

EVALUATION OF A GAMIFIED LEARNING EXPERIENCE: ANALYSIS OF FACTORS THAT IMPACT THE EFFECTIVENESS OF A GAMIFIED EXPERIENCE

AVALIAÇÃO DE UMA EXPERIÊNCIA DE APRENDIZAGEM GAMIFICADA:
ANÁLISE DOS FATORES QUE AFETAM A EFICÁCIA DE UMA
EXPERIÊNCIA GAMIFICADA

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ABSTRACT

Gamification has gone through a faddish cycle. It first gained prominence around 2012 and was quickly abandoned, as practitioners did not achieve the outcomes they expected. According to Gartner's Hype Cycle, Gamification is at a point at which one might expect wide scale adoption. However, if history is not to repeat itself and results are to be achieved as theoretically predicted, a deeper understanding of the concept is essential. In the current study, the researchers attempt to evaluate a gamified learning experience. The participants were students of a Master in Business Administration course. The students were asked to participate in a gamified module and relevant data was collected, before and after the intervention. Based on a review of literature, the researchers identified the exogenous variables of Valence, Attitude towards use of Technology and Experience with Technology. The endogenous variables identified included Reaction and Learning. The findings of the study suggest that the gamified module resulted in increase in knowledge and that Attitude, Experience and Valence significantly predicted the Learner's reaction to the experience. The findings of the study provide support to key theories in the area of gamification and insights for practitioners, on the factors to be considered before using a gamified learning intervention.

Keywords: Learning. Reaction. Gamification. Academics.

RESUMO

A gamificação passou por um ciclo de moda passageira. Ela ganhou destaque por volta de 2012 e foi rapidamente abandonado, pois os praticantes não alcançaram os resultados esperados. De acordo com o Hype Cycle da Gartner, a gamificação está em um ponto em que se pode esperar uma adoção em larga escala. No entanto, para que a história não se repita e os resultados sejam alcançados conforme teoricamente previsto, é essencial uma compreensão mais profunda do conceito. No estudo atual, os pesquisadores tentam avaliar uma experiência de aprendizagem gamificada. Os participantes eram alunos do curso de Mestrado em Administração de Empresas. Os alunos foram convidados a participar de um módulo gamificado e dados relevantes foram coletados, antes e após a intervenção. Com base em uma revisão da literatura, os pesquisadores identificaram as variáveis exógenas de Valência, Atitude em relação ao uso de Tecnologia e Experiência com Tecnologia. As variáveis endógenas identificadas incluem Reação e Aprendizagem. Os resultados do estudo sugerem que o módulo gamificado resultou em aumento no conhecimento e que Atitude, Experiência e Valência previram significativamente a reação do Aluno à experiência. Os resultados do estudo fornecem suporte para as principais teorias na área de gamificação e insights para os profissionais sobre os fatores a serem considerados antes de usar uma intervenção de aprendizagem gamificada.

Palavras-chave: Aprender. Reação. Gamificação. Acadêmicos.

1 INTRODUCTION

In the 2019 Deloitte Global Capital Trends survey, businesses across the globe indicated that their focus area, for the next decade, would be Training and Development of their human resources. Organizations, that participated in the survey, clearly indicated that the biggest challenge that they face, and most likely would continue to face, is a lack of skilled human resources or in other words a talent crunch. This fear has also been echoed in the PWC CEO Survey (PwC, 2017). As per the information shared by Indian corporates, the annual spend on Training is less than 2% of the average spend on employees. The International Monetary Fund predicts that India is likely to be the third largest economy by 2030. This would require phenomenal growth that can only be achieved with a proportional increase in the focus on training and development (Menon, 2019). Thus, the Training function would need to form the backbone of the growth story and innovations and adoption of ideas would be required in order to fulfil the growth expectations.

Gamification has been one such concept that organizations and researchers have been exploring since 2011. In 2013, Gamification became a buzzword with practitioners rushing to adopt the concept (McCormick, 2013). However, just a year later, Clancy (2014) suggested that it "looks like that whole 'gamification' thing is over". According to Burke (2014), the reason that organizations and researchers were moving away from the concept of gamification was because "not many were getting it right". The Hype Cycle of Emerging Technologies in 2014 suggested that majority of the organizations were applying the concept without a clear understanding of the same. The technique was proving to be ineffective because the lack of understanding resulted in incorrect application and not because Gamification was an ineffective technique (Rivera and Van der Meulen, 2014).

The Gartner Hype Cycle for 2017 showed that Gamification is poised for large scale adoption in the next couple of years (Panette, 2017). While studies in the area have increased in the last five years, the number of studies still appear to be low. During the literature review for the current study, the researchers were able to identify only 112 empirical studies conducted in the last five years, in the area of Gamification. While the review was restricted to the ProQuest databases, to ensure quality, the number is still considerably low. Thus, the current study attempted to understand how the learner responds to a gamified module. The objective of the study was to understand the factors that could predict learning outcomes in a gamified scenario. The study is a part of a series of studies that the researchers propose to undertake in the area of gamification. The findings of the study would provide insights to practitioners and researchers with regards the effectiveness of the process of Gamification and the factors that could influence the success of a gamified learning process.

2 LITERATURE REVIEW

The concept of Gamification is relatively new. To better understand how the concept has evolved and been studied, the researchers conducted a two-fold review of literature. The first step involved understanding the theoretical framework for gamified learning by reviewing the commonly cited theories. The second step was the review of studies that have explored the area of Gamification.

2.1 THEORETICAL FRAMEWORK

The number of theories related to the construct of Learning are many. Some of the most commonly cited theories, in studies of gamified learning, include the Self-determination Theory, The Experiential Learning theory and Input-Process-Output theory of learning. These have contributed to the creation of the Theory of Gamified Learning (Landers, 2014).

The Self-determination Theory is one of the first macro theories that linked motivation, development and wellness (Deci & Ryan, 2008). The theory treated motivation as two types, namely, controlled and autonomous, while also distinguishing it from the concept of amotivation. Autonomous motivation is more intrinsic in nature and arises from the belief that there is some value to be gained from participating in an activity. On the other hand, controlled motivation, stems from the expectation of punishments or rewards or from an individual's need for approval, self-esteem requirements and other ego related outcomes. While both would drive behaviour, amotivation would prevent the individual from participating. The SDT suggests that in the learning process, one must focus on creating Autonomous Motivation. This would make the learning process a continuous process. In addition, the need to experience mastery, control outcomes, to interact and relate to others and to remain the causal agents of ones' own life would ensure the learning process is a success.

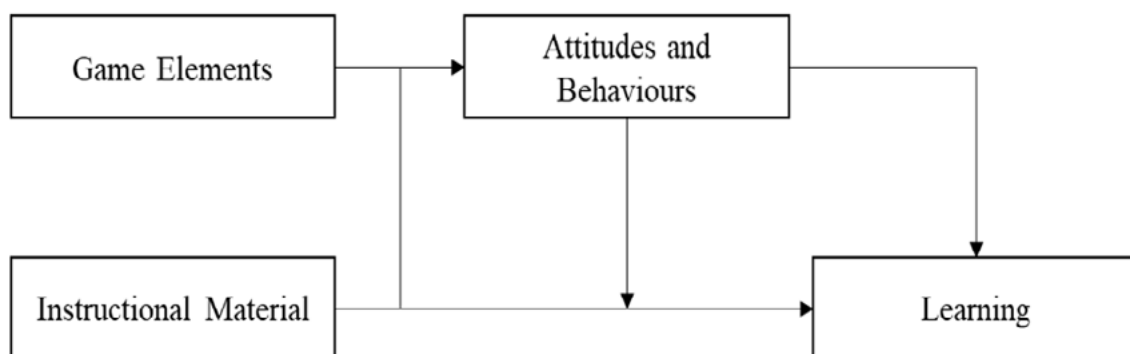
The Experiential Learning Theory, suggested by Kolbe (1984) has been credited for the shift from trainer focused learning to trainee focused learning interventions. There are six major propositions to be drawn from this theory. Firstly, Learning is a process and not an outcome. Secondly, the process is continuous and includes learning and relearning. Third, the process requires the learner to move between learning and reflection. Fourth, the process must be designed as a holistic system and must include positive interactions between the learner and their environment. Lastly, the process must be considered a collaboration for the creation of knowledge.

Garris et. al. (2002) have further built on the propositions of the ELT. While the ELT suggests that learning is a continuous process, the Input-Process-Output Model (Garris et. al. 2002) suggests that only Learner Motivation can make the process continuous. The model proposes viewing the learning

process as three major steps. The first step involves the design and creation of instructional material. This material must trigger the cycle of learning loop. This loop must then result in the third phase of learning outcomes. Thus, if the learning process must achieve the required outcome, the process must be aligned correctly and instructional design must motivate the learner to participate and revisit the learning. In this aspect, the process of gamification has been considered beneficial as the game elements are expected to increase learner motivation and thereby improve learner participation in the process.

Landers (2014), proposed a theoretical framework, specific to Gamification. While he believed that borrowing taxonomy from related concepts was acceptable, the understanding of the process would be incomplete without a theory. His theory draws from the area of Serious games and has been adapted to explain the role of Game Elements. The model has been presented as Figure 1.

Figure 1: Theory of Gamified Learning



The first relationship proposed by the Theory of Gamified Learning is a direct relationship between the instructional material and the learning outcomes. This relationship has been explored and empirical evidence for the relationship is available (Arthur et. al. 2003; Seidel & Shavelson, 2007). The second proposed relationship explains the role of learner attributes and behaviours on the learning process. The third proposition suggests that the Game Elements would directly influence the learner's attitudes and behaviours. The fourth and fifth propositions are the key relationships to the understanding of Gamification. The fourth proposition explores the moderating role of game elements, suggesting that game elements would influence the learner attitudes and behaviours and thereby influence relationship between the instructional material and learning outcomes. The last proposition suggests that the game elements would also directly impact the learning outcomes by encouraging the required learner attitudes and behaviours. This relationship of mediation is expected to be the primary role played by gamification (Hamari, Koivisto, & Sarsa, 2014).

Taking into consideration the increased use of technology, Landers and Armstrong (2017) also proposed the Technology Enhanced Training Effectiveness Model or TETEM. They propose that the effectiveness of any learning process in a technologically enhanced environment would depend on two sets of factors. The first set deals with the learner's personal characteristics and includes their Attitude towards Video Games and their Experience with Video Games. The second set of factors is related to the organizational culture and perceived supervisory support for gamified activities.

2.2 EMPIRICAL AND CONCEPTUAL LITERATURE REVIEW

Gamification has been defined as the application of game elements to a non-game context (Deterding et. al. 2011). This definition suggests two main features of the concept of Gamification. The first is that Gamification is a process and not the outcome (Landers, 2014). Thus, a learner cannot learn from Gamification but Gamification can be used to enhance the learning process. Secondly, Gamification involves the use of game elements. These elements act as building blocks in the process and are used to create the final product. Landers (2019), stresses on the need to understand the application of these elements. He stresses that organizations and practitioners jump to the application without understanding the purpose and the audience first. This is the major cause for the failure of the process.

The popularly considered game elements are; Points, Leader boards, Achievements or Badges, Levels, Story or Theme, Clear Goals, Feedback, Rewards, Progress and Challenge. Bedwell and colleagues (2012) provided a list of attribute categories that they believed existed in every game; Action Language, Assessment, Challenge, Environment, Game Fiction, Rules, Interaction, Immersion and Control. This was then adapted by Landers (2014) and applied to the field of gamification.

The second part of application of the elements has been made simpler through the creation of a number of frameworks. One popularly used framework is the Octalysis framework (Chou, 2015). This framework proposes that all human action is driven by a need, also called the core drives. In order to improve or enhance any learning process, there is a need to first identify the core drive that one would like to target and then apply the corresponding game elements. Other such models include the Game Frame by Dignan (2011). The model provides a method for application of game elements to a context and the creation of a game-like scenario.

Gamification has been studied in both the Academic and Organizational Context. Researchers have attempted to evaluate the perception towards Gamification, the impact on behavioural outcomes like knowledge sharing (Suh and Wagner, 2017), learning in the organization (Trimblett, 2016; MacKinnon et. al., 2015; Andriamiarisoa, 2018) and learner engagement (Sargent, 2017; Trimblett, 2016). Gamification

has also been found to improve learner reaction to training (Armstrong, 2015). However, in the same study, they did not find a statistical difference between the pre-test and post test scores. This indicated that while the learner reaction was significantly higher through gamification, there was some doubt regarding the increase in declarative knowledge.

Based on the theoretical framework and the studies reviewed the researchers arrived at the following Hypotheses;

H1: A Gamified module would result in increase in knowledge.

H2: In a gamified context, the pre-training valence would significantly predict Learning.

H3: In a gamified context, the pre-training valence would significantly predict Reaction to the training.

H4: In a gamified context, the participant's attitude towards technology would significantly predict Learning.

H5: In a gamified context, the participant's attitude towards technology would significantly predict Reaction.

H6: In a gamified context, the participant's experience with technology would significantly predict Learning.

H7: In a gamified context, the participant's experience with technology would significantly predict Reaction.

3 METHODOLOGY

The current study adopted a One-shot methodology. Students of the Masters in Business Administration program were chosen for the experiment and the module was presented to them as part of their regular classes. The module covered recent developments in Training and Development. The data for the study was collected before and after the module. The Learning was measured through a pre and post, conceptual test. The reaction to the module (R) was recorded through a modified version of the Kirkpatrick Learner centric scale. The valence (V) scale was adapted from the Learner Engagement scale (T-VIES-it). The Attitude towards Technology (A) and Experience with Technology (E) scales were adapted from Bourgonjon (2010). The reliability scores of the scales has been presented in Table 1.

Table 1: Reliability of Scales

Scale	Reliability
E	0.773
A	0.834
V	0.918
R	0.893

Sixty-one students from the Masters in Business Administration course participated in the module. The initial data analysis revealed 55 data sets that could be used for the final analysis.

4 ANALYSIS

The first step in the analysis involved the descriptive statistics of the variables. The descriptive statistics for the variables have been provided in Table 2.

Table 2: Descriptive Statistics

	N	Mean	Std. Deviation	Skewness	Kurtosis
E	55	4.1455	.52452	.091	-.273
A	55	4.0364	.46002	.426	.675
R	55	4.0182	.42338	.219	.850
V	55	4.2000	.52364	-.307	.842
Learning	55	2.62	2.03	-.459	1.259

The Skewness and Kurtosis values were within the acceptable range, allowing the researchers to treat the data as normally distributed. The researchers then analysed the correlation between the variables. The results of the analysis are provided in Table 3.

Table 3: Correlations

	E	Learning	A	R	V
E	1				
Learning	-.181	1			
A	.714**	-.067	1		
R	.395**	-.051	.611**	1	
V	.185	-.077	.302*	.558**	1

The analysis of correlation suggest that the variable was not significantly correlated with any of the other variables. In order to test if learning had taken place, the researchers conducted a paired sample t-test on the pre-test and post test scores. The Paired Sample Statistics provided in Table 4 shows that the mean value of the post test is 7.04 and higher than the mean value of the pre-test (4.42). The significance value of the t-test, provide in Table 5, suggests that the difference is statistically significant ($p < 0.05$).

Table 4: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed)
Pair 1 Learning 2	7.04	55	1.742	.235		
Pair 1 Learning 1	4.42	55	2.034	.274	9.56	0.000

The results suggest that the intervention resulted in learning for the participants. Since the variables of Reaction, Valence, Attitude towards Technology and Experience with Technology were not found to be correlated with Learning, the researchers only used Reaction as the dependent variable for the model analysis. The model was analysed using PLS. The first step in the analysis of the model was the analysis of the measurement model. The values have been provided in Table 6.

Table 6: Analysis of Measurement Model

Scale	Composite Reliability	AVE	HTMT Ratios			
			E	A	V	R
E	0.860	0.672				
A	0.847	0.581	0.697			
V	0.909	0.768	0.212	0.355		
R	0.899	0.509	0.344	0.683	0.651	

One indicator EE3 had to be removed to achieve discriminant validity. The list of indicators and the codes have been provided in the annexure. The next step involved the analysis of the Structural Model. The values have been provided in Table 7.

Table 7: Structural Model Analysis

Variable	VIF	R ²	f ²	Q ²
E	1.000	0.462	0.893	0.155
A	1.121	0.719	1.038	0.083
V	1.121		0.776	0.107

The VIF values suggest that there does not exist any collinearity among the independent variables. The f^2 values or effect sizes suggest that the exogenous variables significantly predict the endogenous variables ($f^2 > 0.35$). The q^2 values suggest that the model has predictive relevance. This implies that the model would hold true in another sample as well.

The direct paths were first analysed and it was found that Experience with Technology did not significantly predict the Reaction to the training. The researchers then analysed if the indirect path was significant. The final model has been presented as Figure 2.

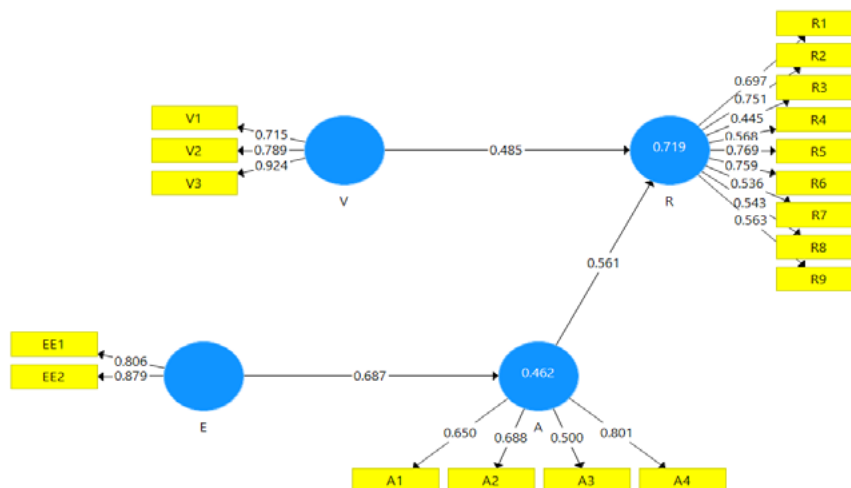


Figure 2: Model Analysis

All the paths were found to be significant in the model ($p < 0.05$). The model was found to predict 72% variance in trainee reaction to training. The path between Experience and Reaction was found to be significant, suggesting that the attitude towards technology fully mediated the relationship.

Table 8: Path Analysis

	Direct Path	t Value	P Value
V -> R	0.485	3.401	0.001
A -> R	0.561	3.433	0.001
E -> A	0.687	4.611	0.000

A summary of the hypotheses analysis has been provided in Table 10.

Table 10: Summary of Hypotheses testing

	Hypothesis	Decision
H1	A Gamified module would result in increase in knowledge	Accept
H2	In a gamified context, the pre-training valence would significantly predict Learning	Reject
H3	In a gamified context, the pre-training valence would significantly predict Reaction to the training.	Accept
H4	In a gamified context, the participant's attitude towards technology would significantly predict Learning	Reject
H5	In a gamified context, the participant's attitude towards technology would significantly predict Reaction	Accept
H6	In a gamified context, the participant's experience with technology would significantly predict Learning	Reject
H7	In a gamified context, the participant's experience with technology would significantly predict Reaction	Accept

5 DISCUSSION

In the current study, the researchers have attempted to understand the impact of Valence, Experience with technology and Attitude towards technology on the learning outcomes of Learning and Reaction. Provided by Kirkpatrick (1959), the first two levels of training evaluation are represented by the learner's reaction to the learning process and the knowledge gained through the process. The researchers restricted the evaluation to the first two levels because the intervention was carried out in a classroom context. The students were explained the objectives of the course and the design of the modules prior to the intervention. They were then asked to record their responses to the valence, attitude towards technology and experience with technology questionnaires. A pre-test was conducted to measure the level of knowledge, prior to the training. The same questions were again presented at the end of the module to measure the knowledge, post the module. The reaction to the training was also recorded after the module.

The first assumption was that gamification would result in learning. This was tested through the pre-test and post test scores. The paired sample test revealed that there was a statistically significant difference between the pre and post test scores. This suggests that the gamified module did result in an increase in knowledge. This finding was contrary to the findings of Armstrong (2015). In their study

they found that although Gamification improved the reaction to the modules, there was no statistically significant increase in the level of knowledge.

The second and third assumption explored the role of pre training valence. The relationship was hypothesised from the Theory of Gamified Learning (Landers, 2014). In the current study, Valence was found to be significantly correlated to the participant's reaction to the learning experience but not correlated to the level of learning. Thus, while valence was found to significantly predict the level of Reaction, it was not found to be significant in predicting the level of learning. There was a significant, positive correlation found between valence and reaction ($r=0.56$) and the direct path between valence and reaction was also found to be significant in the model.

The third and fourth assumptions were based on the Technology Enhanced Training Effectiveness Model (Landers and Armstrong, 2017). The model suggested that the participant's attitude towards video games would moderate the effectiveness of the gamified module. The researchers adapted the relationship and attempted to understand the relationship between the learner's attitude towards technology and the learning outcomes of Learning and Reaction. The findings of the study suggest that the attitude towards technology did not have a significant relationship to the learning from the module. However, the attitude towards technology had a significant positive correlation with the reaction towards the learning experience. It was also found that the attitude towards technology was significant in predicting the learner's reaction to the module. While there appeared to be a significant relationship between the attitude towards technology and pre training valence, the final model analysis revealed that the path was not significant and that the learner's attitude towards the use of technology did not predict the pre training valence.

The last two assumptions were also borrowed from the TETEM (Landers and Armstrong, 2017). The model suggested that the experience with video games would moderate the effectiveness of the learning process in a gamified module. The findings of the study suggest that while the Experience with technology did not have a significant relationship with Learning, it did have a statistically significant relationship with Reaction to the training. However, the path analysis revealed that the Experience with technology did not directly predict the Reaction to the training but that the relationship was mediated by the learner's attitude towards the use of technology in a training program. Thus, Experience could predict the Attitude ($R^2=0.462$), which would in turn impact the learner's reaction to the gamified module.

The final model suggests that the pre training Valence, Attitude towards the use of technology and Experience with Technology were significant in predicting the learner's reaction to the gamified training

module. The three variables were found to predict 72% variance in Reaction and the model was found to have predictive accuracy and out-of-sample predictive relevance.

6 IMPLICATIONS

The findings of the study provide two main implications for practitioners and researchers. The first is that there is a statistically significant difference in the means scores of the pre-test and post-test. This suggests that the module has definitely resulted in Learning and increase in knowledge. The second major finding from the study is that the pre training valence and the personal characteristics were able to significantly predict the students' reaction to the training. Thus, the TETEM holds true, with the experience with technology influencing the attitude and thereby the learner's Reaction to the training. Thus, if an organization is looking to adopt the process of gamifying training modules, the target audience must be understood in terms of their attitude and experience with technology to ensure the success of Gamification. As researchers, the relationship between Experience, Attitude and Reaction provides an additional angle that must be explored while studying gamification.

7 LIMITATIONS

The current study used a one-shot methodology. The validity of the study would have been higher had a control group been chosen for comparison. However, the researchers chose to include all students in the intervention, as the number of participants was not sufficient for random control testing. Further research would be required to establish the relative effectiveness of gamification as compared to a traditional module.

8 CONCLUSION

Gamification is a powerful tool to enhance any context. It's application to the Learning process has received significant focus in the last couple of years, as organizations and academicians attempt to enhance learning experiences through the application of game elements. Literature and researchers stress the need to understand the audience and context of the experience prior to the application. While the application and the elements form a critical part of the process, this perspective indicates

the importance of the objectives and the learner characteristics. The Technology Enhanced Training Effectiveness Model proposes two key learner characteristics that may impact the effectiveness of the gamified experience; the learner's attitude and experience with video games. Broadening the scope of the two characteristics, in the current study the researchers explored the relationship between the variables of attitude and experience with technology, pre training valence, reaction and learning. The objective of the study was to understand the relationship between the variables in a gamified learning experience. While the learner characteristics and valence did not show a significant relationship with the learning or changes in knowledge level, they did significantly predict the reaction to the training. The intervention was also found to result in increased knowledge as shown by the analysis of the pre-test and post test scores. Thus, the gamified module resulted in increase in knowledge and the variables of valence, attitude towards technology and experience with technology were found to significantly predict the learner's reaction to the gamified experience.

Declarations

- The authors also certify that they have no known conflict of interest to report and that the study has not received funding from any individual or organization.
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