

Understanding the effect of gamification on learners with different personalities

Ghaban, Wad; Hendley, Robert

License:

None: All rights reserved

Document Version

Peer reviewed version

Citation for published version (Harvard):

Ghaban, W & Hendley, R 2019, Understanding the effect of gamification on learners with different personalities. in *Proceedings of the 11th International Conference on Computer Supported Education (CSEDU 2019) - Volume 2*. SciTePress Digital Library, 11th International Conference on Computer Supported Education (CSEDU 2019), Heraklion, Crete, Greece, 2/05/19.

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

Checked for eligibility: 31/05/2019

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Understanding the Effect of Gamification on Learners with Different Personalities

Wad Ghaban¹, Robert Hendley²

^{1,2}*School of Computer science, University of Birmingham, B15 2TT, UK*
{whg360, R.J.Hendley}@cs.bham.ac.uk

Keywords: Gamification, Motivation, Online learning, Survival analysis.

Abstract: Gamification has been shown to enhance the motivation of learners in online courses. However, learners respond differently to gamification depending on their personalities. For this reason, it has been suggested to build a learner model that would enable a system to match gamification elements to learners' personalities. To do this, we need to understand the relationship between gamification and personalities. Thus, two versions of a learning website have been built: one with gamification elements and the other without these elements. We measured learners' motivation, knowledge gain, and satisfaction in both versions. The results confirm the benefit of gamification overall in enhancing learners' motivation. However, the knowledge gain of learners was worse in the gamified version. The results vary between personalities. This finding may be explained by the optional nature of the chat and the learners' tendency to take the initiative. Further study of more gamification elements and compulsory chat might be considered.

1 INTRODUCTION

Most learners lose their motivation in online courses after a few weeks (Caponetto et al., 2014). For that, gamification has been introduced as a technique to enhance the motivation and the knowledge gain of learners (Stott and Neustaedter, 2013). Indeed, many studies have confirmed the benefits of gamification in enhancing motivation and engagement in different areas, such as sports (Tondello et al., 2016), business (Xu, 2011), health (King et al., 2013), and learning (Dicheva et al., 2015). However, (Bergmann et al., 2017) claims that the use of gamification has no significant impact on learners and that most learners exhibited the same performance and behaviour in gamified as in traditional systems (Caponetto et al., 2014). Further, other research has posited that gamification may have a negative effect on some learners who find the gamification elements annoying and boring (Fitz-Walter et al., 2011), while others may get distracted by these elements. Learners may busy themselves collecting points and badges rather than concentrating on the learning contents (Faiella and Ricciardi, 2015). Therefore, we propose to build a learner model that will enable us to fit the best gamification elements to learners' personalities (Tondello et al., 2016). To do this, we need to understand the relationship between gamification and personality. A few studies have tried

to understand this relationship (Codish and Ravid, 2014a) (Codish and Ravid, 2014a) (Jia et al., 2016). These studies point to the varying effects of gamification on different personalities. For example, they revealed that extroverted learners prefer points, badges and social elements such as leaderboards, conscientious learners do not prefer gamification elements but prefer to see their progress represented as progress bars or levels. Gamification elements will demotivate neurotic learners, who find these elements boring and annoying (Codish and Ravid, 2014a) (Jia et al., 2016). Most of the related studies were based on self-report questionnaires, filled in by users after completing a gamified course, about the elements they preferred and enjoyed. However, this approach may be unreliable. These studies force learners to complete the whole study which misses the main aim of gamification. In addition, this kind of research ignores learners who dropout in the middle of the experiment. This may bias the results because these dropout learners may be the most important participants to consider, and it is essential to understand the reasons for their dropping out.

To address this issue, (Ghaban and Hendley, 2018) applied a more objective approach by using the dropout rate as a proxy for learners' motivation. They assumed that more motivated learners would use the system for a longer duration. However, they only used

a limited number of gamification elements. In addition, they did not consider learners' knowledge gain. For that, in this research, we aim to include a greater number of gamification elements. We will also assess learners' knowledge gain and satisfaction

We hypothesise that, overall, learners will benefit from gamification as it will help to enhance learners' motivation. Further, we hypothesise that gamification's effects on different personalities will vary. Highly conscientious learners always have their own trigger to motivate them. For that, we hypothesise that the behaviour of the highly conscientious learners will be the same in the gamified and the non-gamified versions. On the other hand, certain other personalities, such as highly extroverted and high agreeable ones, will be more motivated by the gamified version. In contrast, neurotic learners will dislike and be demotivated by gamification elements.

The results supported our hypotheses. Overall, learners were more motivated when gamification elements were present. Results varied depending on learners' personalities, but in most cases, gamification was shown to motivate learners. Some personalities showed significant benefit in this area, such as highly extroverted and highly agreeable learners, while others demonstrated little benefit, such as highly neurotic learners. However, we noticed that highly extroverted learners have less knowledge gain in the gamified version. These results indicate that some personalities stayed for a longer duration in the gamified version and are satisfied with it. However, their progress was lower than that of other learners. These individuals spent their time in the gamified version chatting and interacting rather than concentrating on the course materials. After analysing the nature of the topics discussed in the social component, we found that most of the topics were irrelevant to the courses and related to travel and fashion.

2 BACKGROUND

Motivating learners in the online courses is considered an important factor in ensuring their success (Isaksen and Ramberg, 2005). (Dicheva et al., 2015) pointed out that a lack of motivation is the primary reason for dropping out of online courses. There are many theories used to explain motivation (Isaksen and Ramberg, 2005). Self-determination theory (SDT) is one of the most popular theories used in learning and education that is proposed by (Ryan and Deci, 2000). They stated that if individuals seek challenge, they will continually and actively gain expertise and experience, adding that to ensure learners' motivation,

three elements must be considered: autonomy (i.e. experience and control), competence (i.e. effectiveness and ability), and relatedness (i.e. feelings of belonging and connectedness) (Isaksen and Ramberg, 2005). (Ryan and Deci, 2000) also split motivation into two categories: intrinsic and extrinsic. On the one hand, intrinsically motivated learners do not need any external re-enforcements. Learners carry out an activity because it is worthwhile or has a value for them. On the other hand, extrinsic motivation is defined as the external reason for learners' undertaking an activity. Extrinsic motivation can be divided into the following categories, (Isaksen and Ramberg, 2005):

- External regulation: the learner performs the activity to receive a reward or to avoid punishment.
- Introjection: the learner performs the activity to meet the expectations of others.
- Identified regulation: the learner performs the activity to obtain a result of personal value to the learner.
- Integrated regulation: the learner performs the activity to potentially satisfy a psychological need of that learner

2.1 Gamification

To address the lack of motivation and engagement in learners in online courses, researchers have suggested using gamification as an effective technique. Gamification is defined as the use of game elements, such as points and badges, in non-game contexts (Codish and Ravid, 2014a) (Simões et al., 2013). (Bergmann et al., 2017) showed that gamification does not involve a complete game. Learners earn points, badges and rewards for performing an activity. In addition, learners can compete and collaborate with other learners by using a leaderboard or by publishing their results on social media. In gamification, learners feel that they are involved in a game, so they are less likely to fear failure. Further, the instant feedback can enhance intrinsic motivation for some learners (Codish and Ravid, 2014a).

Research has shown the benefits of gamification for enhancing learners' motivation and engagement. (Cheong et al., 2013) developed their QuickQuiz to motivate learners. After four weeks, the researchers asked the learners about their motivation. They found that 77 percent of learners were motivated by the gamification. (Barata et al., 2011) asked learners to use two versions of a website: a gamified and a non-gamified version. Afterward, they asked the learners about their motivation. They found that learn-

ers using the gamified version were more satisfied. (Merry et al., 2012) confirmed these results. They showed that gamification enhanced the level of satisfaction and the performance of learners. However, some researchers have pointed out the negative effects of gamification, especially in long-term courses. Some researchers have demonstrated that gamification can be annoying and boring for some learners (Jia et al., 2016), while other learners get distracted by collecting points and badges rather than focusing on learning content (Codish and Ravid, 2014a) (Codish and Ravid, 2014b) (Jia et al., 2016). For that reason, it has been suggested to build a learner model that can adapt gamification elements to learners' characteristics (Tondello et al., 2016) which can be either states or traits (Caponetto et al., 2014). However, effectively adapting to states and emotions may be unreliable because those qualities change frequently (Shen et al., 2009), while using personality traits may be more effective (Caponetto et al., 2014). (Shoda and Mischel, 1998) confirmed that, over time, personality is more stable.

2.2 Personality

Personality can be defined as a set of traits that are used to describe how individuals interact with the outside world (Hofstee, 1994). There are different theories used to describe and classify personality. For example, the Myers-Briggs Type Indicator, and the Big Five personality traits or five-factor model. In this research, the Big Five will be used because it is the most common theory used in similar research (Hofstee, 1994).

2.2.1 Big five model

The Big Five personality traits or the five-factor model divides individuals' personalities into five traits: conscientiousness, extroversion, agreeableness, neuroticism and openness to experience (Hofstee, 1994). The first trait is conscientiousness. Personalities associated with this trait tend to be careful, hard-working, responsible, and organized. A large body of research has been dedicated to investigating the strong relationship between this trait and academic and work achievement (Judge et al., 1999) (Hogan and Hogan, 1989). The second trait is extroversion. Individuals exhibiting this personality trait are described as social, active and energetic. These individuals are usually the leaders of their groups, and they like challenging activities. The trait of agreeableness is associated with being loving, helpful trusting, friendly and kind. The fourth trait is neuroticism or emotional instability. Individuals who exhibit this

personality trait are usually anxious, depressed, angry, embarrassed, emotional, worried and insecure. Finally, openness to experience, or intellectuality, is associated with being imaginative, curious and open-minded (Judge et al., 1999).

2.2.2 Big five model instrument

Many instruments have been developed to measure learners' personalities according to the Big Five model. The most popular instruments are the NEO Five-Factor Inventory (NEO-FFI) and the Big Five Inventory (BFI). There are many versions of the NEO-FFI. One of these versions is called the NEO-PI, which contains 181 self-reported questions, and another version has 240 questions (Costa Jr, 1992). However, the number of questions makes using these instruments difficult. Therefore, these instruments have been modified into several shorter versions, but the problem with them is their unreliability. Additionally, these instruments are not free to use (Aluja et al., 2005). For these reasons, most research in this area uses the BFI, which consists of 46 questions and is free to use. Additionally, there are many versions of this instrument. A number of versions have been developed for learners of different ages: some are for adults and others are for children. Also, many versions have been translated into other languages, such as Chinese and German (John et al., 1991). In this research, we will use the 46-question BFI, specifically, the version developed for children under 18 years old.

2.3 Related work

Few research studies have examined the relationship between elements of gamification and learners' personalities. One such study, by (Codish and Ravid, 2014a), focused on a single dimension of personality, extraversion. In their study, the researchers asked learners to use a gamified learning system, after which they asked the learners about their preferred elements. They found that extroverts enjoyed more of the gamification elements than did introverted learners. Extroverted learners were more likely to enjoy collecting points, badges and rewards. In a follow-up study, the researchers incorporated all personality dimensions (Codish and Ravid, 2014b). They developed a pen and paper prototype with gamification elements and asked participants about their favourite elements. They found that highly introverted learners and highly agreeable learners preferred badges, while highly extroverted learners preferred rewards. They also found that those high in conscientiousness did not need gamification elements for motivation - they were motivated by their ambition to complete the

task - but the authors argued that the progress bar and levels related to achievement were still preferred by highly conscientious learners.

Another study, by (Jia et al., 2016), required learners to complete two questionnaires: one related to their personality and the other about the most helpful gamification elements. The study showed that highly agreeable learners preferred challenge elements, while highly conscientious ones preferred progress levels. Learners low in neuroticism preferred points, badges and progress, while those low in openness liked the use of avatars.

Most of the previous studies were based on self-report questionnaires obtained from learners who completed the whole experiment. Using such an approach may provide unreliable results. Forcing learners to complete the experiment may miss the main goal of gamification. In addition, ignoring learners who dropout in the middle of experiment from the analysis may bias the results. Thus, (Ghaban and Hendley, 2018) provide a more objective approach by using the dropout rate as a proxy for motivation. They study the influence of the gamification on learners' motivation in the gamified and non-gamified versions. Their results pointed to the benefit from gamification in enhancing the motivation of learners. However, in their research they used a limited number of gamification elements. For that, in this study we will use more gamification elements and we will also consider learners' knowledge gain and satisfaction.

3 Method

This study aimed to determine how different personalities respond to gamification elements. Toward that end, the learners' motivation, knowledge gained from the course and satisfaction level were measured.

Setup:

We built a learning website to teach students how to use Microsoft Excel. The course consisted of 15 lessons, starting with simple topics, such as drawing tables and visualising graphs. From there, the course progressed to high-level topics, such as mathematical and logical functions. We built two identical versions of the website: one version included gamification elements and the other version did not include these elements. In the gamified version, we used points, badges, a leader board and a chat. In the course, there is a quiz after each lesson, and when a question is answered correctly, a learner is assigned one point. After collecting five points, the learner can earn a badge, and the number of badges acquired is used to move the learner's position on the leader board. Moreover,

in the gamified version, there is a button called 'Talk to a friend', which the learner can click to start chatting with other learners. The learners thought they were talking to a friend, whereas they were actually talking to the researcher. We did this to control the experiment and to be able to analyse the nature of the topics discussed with the learner.

At the beginning of the experiment, we asked the learners to register on the website and set up a username and password. We also asked them to provide us with demographic information (age and gender), to take the Big Five Inventory (BFI) personality test and a pre-test, which included eight questions related to Microsoft Excel to measure their knowledge.

Participants:

Before running the experiment, we received approval, in accordance with ethical standards, from four different schools in Saudi Arabia. Then, we sent a consent form to the participants' parents to explain the purpose of the experiment and to inform them that all the collected data would be anonymous and secure. The learners and their parents were made aware that the learners were free to withdraw from the experiment at any time. After obtaining informed consent from the schools and the parents, we conducted the experiment with 194 participants (91 boys, 103 girls), ranging in age from 16 to 18.

The classification of personalities:

Because the study aimed to determine the influence of gamification on different personalities, we classified each personality dimension based on the score obtained from the BFI personality test into high, average and low. To accomplish this, we drew a histogram that shows the values of the personality dimension in the x-axis and the frequency of the learners with that personality type in the y-axis. Then, we classified the learners who are lower than $\mu - \sigma$ as low. Learners who are assigned values for a specific personality trait above $\mu + \sigma$ are considered to exhibit the high extreme of that personality trait. Figure 1 shows the classification of an individual with a conscientiousness personality.

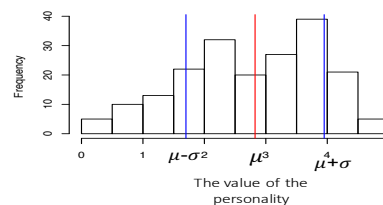


Figure 1: The classification of the learners with conscientiousness personality

Procedure: After obtaining approval from the learners and their parents, we asked the learners to fill out a registration form to obtain their demographic in-

formation. We also asked them to complete a BFI personality test and a Microsoft Excel pre-test. Then, we divided the learners equally into the two groups, balanced on age, gender, type of personality (obtained from the BFI personality test) and knowledge level (obtained from the pre-test). Later, we asked the learners to use the learning website any time they liked. The learners were free to dropout of the study at any time. After seven weeks, most of the learners had either dropped out of the course or completed it. Thus, in order to have more understanding of the behaviour of different personalities toward gamification, after two months, we asked the learners to take a post-test that has the same number of questions as the pre-test. We then calculated the knowledge gain of the learners using the following formula:

$$\text{Learners' knowledge gain} = \text{Learners' post-test} - \text{learners' pre-test}$$

At the same time, we measured the learners' satisfaction levels using the e-learner satisfaction tool (ELS) (Wang, 2003). This tool considers many components, such as the system interface, the learning content and system personalisation. The questionnaire consists of 13 questions, with a seven-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

Hypotheses: Most previous related studies pointed to the benefit of gamification (Cheong et al., 2013). Thus, we hypothesised that, overall, the learners' motivation, knowledge gain and satisfaction level would benefit from gamification.

H1: Learners who are assigned to the gamified version of the website will be more motivated than learners using the non-gamified version of the website.

We hypothesised that the learners' response to the gamification elements will vary, depending on their personality type. Highly conscientious learners are described as learners who are always organised, and they always do their job. Learners with this type of personality have their own motivational triggers, and they do not need gamification elements. Consequently, these learners will not have a significant benefit from gamification. Thus, we hypothesises the following:

H2: Highly conscientious learners will have the same level of motivation in the gamified and the non-gamified versions of the website.

Highly extrovert learners are described as social and talkative. Thus, we hypothesised that learners with this type of personality will be highly motivated by the gamification elements. These learners will enjoy talking with others and using the chat function. They will also like to compete with their friends to gain a good position on the leader board.

H3: Highly extroverted learners will gain significant

benefit from gamification. Their motivation level will be much better in the gamified version of the website than the non-gamified version.

Learners with a highly agreeable personality are usually kind, and they like to collaborate with and help others. Thus, we suggest that these learners would like to use the chat function to talk to others and ask them if they need help. This may enhance their motivation level in the gamified version of the website.

H4: Highly agreeable learners will be more motivated in the gamified version of the website than the non-gamified version.

Highly neurotic learners are usually described as emotionally unstable. Thus, we thought these learners would be annoyed by the gamification elements. They may find these elements childish and silly.

H5: Highly neurotic learners will be demotivated by the gamification elements.

Highly open learners are usually imaginative, and they like to be creative. Thus, we suggest that the badges might motivate these learners.

H6: Highly open learners will be more motivated in the gamified version of the website than the non-gamified version.

4 Results

This study aimed to identify the influence of gamification on different types of personalities by measuring the learners' motivation.

In their study, (Ghaban and Hendley, 2018) used the dropout variable as the proxy for motivation. They hypothesised that learners who were more motivated would use the online website for a longer time. Then, they used survival analysis method to analyse their results. Survival analysis is a method that is commonly employed in the fields of bioscience and medicine; it can be defined as a set of methods used to analyse the time spent by participants from the time entering the experiment until the event of interest occurs (Cox, 2018). For example, an event can be death or dropping out. One popular method in survival analysis is the Kaplan-Meier method, which is used to visualise and compare the dropout rates of two groups (Cox, 2018). Figure 2 shows the Kaplan-Meier graph for the cumulative dropout rate of all the learners in the gamified and non-gamified versions of the website for the present study.

The main issue with the Kaplan-Meier graph, as it pertains to this study is that it is used to compare the cumulative survival distributions of two groups at arbitrarily chosen points rather than to present the differences between the groups at all times. More-

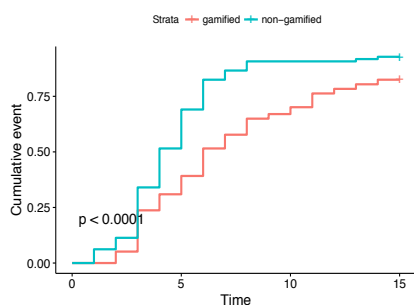


Figure 2: The Kaplan-Meier graph for the overall learners in the gamified and the non-gamified versions.

Table 1: The results from the Cox-Proportional hazard when it is applied on the overall learners in the gamified and the non-gamified versions

N=194 Number of dropout=170		
coef	Exp(coef) =HR	P-value
0.63	1.88	5e-05

over, it only shows which group performs better without defining the degree to which the two groups differ. Therefore, many researchers have used the Cox proportional-hazards model instead. The Cox proportional-hazards model applies to survival analysis, and it is used to evaluate the effect of specific factors on the rate of a particular event's occurrence, which is called the hazard rate (HR). This model analyses the relationship between the hazard function and the predictors or the treatment (Cox, 2018). Table 1 shows the result of the Cox proportional-hazards regression analysis when it was applied to the learners, overall. The coefficient result was 0.6343. This positive result shows that the dropout rate for the second group (non-gamified version) was higher than the dropout rate in the gamified version. The HR result, represented by $\exp(\text{coef}) = 1.88$, indicates that the dropout rate of the learners in the non-gamified version was almost twice as high as the dropout rate in the gamified version. Thus, we conclude that, overall, the motivation of the learners in the gamified version of the website is better than the motivation of the learners in the non-gamified version. We applied the same analysis to each high and low extreme of each personality dimension. Figure 3 and Figure 4 show the Kaplan-Meier graph applied to the high and low extrovert learners, respectively. Table 2 summarises the results obtained from the Cox proportional-hazard regression analysis applied to the extreme personalities. The results show that highly conscientious learners receive little benefit from gamification. While, highly neurotic learners have nearly the same level of motivation in the gamified and the non-gamified versions of the website. In contrast, highly extroverted

and highly agreeable learners were found to have a statistically significant benefit from gamification.

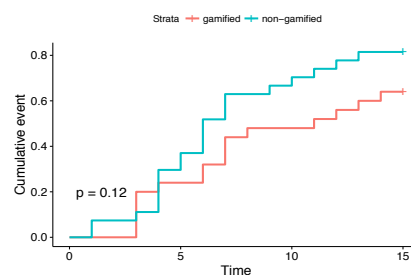


Figure 3: Kaplan-Meier graph for the high conscientious learners in the gamified and the non-gamified versions.

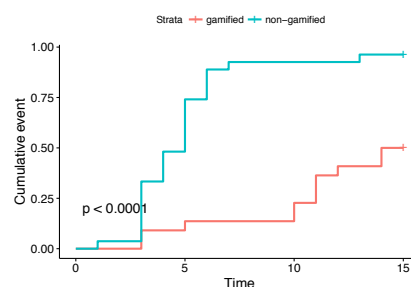


Figure 4: Kaplan-Meier graph for the high extrovert learners in the gamified and the non-gamified versions.

Table 2: The Summary of the Cox-proportional Hazard on Different Personalities

Independent variables in gamified vs. non-gamified versions	P-value	Coef	Exp (coef) =HR
Overall learners	4e-05	0.6343	1.8856
High conscientious	0.1	0.4981	1.6456
Low conscientious	0.04	0.6112	1.8427
High extraversion	6e-7	1.848	6.3470
Low extraversion	0.7	0.1022	1.1076
High agreeableness	0.001	0.8998	2.4592
Low agreeableness	0.1	0.4368	1.5478
High neuroticism	0.7	0.1078	1.1138
Low neuroticism	4e-5	1.4471	4.2508
High openness	0.4	0.2923	1.3396
Low openness	0.005	1.0433	2.8385

5 Discussion

This research sought to understand the influence of gamification on learners with different personality types by measuring the level of learners' motivation. The results support our hypothesis that gamification will, overall, enhance the learners' motivation. Additionally, to have more understanding of learners' behaviour, we looked to their knowledge gain and

their satisfaction. We found that, overall learners are more satisfied with the gamified version and they have the same level of knowledge gain in both versions.

Regarding personalities, the results pointed to variations in the responses to gamification among learners of different personality types. For that, in order to have more understanding we looked to the level of the knowledge gain and the satisfaction for learners with different personalities (tables 3 and 4).

Highly conscientious learners, for example, were shown to exhibit the same behaviour in the gamified and non-gamified versions. Their levels of motivation were not statistically significantly different in the two versions. Moreover, these learners have almost the same level of knowledge gain in both versions. These results may be explained as proposed by (Jia et al., 2016), who stated that highly conscientious learners have inner triggers to motivate them. These learners do not need any external factors to accomplish this. At the same time, different studies have pointed to a strong correlation between the conscientious personality and high academic achievement.

Highly extroverted learners were shown to receive a significant benefit from gamification. These learners were more motivated in the gamified version than they were in the non-gamified version, which supported hypothesis H3. These learners were also more satisfied in the gamified version. These results confirmed the findings from the studies done by (Codish and Ravid, 2014a). However, the knowledge gain of the learners in the gamified version was much worse than the knowledge gain in the non-gamified version. These learners were described by (Judge et al., 1999) as being easily distracted. Thus, these learners may start contacting and chatting with each other rather than concentrating on the course's contents. To consider this, we reviewed the number and nature of the messages received by the highly extrovert learners. We found that a high numbers of messages were sent from this personality. Further, these learners usually continued chatting about other topics rather than the course; for example, they talked about fashion, travel and sport.

Like highly extroverted learners, highly agreeable learners were shown to obtain a significant benefit from gamification – in terms of enhancing their level of motivation. This confirms hypothesis H4. However, when we observe their knowledge gain, we found that it was significantly worse in the gamified compared with the non-gamified version. While, their satisfaction levels were almost the same in the gamified and the non-gamified versions. This type of learners ranked second, behind high extroverts, in relation to the number of messages sent. However, most

of their topics involved self-introduction and determining who they were talking to.

In hypothesis H5, we expected that highly neurotic learners would be demotivated in the gamified version. However, the motivation of these learners were not statistically significantly different between the two versions. The motivation of this personality type can be explained by multiple factors, including that chatting was optional and the learners had to take the initiative. Learners with certain personality types, such as the highly neurotic, did not choose to interact or chat with others. Further, the correlation and interaction between personalities must be considered. There are some learners who are simultaneously highly extroverted and highly neurotic learners.

Highly open learners were shown to have the same level of motivation in the gamified and non-gamified versions. These results conflict with hypothesis H6, which suggested that these learners will have a significant benefit from gamification. Further, these learners were found to have almost the same level of knowledge gain and satisfaction in both versions. The results can be partly explained by the interaction between personalities. In addition, these learners are described as preferring imaginative and unusual ideas, but this was not evident in our experiment (Judge et al., 1999). Our gamified version included points, badges, leaderboards and chat capabilities, which may not have been interesting for these learners.

Because of the limitations of this study, further research should consider social gamification elements to examine their effects on learners with different personalities. Such an investigation could be carried out in different ways. For example, it may be possible to repeat the experiment by maintaining the chat feature with the proviso that the researcher must take the initiative. We can assume that some learners, such as highly neurotic learners, will be annoyed when they are asked to talk. Further, the social elements could be made more 'realistic' by letting learners interact with one another. Moreover, more gamification elements, such as avatars and motivational phrases, may be considered.

6 CONCLUSIONS

Because of the different effects of gamification, it has been suggested that the best gamification elements will be matched to learners' characteristics, such as their effective state, learning style and personality. In this study, we considered personality as a more stable characteristic. To do this, we needed to understand the relationship between gamification and personali-

Table 3: The Summary of the Results of the Knowledge Gain for the Personalities.

The personality	Knowledge gain in the gamified version			Knowledge gain in the non-gamified version			p-value
	N	Mean	Sd	N	Mean	Sd	
High conscientious	22	2.12	1.5	12	2.58	1.7	0.42
Low conscientious	16	2.5	0.45	13	2.15	1.86	0.47
High extraversion	23	1	2.1	24	2.04	1.45	0.05
Low extraversion	22	2.04	1.9	12	1.33	1.55	0.28
High agreeableness	16	1.2	2.4	17	2.17	1.81	0.19
Low agreeableness	15	1.06	2.3	12	1.91	1.44	0.27
High neuroticism	18	0.87	2.2	15	1.2	2.27	0.67
Low neuroticism	26	1.61	1.9	14	2.5	1.28	0.12
High openness	21	1	2.4	16	2.37	1.5	0.05
Low openness	26	1.34	1.5	14	1.64	1.94	0.59

Table 4: The Summary of the Results of the satisfaction for the Personalities.

The personality	Satisfaction in the gamified version			Satisfaction in the non-gamified version			p-value
	N	Mean	Sd	N	Mean	Sd	
High conscientious	22	6.67	0.6	12	6.1	0.76	0.02
Low conscientious	16	6.4	0.78	13	6.07	0.73	0.25
High extraversion	23	6.64	0.58	24	6.1	0.49	0.0007
Low extraversion	22	6.6	0.53	12	6.01	0.73	0.01
High agreeableness	16	6.34	0.9	17	6.2	0.96	0.66
Low agreeableness	15	6.4	0.78	12	6.3	0.77	0.74
High neuroticism	18	5.1	0.7	15	6.3	0.87	0.0001
Low neuroticism	26	6.3	0.78	14	6.3	0.75	1.00
High openness	21	6.5	0.78	16	6.3	0.83	0.47
Low openness	26	6.3	0.87	14	6.3	0.8	1

ties. In this study, we assessed the influence of gamification on personalities using learners' motivation (by using their dropping out as a proxy for motivation) after using one of the two versions. One version included gamification elements (points, badges, leaderboards, chat capabilities) and the other lacked these elements.

This research showed that, overall, the learners were motivated by and enjoyed the presence of the gamification elements. However, there was a variation in the effect of the gamification according to different personality types. Different people responded differently to the presence of gamification in general and specific gamification elements. Some preferred the gamification, while others felt annoyed by it. Furthermore,

some individuals preferred specific gamification elements; for example, some liked the badges and leaderboards, while others preferred the social elements.

To adapt the presentation of gamification and its elements to suit learners, we need a better understanding of gamification's effects on individuals. We can obtain this information by incorporating more - and more intensive - gamification elements or investigating learner characteristics other than personality. For example, we could study how the effects of gamification depend on the learners' moods, affective states, learning styles and contexts. Acquiring this sort of understanding will help in adapting the presentation of gamification and specific gamification elements to learners' characteristics. However, the process of adaptation must be monitored and adjusted continuously. In this way, we can build a dynamic model of adaptive gamification that would ensure the best results from gamification are obtained for learners. In this way, we could enhance learners' motivation, knowledge gain and satisfaction. For example, based on the results of this research, we found that extroverted learners prefer social components, which motivated these learners. However, their conversation was not related to the topic. Thus, it negatively affected their learning. To address this problem, these learners may need a dynamic model that adapts the gamification elements. We could provide a social component for extroverted learners to motivate them while keeping them under observation. However, if the learners are allowed to use the social component inappropriately by talking about things other than the course and their progress, we may need to lock down these social components or direct the interactions among learners by adapting the discussion to make it relevant to the course. Building the dynamic model described above falls under what a good teacher would naturally do. Good teachers always observe learners to understand their needs and then employ suitable techniques to keep them motivated and enhance their performance. We think that a dynamic model of gamification should be a priority for any education system that wishes to make the best use of its technological resources to serve the interests of its students.

REFERENCES

- Aluja, A., Garcia, O., Rossier, J., and Garcia, L. F. (2005). Comparison of the neo-ffi, the neo-ffi-r and an alternative short version of the neo-pi-r (neo-60) in swiss and spanish samples. *Personality and Individual Differences*, 38(3):591-604.
- Barata, G., Gama, S., Jorge, J., and Gonçalves, D. (2011).

- So fun it hurts-gamifying an engineering course. *Found. Augment*, page 10.
- Bergmann, N., Schacht, S., Gnewuch, U., and Maedche, A. (2017). Understanding the influence of personality traits on gamification: The role of avatars in energy saving tasks.
- Caponetto, I., Earp, J., and Ott, M. (2014). Gamification and education: A literature review. In *European Conference on Games Based Learning*, volume 1, page 50. Academic Conferences International Limited.
- Cheong, C., Cheong, F., and Filippou, J. (2013). Quick quiz: A gamified approach for enhancing learning. In *PACIS*, page 206.
- Codish, D. and Ravid, G. (2014a). Personality based gamification-educational gamification for extroverts and introverts. In *Proceedings of the 9th CHAIS Conference for the Study of Innovation and Learning Technologies: Learning in the Technological Era*, volume 1, pages 36–44.
- Codish, D. and Ravid, G. (2014b). Personality based gamification: How different personalities perceive gamification.
- Costa Jr, P. T. (1992). Revised neo personality inventory and neo five-factor inventory. *Professional manual*.
- Cox, D. R. (2018). *Analysis of survival data*. Routledge.
- Dicheva, D., Dichev, C., Agre, G., and Angelova, G. (2015). Gamification in education: A systematic mapping study. *Journal of Educational Technology & Society*, 18(3).
- Faiella, F. and Ricciardi, M. (2015). Gamification and learning: a review of issues and research. *Journal of e-Learning and Knowledge Society*, 11(3).
- Fitz-Walter, Z., Tjondronegoro, D., and Wyeth, P. (2011). Orientation passport: using gamification to engage university students. In *Proceedings of the 23rd Australian computer-human interaction conference*, pages 122–125. ACM.
- Ghaban, W. and Hendley, R. (2018). Investigating the interaction between personalities and the benefit of gamification. In *Proceedings of the 32nd International BCS Human Computer Interaction Conference*, page 41. BCS Learning & Development Ltd.
- Hofstee, W. K. (1994). Who should own the definition of personality? *European Journal of Personality*, 8(3):149–162.
- Hogan, J. and Hogan, R. (1989). How to measure employee reliability. *Journal of Applied psychology*, 74(2):273.
- Isaksen, G. and Ramberg, P. A. (2005). Motivation and online learning. In *Interservice/Industry Training, Simulation, and Education Conference (IITSEC)*, pages 1–12.
- Jia, Y., Xu, B., Karanam, Y., and Voids, S. (2016). Personality-targeted gamification: a survey study on personality traits and motivational affordances. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, pages 2001–2013. ACM.
- John, O. P., Donahue, E. M., and Kentle, R. L. (1991). The big five inventory?versions 4a and 54.
- Judge, T. A., Higgins, C. A., Thoresen, C. J., and Barrick, M. R. (1999). The big five personality traits, general mental ability, and career success across the life span. *Personnel psychology*, 52(3):621–652.
- King, D., Greaves, F., Exeter, C., and Darzi, A. (2013). ?gamification?: Influencing health behaviours with games.
- Merry, S. N., Stasiak, K., Shepherd, M., Frampton, C., Fleming, T., and Lucassen, M. F. (2012). The effectiveness of sparx, a computerised self help intervention for adolescents seeking help for depression: randomised controlled non-inferiority trial. *Bmj*, 344:e2598.
- Ryan, R. M. and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55(1):68.
- Shen, L., Wang, M., and Shen, R. (2009). Affective e-learning: Using “emotional” data to improve learning in pervasive learning environment. *Journal of Educational Technology & Society*, 12(2).
- Shoda, Y. and Mischel, W. (1998). Personality as a stable cognitive-affective activation network: Characteristic patterns of behavior variation emerge from a stable personality structure.
- Simões, J., Redondo, R. D., and Vilas, A. F. (2013). A social gamification framework for a k-6 learning platform. *Computers in Human Behavior*, 29(2):345–353.
- Stott, A. and Neustaedter, C. (2013). Analysis of gamification in education. *Surrey, BC, Canada*, 8:36.
- Tondello, G. F., Wehbe, R. R., Diamond, L., Busch, M., Marczewski, A., and Nacke, L. E. (2016). The gamification user types hexad scale. In *Proceedings of the 2016 annual symposium on computer-human interaction in play*, pages 229–243. ACM.
- Wang, Y.-S. (2003). Assessment of learner satisfaction with asynchronous electronic learning systems. *Information & Management*, 41(1):75–86.
- Xu, Y. (2011). Literature review on web application gamification and analytics. *Honolulu, HI*, pages 11–05.