnaire-based evaluations.

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