Impact of Gamification on Student Learning Outcomes Using Social Learning Theory

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Educational institutions are continually revising their strategies on the quality of education at all levels to prepare students for labour markets. The instructor needs to offer the courses in a more meaningful way because conventional teachings are inadequate for the modern generation with a shorter attenti[1]on span. The most topical development is game-based learning, that allows the introduction of appropriate games in the classroom. The goal of this study is to look into how gamification in the classroom, through various gamification tools and user experience in playing games, affects students' learning abilities (cognitive, affective, and behavioral), as well as motivation.

Keywords: Gamification, Self-determination theory, Social Learning, Improving classroom teaching, Interactive learning environments, Teaching/learning strategies

1. Introduction

Technology adaptation has brought improvements across all age groups. This new technology has changed the way we do things historically. According to reports, the average person spends about 3 hours 30 minutes per day using mobile internet, and this amount of time is increasing on an annual basis. This transition has generated a need for organizations to atone for the use of technology, particularly the education industry. Approximately one-third of students drop out of university in their first year due to a lack of motivation to learn (Paura & Arhipova, 2014). Student dropout is the result of a lack of information, which typically leads to learning problems as well as behavioral and emotional issues (Freeman & Simonsen, 2015). Furthermore, students who do not leave the educational system and complete their degrees exhibit a high level of disinterest and frustration in the learning process, believing that the time spent studying is truly boring (Heublein, 2014). As a result, it is critical to develop new approaches to increasing student participation in the teaching-learning process.

Several approaches have been developed to increase the interest of students and to inspire students particularly through educational games which is known as “gamification” in learning (Hamari et al, 2014). The term "gamification" was defined by Deterding et al., (2011) as "the use of game design elements in non-game contexts," which is the most widely accepted definition to date. Playing games in past used to help with social growth and social life because it encouraged formal and informal learning. Games are frequently used to assist users in completing a task in a more enjoyable manner. With the help of game design elements, this promises user engagement, inspiration, allegiance, and fun (Deterding et al., 2011). Newer computer games were made possible by recent computer technology, which made games more accessible. Through the advent of the internet, it is now possible to host a large number of players in a collaborative manner at the same time. The creation and implementation of computer-based simulations is a significant advancement in the use of models to aid in problem solving. It is not surprising that the data shows an increase in the use of gamification in all sectors (Gartner, 2011). But how should gamification accomplish this in the field of education? Motivation could be an important factor.

Motivation is important in persuading people to act in certain manner. There are numerous motivation theories that address various aspects of the phenomenon. Two motivation theories that are particularly relevant in gamification research are discussed. The self-determination theory proposed by Deci and Ryan in 1985 can be used to further illustrate the motivation notion in gamification. According to Ryan and Deci, people are motivated to grow in order to find self-fulfillment. The two key assumptions of self-determination theory are: a) people are actively oriented toward growth, for example, "new experiences are necessary for developing a cohesive sense of self"; and b) the theory focuses primarily on internal forms of motivation, such as a desire to learn or independence (Ryan & Deci, 2000). Self-determination is a significant concept that refers to each individual's capacity to think, make choices and manage their lives. Overall, it has an impact on performance because people are more motivated to take action when they believe their actions will help to improve the perceived outcome. In addition, the theory validates three innate and universal psychological needs that motivate people to unfold: “competence, connection, and autonomy” (Deci & Ryan, 1985). Competence is defined as the ability to master a task and learn new skills. Connection or relatedness refers to people's desire to belong to a group and attunement. The need for people to feel in control of their own behaviors and goals is referred to as autonomy. Ryan and Deci explained that for this theory to work, the following factors must be present: social conditions, extrinsic rewards, and positive feedback, which can result in either proactive or passive behavior. The theory of self-determination has also been successfully applied in the context of games (Ryan et al., 2006). People have the ability to master a task and learn new skills, as well as a sense of attachment, which means they are doing it solely for the

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enjoyment of it. As a result, students have control over their behavior, which is one of the most important aspects of gamification.

The other theory that can be used to explain motivation appears to be Albert Bandura's Social learning theory, which emphasizes the importance of observing, simulations, and impersonating behaviors. This theory considers how environmental and cognitive factors directly influence human behavior. Albert expands on two key concepts in his theory. People who pay attention to behavior and encode it later, he claims, will imitate the behavior they observe. This is referred to as environment-based behavior learning, and it is accomplished through the process of observational learning. Furthermore, Bandura argued that there is a mediational process that serves as a "bridge" between traditional learning (i.e. behaviorism) and the cognitive approach. The cognitive approach entails knowledge and the development of intellectual skills, which are required for learning (Bloom, 1956). Skinner (1977) believes that humans are active information processors who consider the relationship between their behavior and their environment (McLeod, 2016). Bandura proposes four mediational processes for the cognitive model: attention, retention, reproduction, and motivation. Gamification attempts to use these four mediational processes to influence behavior in order to achieve student engagement.

In order to promote effective learning, transactional cognitive and affective domains interact significantly in instruction (Martin & Briggs, 1986). It is unknown whether the gamification process addresses the affective domain, which deals with one's feelings, attitudes, and emotions (Bloom, 1956). Affective learning inculcates experiential values and beliefs based on the information in which the person is engaged. It also refers to willingness to try new things. Although attitudes cannot be directly measured (Pierre & Oughton, 2007), this domain has a substantial impact on learning.

2. Review of Literature

Researchers in this field have demonstrated how to assimilate learning with games in non-game contexts, cultivating students' "*attention, interest, motivation, and social interaction*". (Shaffer, 2006; Shaffer et al, 2005; Gee, 2003). Many scholars agree that gamification benefits a target audience because games encourage users to err and try again, face learning without fear, and thus become more involved in the learning process (Stott & Neustaedter, 2013 and Lee & Hammer, 2011). In general, gamification effect results take on many dimensions that can be either positive, negative, mixed, or even null. It is due to gamification not having a similar effect on all participants. Nevertheless, many writers found it useful (Lin & Bhattacherjee, 2008; Hellwege & Robertson, 2012; González & Area, 2013). Looking at the studies most commonly cited in the literature, it is likely, according to Domínguez et al. (2013), to find signs of increased motivation at an early stage, but also of poor results, as well as an improvement in interest shown by marketing game users or the numerous effects of using game based tools. Many studies also highlighted the fact that there are demographic gaps with regard to the impacts of gamification and effectiveness (Venkatesh et al, 2000; Bagley, 2012; McDaniel & Fanfarelli, 2016). Other research found that feedback on success enhanced learning and decreased rates of failure (Bellotti et al., 2013). Roy and Zaman (2018), indicated there is no evidence for a novelty gamification effect. Previous studies in gamification have found that it has a positive effect on learner performance and study behavior from a self-determination motivational standpoint. In terms of desirable motivational effects, there were only minor differences between gamified and non-gamified environments (Alsawaier, 2018). Nonetheless, the introduction of games continues to be associated with intrinsic motivators and learning abilities.

2.1 Learning Environment for Gamification

It is critical to create an appropriate learning environment in order to achieve the desired behavior. The learning environment refers to the availability of classroom planning to foster user involvement and engagement. A suitable environment motivates, engages, and prompts them to finish the task at hand. The majority of studies focus on the competitive platform arrangements for providing games, such as MySQL, PostgreSQL, and so on, rather than the learner's favorable environment itself. Many earlier studies focused on virtual learning environments with design, system, material, and facilitators to see how users interact, and it was discovered that there is a positive relationship between student participation (Amriani et al., 2013). Classroom organization is critical because it can have a tangible effect on students. The emotional environment is a component of each of these classroom aspects (Hannah, 2013). Cheng (1994) discovered that both physical and psychological environments matter; "*a good learning environment is highly correlated with student learning efficiency*".

2.2 Cognitive, Affective Domain Influence on Behaviour

The three main domains of a person's learning ability are cognitive, affective, and psychomotor (behavioral). However, few efforts have been made to determine the relationship between these domains and study them as distinct entities (Micklich, 2012). The cognitive aspect of gamification includes processes such as "*attention, learning, language processing, problem solving, and memory*" (Mullins & Sabherwal, 2020). Gamification has been shown to improve working memory, problem solving skills, and overall learning. When compared to conventional training, gamified training increases motivation (Ninaus et al., 2015). In research on affective domain (emotion), there has been little agreement on core tenets such as sources, frameworks, or definitions of emotion (experiential value) (Mullins & Sabherwal, 2020). According to Hoover et al. 2010, experiential exercises do not guarantee the integration of experiences for behavioral components.

3. Conceptual Framework

We sought to determine whether the gamification process at university affects students' motivation differently by developing a research model (Fig 1) based on self-determination and social learning theories. To determine whether distinct gamification components a) "gamification tools such as matching, ordering, classification, and gamified element" and, b) user experience in completing the games within a given time frame have any effect on students' learning abilities, behavior and, motivation. The cognitive and affective domains of learning abilities are useful in establishing a motivational continuum. "*People may engage in behaviors over which they believe they have some level of control, and the behaviors may eventually align with something important to their self-concept*" (Cherry, 2021). Students who are self-determined are more likely to be motivated. This study also focuses on the learning environment's contribution, such as infrastructure in the form of IT labs, computers, connectivity, and plug points that provide positive learning opportunities. The following hypothesis derived in testing the relationship between the variables.

Gamification Tools and Cognitive - Return Intentions
H1: There is no significant difference between the gamification tools such as matching, ordering, classification and etc. with respect to the cognitive learning abilities.
User Experience and Cognitive – Return Intentions
H2: There is no significant difference between the user experience with respect to the cognitive learning abilities.
User Experience and Affective – Experiential Value
H3: There is no significant difference between the user experience with respect to the affective learning abilities.
Environmental Factors and Behavioural Aspects
H4: There is no significant difference between the environmental factor with respect to the behavioural influences.
Cognitive and Behavioural Aspects
H5: There is no significant difference between the cognitive abilities with respect to the modelling behaviour.
Affective and Behavioural Aspects
H6: There is no significant difference between the affective abilities with respect to the modelling behaviour.
Behavioural Aspects and Perceived Learning Outcome: Motivation
H7: There is no significant difference between the behavioural influences and perceived learning outcome, motivation.

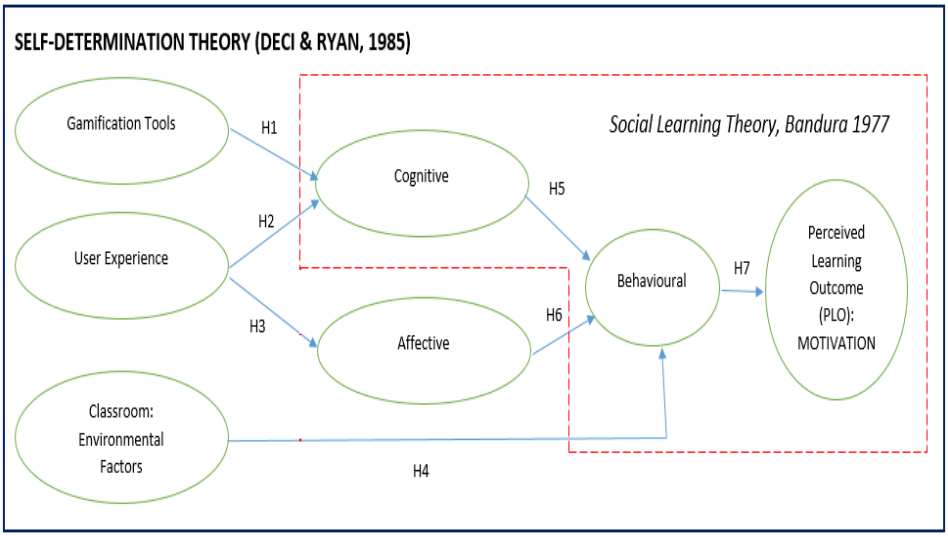

Figure 1: *Proposed Research Model*

4. Methodology

Data for this study were gathered using five-point "Likert" scale survey questionnaire. The questions were created using information gleaned from gamification literature. The questionnaire is divided into seven sections. The first three sections included questions to assess endogenous variables such as gamification tools, user experience, and environmental factors, while the remaining sections assessed exogenous variables such as cognitive, affective, behavioral, and motivation. The sample size for this research study is 172 students, with a response rate of 49 percent from 350 questionnaires distributed to university students in Malaysia and India. This figure satisfies the criteria for interpretive data analysis. The structural equation modeling (SEM) method was used to examine the questionnaire's reliability, and to test hypotheses.

5. Results

5.1 Respondent Demographic Profile

Males made up 51.16 percent of the 172 respondents, while females made up 48.84 percent. The respondents ranged in age from 18 to 55, with 93.02 percent being between the ages of 18 and 55, 5.82 percent being between the ages of 17 and under, and 1.16 percent being over 55. The majority of students, approximately 50%, are pursuing postgraduate studies, while 45.93%

are pursuing undergraduate studies and the remaining 4.07 percent are pursuing other courses. More than half of the respondents (66.86 percent) agreed that the course instructor regularly uses gamification software in the classroom, while 33.14 percent said they don't get to play any games regularly in class. Table 1 provides the summary of the demographic profile for the 172 respondents.

Table 1: *Respondents Demographic Profile (N=172)*

Variables	Percentage	Frequency
Gender		
Male	51.16	88
Female	48.84	84
Age		
17 and below	5.82	10
18 - 55	93.02	160
Above 55	1.16	2
Course enrolled		
Undergraduate	45.93	79
Postgraduate	50.0	50
Other	4.07	7
Frequency of playing games in classroom		
Frequent	66.86	115
Not Frequent	33.14	57

6. Data Analysis

The proposed research model's convergent and discriminant validity are validated to ensure the model's quality. All convergent validity criteria are met: all factor loadings on their respective constructs exceed 0.70, composite reliability of each construct exceeds 0.70, and all average variance extracted (AVE) values range from 0.674 to 0.792 (AVE > 0.50) and exceed the variance due to measurement error for that construct (Table 2). Discriminant validity is also supported because the square root of a construct's average variance extracted (AVE) is greater than any correlation with another construct (Table 3).

Table 2: *Descriptive statistics and results for convergent validity for the measurement model*

Constructs	Mean (SD)	Factor loadings	Cronbach's alpha	Composite reliability	AVE
Gamification Tools	2.162 (0.70)		0.737	0.884	0.792
G1		0.752			
G2		0.828			
User Experience	2.218 (0.71)		0.651	0.851	0.741
U1		0.791			
U2		0.832			
Environmental factor	2.337 (0.78)		0.757	0.861	0.674
E1		0.722			
E2		0.821			
E3		0.760			
Behavioural factor	2.286 (0.74)		0.829	0.897	0.745
B1		0.756			
B2		0.806			
B3		0.832			
Cognitive factor	2.196 (0.65)		0.897	0.928	0.764
C1		0.772			
C2		0.813			
C3		0.700			
C4		0.783			
Affective factor	2.133 (0.72)		0.843	0.905	0.761
A1		0.815			
A2		0.728			
A3		0.767			
Motivation	2.110 (0.62)		0.838	0.892	0.741
P1					
P2		0.758			
P3		0.743			

P4		0.826 0.833			

**(acceptable threshold values in brackets)*

Table 3 *Discriminant validity for the measurement model*

	Aff	Beh	Cogni	Environ	Gamifi	PLO	USer
Affect	**0.872**						
Behavioural	0.621	**0.863**					
Cognitive	0.777	0.668	**0.874**				
Environmen	0.463	0.714	0.506	**0.821**			
Gamifi	0.587	0.724	0.627	0.641	**0.890**		
PLO	0.796	0.628	0.774	0.494	0.622	**0.820**	
USer	0.608	0.542	0.731	0.438	0.569	0.639	**0.861**

**(values in bold: the square root of the average variance extracted for each construct)*

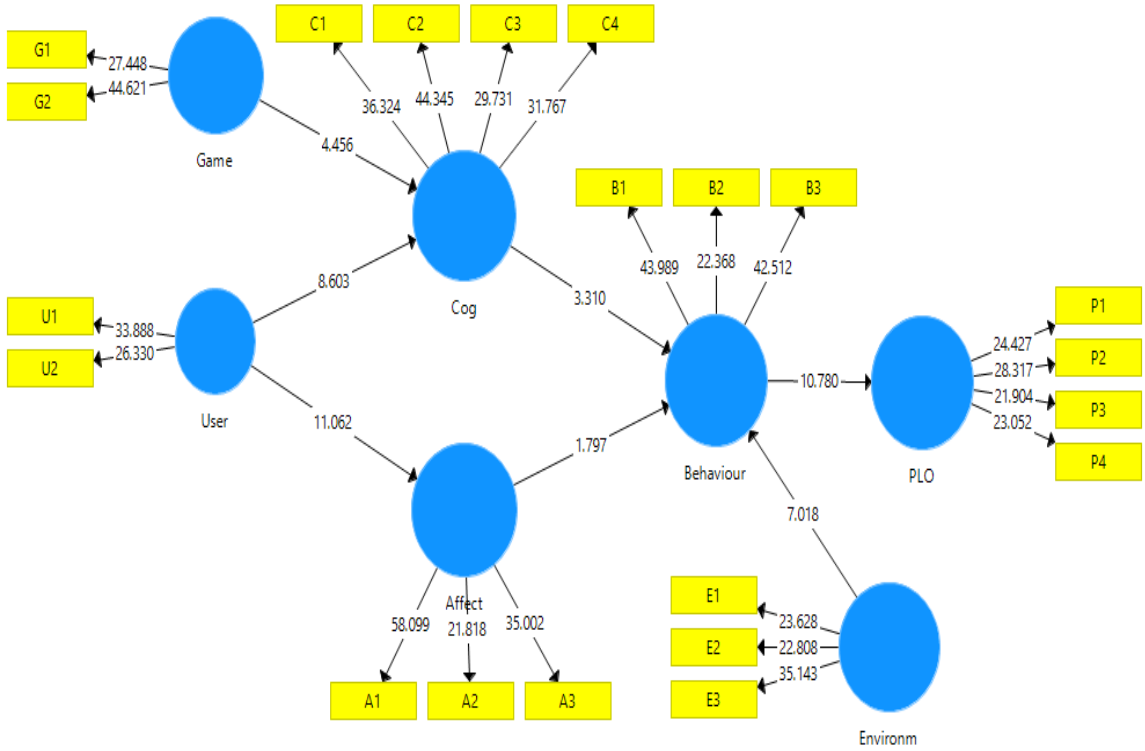

Figure 2: *Illustrative path model of the relationship among independent and dependent variables*

Table 3 *Hypothesis testing results*

Hypothesis	Path	Path Co-efficient	Result
H1	Gam→ Cognitive	4.456***	Supported
H2	User→ Cognitive	8.603***	Supported
H3	User → Affective	11.062***	Supported
H4	Environment→Behavioral	7.018***	Supported
H5	Cognitive → Behavioral	3.310***	Supported
H6	Affective → Behavioral	1.797	Not Supported
H7	Behavior→ per_motivation	10.780***	Supported

The structural model and hypothesis testing results are summarized in Figure 2 and Table 3. Figure 2 depicts the path coefficient for each path, as well as its significance *p0.1, **p0.05, ***p0.01 and R2 for each endogenous variable. Table 3 displays the statistical significance of the model's relationships. Gamification tools have an immediate positive impact on cognitive behavior (t=4.456). User experience has a direct positive effect on cognitive behavior (t=8.603) and with respect to behavioural factor, the cognitive factor (t=3.310); and environmental factor (t= 7.018) showed a direct positive effect but for affective behaviour (t=1.797) the path doesn't show significant relationship.

7. Conclusion

The proposed gamification framework contributes to gamification research by explaining how game design elements, user exposure and experience in handling games and environment factors can interact with cognition and emotions to produce desired behavior and learning outcomes. What can be inferred from the analysis is that; the tools introduced and usability affects cognitive skills in order to derive the positive behavior and to produce the intended learning, i.e. to motivate students to learn better. In order to increase learning resilience, instructional environment factors do promote positive reinforcement of behavior. Surprisingly, the affective domain refers to 'emotional immersion' that is not reflected, and because this emotion varies to some extent from one individual to the next, it has less influence on people's learning behavior and motivation. Although most gamification attitudes revolve around rewards, manageable tools combined with user experience, as well as an appropriate environment, do contribute to learning effectiveness. On the outset of gamification, there is a healthy skepticism.

8. References

1. Alsawaier, R. S. (2018). The effect of gamification on motivation and engagement. The International Journal of Information and Learning Technology.
2. Amriani, A., Aji, A. F., Utomo, A. Y., & Junus, K. M. (2013, October). An empirical study of gamification impact on e-Learning environment. In Proceedings of 2013 3rd international conference on computer science and network technology (pp. 265-269). IEEE.
3. Ninaus, M., Pereira, G., Stefitz, R., Prada, R., Paiva, A., Neuper, C., & Wood, G. (2015). Game elements improve performance in a working memory training task. International journal of serious games, 2(1), 3-16.
4. Bagley, K. S. (2012). Conceptual mile markers to improve time-to-value for exploratory search sessions (Doctoral dissertation). University of Massachusetts Lowell, Lowell, MA, USA.
5. Bellotti, F., Berta, R., De Gloria, A., Lavagnino, E., Antonaci, A., Dagnino, F. M., & Ott, M. (2013, July). A gamified short course for promoting entrepreneurship among ICT engineering students. 2013 IEEE International Conference on Advanced Learning Technologies, Beijing, China, 13. https://doi.org/10.1109/ICALT.2013.14
6. Bloom, B. S. (1956). Taxonomy of educational objectives. Vol. 1: Cognitive domain. New York: McKay, 20, 24.
7. Cheng, Y. C. (1994). Classroom environment and student affective performance: An effective profile. The Journal of experimental education, 62(3), 221-239.
8. Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining" gamification". In Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15)
9. Domínguez, A., Saenz-de-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013). Gamifying learning experiences: Practical implications and outcomes. Computers & education, 63, 380-392.
10. Freeman, J., & Simonsen, B. (2015). Examining the impact of policy and practice interventions on high school dropout and school completion rates: A systematic review of the literature. Review of Educational Research, 85(2), 205–248.
11. Gartner (2011). Retrieved from < http://www.gartner. com/it/page.jsp?id=1629214 > . Accessed June 1, 2021
12. Gee, J. P. (2003). What video games have to teach us about learning and literacy. Computers in Entertainment, 1(1), 20–20.
13. González, C., & Area, M. (2013). Breaking the rules: Gamification of learning and educational materials. Proceedings of the International Workshop on Interaction Design in Educational Environments, Portugal, 2. https://doi.org/0.5220/0004600900470053
14. Hamari, K., Koivisto, J., & Sarsa, H. (2014). Does gamification work? –a literature review of empirical studies on gamification. System Sciences (HICSS), 2014 47th Hawaii International Conference On (pp.3025–3034).
15. Hannah, R. (2013). The effect of classroom environment on student learning.
16. Hellwege, B., & Robertson, C. (2012, October). Entertain, engage, educate. Proceedings of Australian Computers in Education Conference, Perth, Australia
17. Heublein, U. (2014). Student drop-out from German higher education institutions. European Journal of Education, 49(4), 497–513.
18. Hoover, J. D., Giambatista, R. C., Sorenson, R. L., & Bommer, W. H. (2010). Assessing the effectiveness of whole person learning pedagogy in skill acquisition. Academy of Management Learning & Education, 9(2), 192-203.
19. Kenda Cherry, (2021, March 15). Self- Determination Theory and Motivation, https://www.verywellmind.com/what-is-self-determination-theory-2795387
20. Lee, J., & Hammer, J. (2011). Gamification in education: What, how, why bother? Academic Exchange Quarterly, 15(2), 146-151.
21. Lin, C.-P., & Bhattacherjee, A. (2008). Elucidating individual intention to use interactive information technologies: The role of network externalities. International Journal of Electronic Commerce, 13(1), 85-108. https://doi.org/10.2753/jec1086-4415130103
22. Martin, B. L., & Briggs, L. J. (1986). The Cognitive and Affective Domains: Integration for Instruction and Research. Englewood Cliffs, NJ: Educational Technology Publications, 35, 123-130
23. McDaniel, R., & Fanfarelli, J. (2016). Building better digital badges: Pairing completion logic with psychological factors. Simulation and Gaming, 47(1), 73-102. https://doi.org/10.1177/1046878115627138

24. McLeod, S. A. (2016, Febuary 05). *Bandura - social learning theory*. Simply Psychology. https://www.simplypsychology.org/bandura.html
25. Micklich, D. L. (2012). The Effect of Affective Domain Characteristics on Behavioral or Psychomotor Outcomes. In Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference (Vol. 39).
26. Mullins, J. K., & Sabherwal, R. (2020). Gamification: A cognitive-emotional view. Journal of Business Research, 106, 304-314.
27. Paura, L., & Arhipova, I. (2014). Cause analysis of students' dropout rate in higher education study program. Procedia-Social and Behavioral Sciences, 109, 1282-1286.
28. Pierre, E., & Oughton, J. (2007). The Affective Domain: Undiscovered Country. College Quarterly, 10(4), 1-7.
29. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American psychologist, 55(1), 68.
30. Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. Motivation and emotion, 30(4), 344-360.
31. Shaffer, D. W. (2006). How computer games help children learn. Macmillan.
32. Shaffer, D. W., Squire, K. R., Halverson, R., & Gee, J. P. (2005). Video games and the future of learning. Phi Delta Kappan, 87(2), 105–111.
33. Stott, A., & Neustaedter, C. (2013). Analysis of gamification in education. Retrieved from http://clab.iat.sfu.ca/pubs/Stott-Gamication.pdf
34. Van Roy, R., & Zaman, B. (2018). Need-supporting gamification in education: An assessment of motivational effects over time. Computers & Education, 127, 283-297.
35. Venkatesh, V., Morris, M. G., & Ackerman, P. L. (2000). A longitudinal led the investigation of gender differences in individual technology adoption decision-making processes. Organizational Behavior and Human Decision Processes, 83(1), 33-60. https://doi.org/10.1006/obhd.2000.2896