

Work-in-Progress: What Motivators Matter When Gamifying a Learning Activity

Christo Dichev
Dept. of Computer Science
Winston-Salem State University
Winston Salem, NC, USA
dichevc@wssu.edu

Darina Dicheva
Dept. of Computer Science
Winston-Salem State University
Winston Salem, NC, USA
dichevad@wssu.edu

Abstract—Although gamification is defined as using game design elements in a non-game context, the main gamification research is focused on the motivational effect of game design elements with less attention to the impact of the “non-game context”. We argue that it is difficult to achieve deeper understanding of how educational gamification may engage or not engage learners by focusing only on the effect of the incorporated game elements, without considering its interaction with motivational drivers engendered from the learning activity. In this paper we report a preliminary study aimed at collecting empirical evidence on how a learner’s responsiveness to gamified learning is impacted by their motivational forces towards the learning activity. Specifically, we experiment with the Expectancy-Value-Cost Scale as an instrument for estimating the potential motivational drivers towards a gamified learning activity.

Keywords— *gamification, learning, motivation, EVC scale*

I. INTRODUCTION

Gamification, the use of game design elements in non-game contexts, is becoming widely used in education to enhance learner engagement, motivation, and performance [1]. While carrying a big promise, little is known about how learners’ motivational drivers towards the gamified activity may impact their engagement. Typically, the reason behind gamifying an activity is that the learners’ motivation to engage in it is low and gamification is seen as a way to strengthen it. However, learners are commonly motivated by a combination of motives. Considering the combined impact of such motives could help in unraveling the potentials of gamification interventions [2].

The theory-based gamification research typically refers to Self-Determination Theory [3] with a focus on motivational affordances promoting autonomy, competence and relatedness. However, learners are not always intrinsically motivated to learn. Their view of gamified activities is colored by their goals, self-efficacy, and personal constraints. While gamification can rise the value of a learning activity, there are other motivational drivers that influence learners’ engagement. In particular, the motivation to choose and engage in a gamified activity depends upon its perceived value and the effort for such engagement. Hence, methods that can make the decisions for gamifying learning activities more methodical and systematic are needed. Such decisions involve various choices, including what activity to gamify, what motivators need boosting and how to do that.

Currently, many gamification-related decisions are made under a significant level of uncertainty. For example, the

decision on the game element selection may raise the question if the selected motivational affordances are suitable and sufficient to achieve the desired level of motivation for engaging in the activity. Approaching this question with a lesser degree of uncertainty suggests an ability to estimate the level of learners’ motivational drivers stemming from the activity. Graded learning activities, such as assignments, projects, and exams are meant to evaluate learners’ knowledge and the effort put into the learning process. Non-graded learning activities are provided to aid learners and are frequently meant to help them prepare for the graded activities. Students’ engagement in required activities is driven by a complex dynamics where the current grading system plays a critical role. Gamified or not gamified, students will engage in such activities if they strive to succeed. In contrast, triggering and sustaining engagement in optional (non-graded) activities is challenging. Students’ engagement with optional learning activities is generally low. It is known that most learners dedicate almost no time to non-graded activities and in many cases, they do not even attempt them. Furthermore, engagement with a non-graded learning activity usually declines as the activity progresses. Interestingly, van Roy, et al [4] found that gamification can have a motivational effect when there is sufficient pre-existing motivation to engage in the activity. This implies the need of instruments to measure that motivation and estimate its quality and level. Such measures can contribute to estimating what motivational affordances can reinforce the experienced low motivational drivers to a level that engenders the desired level of engagement and whether this goal is feasible.

One possible way to measure the quality and level of motivation is through instruments developed within the Expectancy Value theory, such as the Expectancy-Value-Cost Scale (EVC) [5]. EVC measures three types of motivators: expectancy, value, and cost. Knowing these measures would allow to estimate not only the initial level of motivation towards an activity, but also the direction and degree of needed motivational reinforcement. Technically, availability of such information would allow reaching more informed answers to questions such as “Is this activity suitable for gamification?” or “Which motivational factors need to be strengthened most?”.

We believe that knowing learners’ motivational drivers to a learning activity is critical in designing effective gamification. This led us to conduct a study using the EVC scale as an instrument for estimating the motivational drivers for a learning activity that can make the targeted effects of its gamifying more predictable. The focus is on optional learning activities as they are typically in need of extra motivational boosters.

II. BACKGROUND

Although gamification is defined as using game design elements in non-game context [1], the focus of gamification research is centered on the motivational effect of game design elements with less attention to the impact of the “non-game context”, which in the case of gamified learning is typically a learning activity. There are two necessary conditions that must be met for achieving the motivational benefits of gamifying an activity: 1) Learners should be willing to take part in the learning activity and invest the required efforts; 2) Learners must be motivated to pursue the goals suggested by the rules shaping the gamification experience. These conditions suggest that for estimating the potential success of gamifying an activity it is useful to know learners “willingness” to take part in the activity. The attention so far has been focused on studying how to boost motivation by incorporating appropriate game elements. Less attention has been paid on studying the potential impact of motivational drivers engendered by the learning activity, such as expectancy for success, task value, and cost on learners’ engagement. However, if these drivers are too weak, they can act as demotivators for engaging which may hinder the potential effect of gamification. For example, if a learner considers an activity of low importance and with little expectations for a successful outcome, the likelihood of deciding to engage in a gamified version of the activity might be slim.

The Expectancy-Value-Cost scale of student motivation provides a scientific lens for examining motivational enablers and barriers to successful gamification. The current educational system cultivates a grade-oriented mindset. The result is that most students are extrinsically motivated by grades. This type of students is more interested in grades than mastery of the material and is pragmatic about the expended efforts. From the lens of the EVC theory, activities that are graded and count towards the course grade are perceived of greater value [6]. In contrast, the non-graded activities are perceived as less useful. Hence, non-graded activities need motivational affordances that are motivating for both grade- and learning-oriented students. Understanding of what motivates and what demotivates learners to take part in an activity is still limited. This makes it difficult to determine why a particular gamified activity fails to engage learners: because of a bad gamification design or because of demotivating factors derived from the learning activity itself.

For getting measurable indicators characterizing student motivation, we propose the use of the EVC scale. This scale builds upon the Expectancy-Value theory [7]. According to this theory, students’ choices and achievements are determined by students’ expectancies for success and subjective task values. Expectancies refer to how confident an individual is in their ability to succeed in a task, whereas task values refer to how important, useful, or enjoyable the individual perceives the task. A task (e.g., taking a practice quiz) might be of value to a learner because it is interesting and fun. Another task (e.g., completing a graded assignment) can have utility value to a learner because it facilitates the attainment of important goals even when the learner is not interested in it for its own sake and does not experience intrinsic satisfaction in doing it. As such, the utility value captures more of the extrinsic motivation for engaging in a task. Studies have shown that the task value predicts both the intention and actual engagement in an activity. If a learner sees

little purpose or value in the activity, they may find more value in not doing it [6]. Recently, researchers added a third component, cost, reflecting negative aspects of engaging in an activity, such as perceptions of the required effort and time.

Gamifying an activity without taking in consideration the expectancy, value, and cost factors may result in low or lack of engagement with the gamified activity. Therefore, it is useful to know what motivational drivers are high or low, so as to focus the gamification on those in need of boosting. For example, for some activities (e.g., practicing) in which learners see little purpose or value, it might be beneficial for gamification to enhance the perceived value of the activity [2].

The EVC scale was developed to address the practical need for a rapid and brief measure of student motivation towards a task. It is intended to provide formative assessment on what motivational factors are high or low in a given group of students and are in need of intervention. In this work we studied empirically how the activity-related motivational factors measured by EVC relate to the level of learners’ engagement in a gamified activity.

III. PRELIMINARY STUDY

Participants in this study were undergraduate students who had taken a gamified course using the OneUp gamification platform [8] within the last academic year. The gamified activity was out-of-class practicing. An invitation to participate in the study was sent by email. Thirty-seven students responded and completed the survey [5]. For this study we slightly modified the survey by including the question “I think my practicing with OneUp is interesting” for assessing learners’ intrinsic interest in practicing. The survey consists of 11 questions distributed in three separate sub-scales using a 6-point Likert scale, ranging from 1 (Strongly Disagree) to 6 (Strongly Agree) (see Table 1).

TABLE I. EXPECTANCY-VALUE-COST SCALE

Category	Items
Expectancy	- I know I can learn how to solve the practice problems in OneUp. - I believe that I can be successful in practicing with OneUp. - I am confident that I can understand the material practiced in OneUp.
Value	- I think practicing with OneUp is important. - I value my practicing with OneUp. - I think practicing with OneUp is useful. - I think practicing with OneUp is interesting.
Cost	- Practicing with OneUp requires too much time. - Because of other things that I do, I don’t have time to put into practicing with OneUp. - I’m unable to put in the time needed to do well in my practicing with OneUp. - I have to give up too much to do well when practicing with OneUp.

As EVC is designed to measure expectancy, value, and cost as three separate, unidimensional scales, we calculated the *mean* score E, V, and C for each scale, calling them *expectancy score*, *value score*, and *cost score*, correspondingly. We used the numbers of practice quizzes taken in OneUp as an indicator for students’ engagement in gamified online practicing. Fig.1 shows

the distribution of the numbers of practice quizzes taken by students with a *value* score greater or equal to 3.5 (the middle point of the interval 1-6). We call it the *high-value group*.

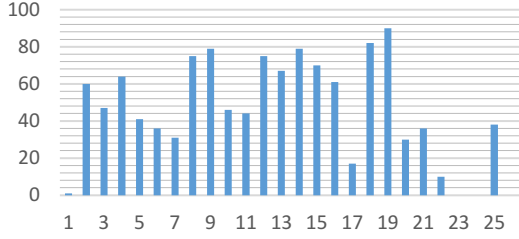


Fig. 1. Distribution of number of challenges solved for $v \geq 3.5$

As it can be seen, most students in the high-value group have completed more than 30 practice quizzes. Namely, 24 students completed above 30 quizzes of which 20 students belong to the high-value group. Fig.1 shows also that there are several students with a very low number of taken quizzes. In Fig. 2 the *cost* score is added next to the numbers of taken quizzes. (For aiding the comparison, cost values are scaled by 10). The figure shows that the students with very low practicing attempts (e.g., students labeled 1, 23, 24, 26, 27) have high-cost scores: 4, 5.25, 5, 4.5, 5.75. Namely, 11 students completed less than 30 quizzes, with 7 belonging to the high-cost group. An explanation may be that they perceived the practicing activity as costly in terms of personal resources. While valuing practicing, they were likely unable to commit the necessary time or effort to engage. This suggests that meaningful engagement with a gamified activity is impacted by the perceived value and cost of engagement.

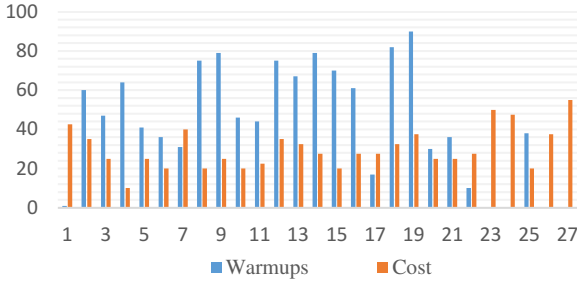


Fig. 2. Number of problems solved with cost scores for $v \geq 3.5$

Fig. 3 shows the value and cost scores next to the numbers of challenges taken by each student. These descriptive analytical results demonstrate that as the perceived value of practicing decreases, the level of meaningful engagement in the activity also decreases. Analogously, as the perceived cost (reflecting negative aspects of engaging) of practicing increases, the level of engagement in the activity decreases. Although not obvious from Fig. 3, the level of engagement exhibits certain positive correlation with the expectancy score. The results of the Pearson's correlation test showed a moderate correlation ($r=0.403$, $p\text{-value}=0.01$) between $E+V-C$ scores and the number of challenges completed. These observations suggest that each student can be characterized by a function $s_{e,v,c}$ of their expectancy e , value v , and cost c scores (e.g., $s_{e,v,c} = e+v-c$) and that there is some measure for success in the activity $t_{e,v,c}$ which also depends on the perceived value, cost, and expectancy. If for most students $s_{e,v,c}$ is below the measure $t_{e,v,c}$, the targeted

involvement of learners in the activity is unlikely to be achieved. This implies that gamification can fulfil its motivating effect on the targeted learners when there is sufficient initial motivation towards the activity, as determined by the perceived value, expectancy, and cost.

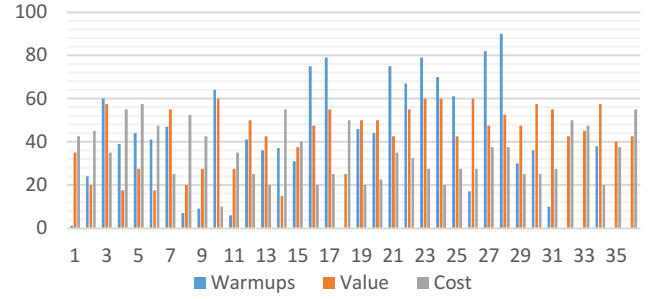


Fig. 3. Number of challenges taken with value and cost scores

IV. CONCLUSION

Educational gamification builds on the assumption that learner behavior and attitudes may be influenced by transferring the motivational potential of games to non-game learning environments. In reality, such transfer brings gameful elements to a system supporting learning activities. To gain a better understanding on the interactive processes driving educational gamification, we designed a study aimed at providing initial evidence on how expectancy, value, and cost measured by the EVC scale relate to the level of learners' engagement in a gamified activity. The initial results suggest that expectancy and task value positively effect engagement in a gamified activity while cost negatively effects it. We are conducting a more in-depth study to confirm these results and provide further insights.

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