Improving Children's Oral Hygiene Habits in Sri Lanka via Gamification

RA Kumarajeewa[*] and PGSA Jayarathne

Department of Marketing Management, Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

ABSTRACT

The researchers seek to provide a Gamification model that will help children of Sri Lanka improve their oral hygiene habits, thereby acting as a change agent to influencing adults' behaviors to have good oral hygiene habits. The nature of the study was a multi-method due to its complexity. The study took place within 13 weeks, where data was longitudinally collected from 50 families in a natural environment. Both descriptive statistics and quantitative methods were used to analyze the data. Our findings suggest that expedient designs need to consider all four clusters, namely System Design, Challenges, Rewards, and Social Influences, as interdependencies among these clusters enable and amplify the effectiveness of Gamification. Our findings should be of particular interest since they generally show vast potential to motivate children through Gamification. Organizations should not see Gamification as a 'magic bullet' for end-user motivation but as a means that must be carefully and deliberately integrated into the model to support a motivational culture that would prompt sustainable behavior.

Keywords: Oral Hygiene, Gamification

INTRODUCTION

With the rise of corporate social responsibility, many theorists have started to question the purpose of the company or the brands. Suppose business leaders begin to think of their brands as a machine generating profits. In that case, there will be a high probability of a lack of emotional commitment towards a brand amongst a consumer. Conversely, by instead recognizing an emotional perspective of the brand, the brand could increase its likeness in the minds of customers. Previous studies show that humanistic or emotional and purpose-driven practices benefit the corporate brand, including those related to financial performance and brand perception (Post et al. 2002).

Oral care products, a daily consumer product, hold a major share in the global markets. High competition exists in the Sri Lanka oral care space with numerous multinational and domestic brands each having their own set of marketing strategies such as toothpaste offered to different age category product aimed for different regions in the country and products with different functional benefits. Hence brands should thrive on creating a competitive edge over their competitors.

Marketing at old age meant having a great product and a great logo, reaching people, and selling them a solution that would ensure the making of a great brand. While the basics of the brand-building remain the same, the language in which marketing is done has undergone a sea change. Brands, today, must stand for something, but that something can't be just anything either. This is what brands today are traversing. To remain relevant and to survive, brands today have to be purpose-led.

"Poor oral health care can result in poor overall health" (George Taylor)

Health is the extent of a living organism's metabolic and functional efficiency. When it comes to humans, it is the ability of individuals or communities faced with physical, mental, or social changes to adapt and self-manage (Grad, 2002). The World Health Organization (WHO) defined health in its broader sense in its 1948 constitution as *"a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."* Poor dental hygiene in the community has several effects on society. One of these effects is physical pain which leads to sleeping problems, eating problems, and behavioral problems, all of which at such a young age should be

avoided as much as possible. The fact is that the little attention paid to the issue of oral hygiene, especially in the developing countries, could be fatally dangerous in advance cases such as in patients with oral cancer, which is the eighth most common worldwide cancer. Hence the prevention of dental problems is of utmost importance for a country. Accordingly, the American Dental association policy defines oral health as a functional, structural, aesthetic, physiologic, and psychosocial state of well-being essential to an individual's general health and quality of life. Good quality of life is possible if students maintain their oral health and become free of oral disease.

When we think of how values are 'transmitted' from one generation to another, the typical idea is that of adults socializing their children, instilling in them values that are in accordance with those of the parents. Traditionally, socialization theories viewed the value development of children was due to parental influence (e.g., Kuczynski et al., 1997). However, the idea that children are 'blank slates' to be affected by parental intervention is no longer accepted (e.g., Harris, 1995; Maccoby, 2000). One result of this conceptual change is that children too can influence their parents' behavior (Ambert, 2001; Kuczynski, et al., 1997).

Children love to play - it's what makes Children. Adding game elements to educate them can be a perfect recipe for success, having children playing and enjoying themselves while learning. It's been proven that children learn through emotion. Other studies have looked at the positive outcomes of games when they are used as a source of information and enhance children's learning (Mitchell & Saville-Smith, 2004; Baghaei et al. 2016; Yusoff & Shamshirband, 2018). Computer games have intrigued many researchers because of their potential to entice and engage the player's attention for extended periods of time (de Freitas 2018). Therefore, Gamification can have a significant effect a child's learning development. Hence, the researcher seeks to provide a Gamification model that will help children learn the importance of oral hygiene and act as a change agent to change s in influencing adults' behaviors to have good oral hygiene habits.

LITERATURE REVIEW

Oral Care

Oral health is a major public health issue affecting all groups of the population. Poor oral health during childhood is directly associated to poor oral health outcomes in childhood and throughout adulthood, as people remain susceptible to developing dental caries throughout their lives (Kawashita et al., 2011). Previous studies have demonstrated the link between oral health and other health issues, for example, early childhood caries (ECC) can lead to comorbid health issues, including diabetes and cardiovascular disease (Kawashita et al., 2011). The World Health Organization (WHO) understands the major impact oral health has on the health of an individual, as well as the population, and has placed major emphasis on improving oral health in all populations.

The Influence of Children on Their Parents' Values

Health education has deployed several approaches to educate children regarding health promotion and prevention matters. Improving the health of population groups as children of today has been an effective strategy for promoting good health. This has been proven over the years by multiple research and has found it easier to change unhealthy behaviors already established in adult populations (U.S. Department of Health and Human Services ,2007). The interactive approaches to health education have replaced the conventional approaches by that help children not only learn but also implement and teach others to improve in health at school, at home, and in their community.

A broader view of children as health change agents captures children as individuals who make things happen in different social environments. As agents, children are capable of strategizing and finding a way to change situations they face as well as controlling resources and constraints. Children can engage with health knowledge and skills and are not merely passive recipients of other people's care and interventions. Children's health agency has been reported in the literature (Christensen, 1998). More recently, Christensen (2004) has advanced the idea of the child as a health-promoting actor in the family context.

Gamification

According to Prensky (2001) motivation plays an integral part in the learning process. He argues that children today are not motivated by what's been included in the curriculum. Yet the same children are motivated and excited to play video games for extended periods of time. What is notable according to Prensky (2001) is that some children's attitude towards traditional teaching is the opposite of the attitude they have toward playing video games. By designing educational tools to be more engaging and motivating and then be integrated with the curriculum can enhance children's motivation and learning.

The term Gamification emerged in the early 2000s and has been the focus of increased attention since the beginning of the 2010s (Deterding et al., 2011; Werbach & Hunter, 2012). The core ideology behind Gamification is to use the motivational elements of video games by adding game design elements to non-game environments (Deterding et al., 2011).

METHODOLOGY

This study is carried out using multi-methods to achieve the research objectives (Dewasiri et al, 2018; Dewasiri et al., 2017). The first objective is achieved through a survey method, and the second objective is achieved through an experiment. Children are the unit of analysis. A questionnaire was used in the first phase of the study, and data was collected from 50 families with children. Fifty families with children are selected for the experiment for the second phase of the study. The study took place within 13 weeks in a longitudinal manner in a natural environment.
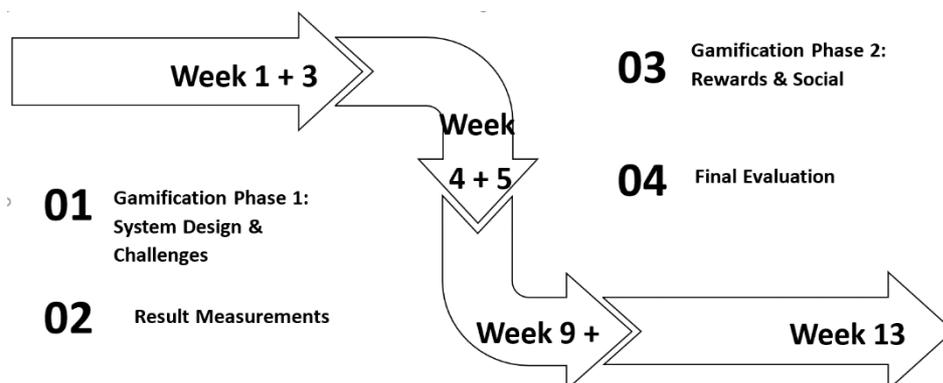

Figure 1: Overview of the methodology

Data Analysis

Table 1 shows the gender distribution of the respondents. It could be seen that they are fairly equally distributed between males and females with a ratio of 46:54. All of these parents have children between the ages of 0 to 12 years.

Table 1: Gender distribution

Gender	Frequency	Percentage
Male	98	46%
Female	115	54%
Total	213	100%

The questionnaire distributed gave an insight on how poor Children's knowledge was on Oral hygiene habits and identified the components needed to make the perfect Gamification model. Table 2 and Table 3 consist of the two elements, the components of each element we included, and the features we included in our pilot study to see how the children would react. The test was done over two weeks.

Gamification phase I

System design

Table 2: System design elements

Component	Feature
Reminder	Alert/notification
Meaning	Educational/Entertainment/Experimental
Interaction Concepts	Video of brushing teeth will be sent to us/we gave oral hygiene information once every week
Visually resembling exciting games	Score card will be maintained
Fantasy	Character Kits

Challenges

Table 3: Challenges elements

Component	Features
Goals	Complete tasks/missions
Time pressure	Brush teeth for 2 minutes/Change brush every month
Progressive Disclosure	Score cards will be put into mail or shared via mail to track progress

Based on the scorecards and observations, it was found that the system design and challenges are insufficient. Parents observed behaviors that are not sustainable in the long run, and they would merely brush their teeth because their parents force them to do so. Children found it difficult to brush their teeth for 2 minutes, and they were not motivated to do so.

Accordingly, Gamification phase 2 was introduced to incorporate the impact of motivators. This, too, was done for two weeks to see the effectiveness.

Gamification phase 2

Rewards

Table 4: Rewards elements

Components	Features
Ownership	Score card points, game currencies
Achievement	Level up options when you complete a task, Points being accumulated, ability to own virtual goods and currencies
Point System	Experience Points
	Reputation Points
	Redeemable Points
Badges	Ribbons were given for each level
Bonus	Physical goods

Social influence

Table 5: Social influence elements

Component	Feature
Loss Eversion	Points being reduced for each task unsuccessful
Status	Leaderboards/Levels
Collaboration	Joint Missions with Family
Reputation	Status level or titles
Competition	With other players
Envy	Leaderboards updated
Social Facilitation	Create networks for better reach

After we included the rewards and social influence elements, we saw tremendous growth in participation in challenges and proactiveness in the children's behavior. The experimental results supported that the children scored higher on involvement after including rewards and social influence than in phase 1. Hence, including all four elements of the model raised participants' degree of involvement during the experiment. These results are consistent with the research conducted by Buckley and Doyle (2014) about a gamified learning

intervention, and they concluded that Gamification has a positive effect on involvement and participation. The higher involvement of the participants in the gamified treatment addresses the feeling of higher relevance and motivation (Zaichkowsky, 1994) emanating from the gamified intervention.

FINDINGS AND DISCUSSION

System Design

As for the design of the Gamification model, feedback mechanisms are considered to be one of the most important mechanics. After an action is performed, immediate feedback and motivation are essential (Wang & Sun, 2011; Groh, 2012). Also, there must be a mechanism where the user is notified of wrongdoing and undo wrong actions (Sweetser & Wyeth, 2005). Using progress bars as a Gamification feedback mechanism will enable the user to know about false inputs (Huotari & Hamari, 2012). By performing several tasks, the user can gain a sense of gratification by looking at a progress bar. (Burke & Hiltbrand, 2011). Providing reminders of the user's wrongdoing will enable the user to rectify it (Liu et al., 2011). One of the following elements identified in system design is providing 'meaning'. (Gnauk et al., 2012). Showing the users how their actions can change their hygiene behavior for the better can create a sense of meaning. Further, using an attractive user interface with stimulating visuals can make the children's experience more enjoyable and more interactive. (Gnauk et al., 2012). The game should be exciting like Tetris, or make it more appealing to children by using fantasy elements (Li et al., 2012).

Challenges

Another important element in the Gamification model relates to implementing challenges. Challenging tasks in the model will guide users by designing challenges and rewarding them at the end (Bunchball, 2010). Formulating clear goals leads to enhanced user performance, for instance, by being satisfied after fulfilling a set goal (Bandura, 1993). In addition, when working on future tasks with similar goals, increased satisfaction plays a key role. Time pressures can also be adopted to create challenges.

Further, it should have a 'flow' which refers to how the users' skills perfectly align with the challenges. (Nakamura & Csikszentmihalyi, 2001). The user will not be bored by combining the aforementioned progressive disclosure

game mechanic and the flow. (Li et al., 2012) This can be achieved by making the model inflow that the level of difficulty will automatically adjust.

Rewards

The point system is widely used in Gamification (Zichermann & Cunningham, 2011). After successfully completing a task, a certain amount points will be sent to the user's account (Burke & Hiltbrand, 2011). By cumulating the points, it will motivate the user to be active. (Burke & Hiltbrand, 2011; Smith, 2011). For the point system to be successful, the designer should ensure that the user knows how the points are awarded and be transparent about it. Further, achievements should be given in the point system to maintain the smooth collaborative functioning of other game elements. (Hamari, 2013). Surprising rewards and badges will further motivate and explore the game (Burke & Hiltbrand, 2011).

Social Influences

In Gamification models, social influences play a significant role. 'Leaderboards' are very important since they will track and display actions. (Bunchball, 2010). This will improve competition amongst the players as it makes ones' performance visible, and updating the leaderboard will motivate them. (Depura & Garg, 2012; Burke & Hiltbrand, 2011). This is key in influencing the motivation of children. All humans in nature seek status and reputation. (Bunchball, 2010). These desires can be met by completing achievements and gaining level-ups. (Bunchball, 2010). Our study introduced family quests to promote collaboration and improve motivation. We can have family quests where families get together and partake in a challenge in our context. A Gamification model that supports collaboration may improve problem-solving processes, facilitate synergy effects and increase motivation. Motivation can further be increased by providing virtual gifts. (Nakajima & Lehdonvirta, 2013). Collaboration can be ensured by considering 'Social Facilitation' (Hamari & Koivisto, 2013). It states that individuals achieve better results when working in a group.

Proposed Gamification Model

Table 6: Proposed Gamification model

Name (# coded)	Description
System Design	
Reminder	History of the users' actions (Liu et al., 2011).
Meaning	"[…] Should consider the users background and the activity involved by considering the context […] The game elements need to come out of aspects of the underlying activity that are meaningful to the user" (Nicholson, 2012, pp. 2-5).
Interaction concepts	"The user interface should be visibly stimulating and exciting" (Gnauk et al., 2012, p. 105).
Visually resembling existing games	Creating an exciting visual interface (Korn, 2012, p. 315).
Fantasy	"By evoking images of objects that are imaginary it will facilitate the emotional appeal" (Li et al., 2012, p. 105).
Challenges	
Goals	Goals should be adapted as challenges (Passos et al., 2011).
Time pressure	Time Pressure should be included (Li et al., 2012).
Progressive disclosure	"By providing progressive disclosures of the users knowledge and the challenges. It will help the challenges match the users' skills level" (Li et al., 2012, pp. 105).
Rewards	
Ownership	"The ownership dynamic represents a positive, sustained connection to an entity that leads to a feeling of shared ownership" (Burke & Hiltbrand, 2011, p. 14).
Achievement	A reward given for completing a goal (Liu et al., 2011).
Point system	Point systems to be given for users for successfully completing task. (Burke & Hiltbrand, 2011).
Badges	"Badges consist of optional rewards and goals whose fulfilment is stored outside the scope of the core activities of a service" (Hamari, 2013, p. 2).
Bonus	Bonuses are rewarded for having completed a series of challenges or core functions (Burke & Hiltbrand, 2011).

Our study produced four key clusters in developing a successful Gamification model. Although we were able to motivate children through our field experiment, a random selection of elements is not necessary. To have an effective Gamification model, all four clusters discussed should be incorporated to amplify the effect.

Further special attention should be given to the setting of Gamification (Blohm & Leimeister, 2013). It should be noted that Gamification will not be suitable for every context, and every element of the model can be applied

effectively (Hamari, 2013). Hence, it is vital to fully understand the context in which a person hopes to use the model. (Rapp et al., 2012). Further, for Gamification to be effective children's affinity for games is crucial.

Using different systematic approaches, organizations might design the model poorly. Neeli (2012) proposed a three-step approach. The first step needs to assess the main task that will be Gamified. The second step should be to identify the objectives for different children involved (cf. Aparicio et al., 2012). Finally, the elements that are needed to motivate children should be identified. Thus, by following such systematic steps, the success rate will rise.

CONCLUSION

Based on the in-depth analysis provided, companies should realize that Gamification requires a proper design to succeed. The goal should be to get children motivated to engage in the game actively. Our study is the first to explain the Gamification elements necessary to promote good Oral hygiene practices. Our main contribution is identifying the cultures, and the clusters should be considered when applying and evaluating the intended approach. We explored a new context by promoting and educating children on good oral hygiene habits through Gamification. As illustrated in our findings, Gamification can motivate children, resulting in them learning more and adopting good Oral hygiene practices, thus spreading the word. In-depth case studies are needed to develop a theory for Gamification, and the long-term effects of using Gamification should be researched.

To foster the motivation of children to utilize the game model, we have taken an innovative approach. In addition, we highlight various elements and options that are crucial for companies to utilize as they show how they can motivate children through Gamification. Companies, therefore, should carefully and deliberately integrate the elements of the study into their model to create a motivational culture, thereby using it for the betterment their consumers.

CONFLICTS OF INTERESTS

The authors declare no conflicts of interest

REFERENCES

Ambert, A.M. (2001). *The Effect of Children on Parents* (2nd ed.). Routledge. https://doi.org/10.4324/9781315786452

American Dental Association Policy, Definition of Oral Health. Available from: www.ada-.org/en/about-ada/ada positions- policies-and-statements/ada-policy-definition-of oral-health

Aparicio, A.F., Vela, F.L.G., Sánchez, J.L.G. and Montes, J.L.I. (2012). Analysis and Application of Gamification. In Proceedings of the 13th International Conference on Interaction Persona- Ordenador, p. 1, ACM, New York, USA. https://doi.org/10.1016/j.ijhcs.2014.09.006

Baghaei, N., Nandigam, D., Casey, J., Direito, A., & Maddison, R. (2016). Diabetic Mario: Designing and Evaluating Mobile Games for Diabetes Education. *Games for health journal, 5*(4), 270-278. https://doi.org/10.1089/g4h.2015.0038

Bandura, A. (1993). Perceived Self-Efficacy in Cognitive Development and Functioning. *Educational psychologist, 28*(2), 117-148. https://doi.org/10.1207/s15326985ep2802_3

Blohm, I., & Leimeister, J. M. (2013). Gamification Design of IT-Based Enhancing Services for Motivational Support and Behavioral Change. *Business & Information Systems Engineering. 5*, 275-278. https://doi.org/10.1007/s12599-013-0273-5.

Buckley, P., & Doyle, E. (2014). Gamification and Student Motivation. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2014.964263.

Bunchball, I. (2010). Gamification 101: An Introduction to the Use of Game Dynamics to Influence Behavior (White Paper). Bunchball Inc.

Burke, M., & Hiltbrand, T. (2011). How Gamification Will Change Business Intelligence. *Business Intelligence Journal, 16*(2), 8-16.

Christensen, P. (1998). Difference and similarity: How chil-dren's competence is constituted in illness and its treatment. In I. Hutchby, & J. Moran-Ellis

(Eds.), Children and social competence: Arenas of action (187-202). London: Falmer Press. https://doi.org/10.4324/9780203975657

Christensen, P. (2004). Whymore 'quality time' is not on the top of children's lists. *Children and Society, 16*, 1-12. https://doi.org/10.1002/chi.709

De Freitas, S. (2018). Are games effective Learning tools? A review of educational games. *J. Educ. Technol. Soc. 21*(2), 74-84.

Depura, K., & Garg, M. (2012). Application of Online Gamification to New Hire Onboarding. 153-156. https://doi.org/10.1109/ICSEM.2012.29.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". In Proceedings of the 15th International Academic MindTrek Conference Envisioning Future Media Environments, p. 9, ACM, New York, USA. https://doi.org/10.1145/2181037.2181040

Deterding, S., Khaled, R., Nacke, L., & Dixon, D. (2011). Gamification: Toward a Definition. In CHI 2011 Gamification Workshop Proceedings, p. 1, ACM, New York, USA.

Dewasiri, N.J., Weerakoon, Y.K.B., & Azeez, A.A. (2018). Mixed methods in finance research: The rationale and research designs. International Journal of Qualitative Methods, 17, 1–13.

Dewasiri, N.J., Weerakoon, Y.K.B., Azeez, A.A., Jayarathne, P.G.S.A., & Weerasinghe, V.A. (2017). Triangulation Approach in Finance Research, 14th International Conference on Business Management, University of Sri Jayewardenepura, Sri Lanka.

Grad, F. P. (2002) . The Preamble of the Constitution of the World Health Organization. *Bulletin of the World Health Organization, 80*(12) , 981-984.

Gnauk, B., Dannecker, L., & Hahmann, M. (2012). Leveraging Gamification in Demand Dis- patch Systems. In Proceedings of the 2012 Joint EDBT/ICDT Workshops, p. 103, ACM, New York, USA. https://doi.org/10.1145/2320765.2320799

Groh, F. (2012). Gamification: State of the art definition and utilization. Proceedings of the 4th Seminar on Research Trends in Media Informatics. 39-46.

Hamari, J. (2013). Transforming Homo Economicus into Homo Ludens: A Field Experiment on Gamification in a Utilitarian Peer-to-Peer Trading Service. *Electronic Commerce Research and Applications, 12*(4), 236-245. https://doi.org/10.1016/j.elerap.2013.01.004

Hamari, J., & Koivisto, J. (2013). Social Motivations to Use Gamification: An Empirical Study of Gamifying Exercise. In Proceedings of the 21st European Conference on Information Systems, p. 1, ECIS, Utrecht, Netherlands.

Huotari, K., & Hamari, J. (2012). Defining Gamification: a service marketing perspective. In Proceeding of the 16th International Academic MindTrek Conference. Association for Computing Machinery, New York, NY, USA, 17–22. https://doi.org/10.1145/2393132.2393137

Kawashita, Y., Kitamura, M., & Saito, T. (2011). Early childhood caries. *International journal of dentistry,* 725320. https://doi.org/10.1155/2011/725320

Korn, O. (2012). Industrial Playgrounds: How Gamification Helps to Enrich Work for Elderly or Impaired Persons in Production. In Proceedings of the 4th ACM SIGCHI Symposium on Engineering Interactive Computing Systems, New York: ACM, 313-316.

Kuczynski, L., Marshall, S., & Schell, K. (1997). Value socialization in a bidirectional context. In J. E. Grusec & L. Kuczynski (Eds.), Parenting and the Internalization of Values: A Handbook of Contemporary Theory (pp. 23-50). New York, NY: Wiley.

Li, W., Grossman, T., & Fitzmaurice. G. (2012). GamiCAD: a gamified tutorial system for first time autocad users. Proceedings of the 25th annual ACM symposium on User interface software and technology. Association for Computing Machinery, New York, NY, USA, 103-112. https://doi.org/10.1145/2380116.2380131

Liu, Y., Alexandrova, T., & Nakajima, T. (2011). Gamifying intelligent environments. In Proceedings of the 2011 international ACM workshop on Ubiquitous meta user interfaces (Ubi-MUI '11). Association for Computing Machinery, New York, NY, USA, 7-12. https://doi.org/10.1145/2072652.2072655

Mitchell, A., & Savill-Smith, C. (2004). The Use of Computer and Video Games for Learning - A Review of Literature.

Nakajima, T., & Lehdonvirta, V. (2013). Designing Motivation Using Persuasive Ambient Mirrors. *Personal and Ubiquitous Computing, 17* (1), 107-126. https://doi.org/10.1007/s00779-011-0469-y

Nakamura, J., & Csikszentmihalyi, M. (2001). The Concept of Flow. In Handbook of Positive Psychology (Snyder, C.R.; Lopez, S.J. Eds.), p. 89, Oxford University Press, New York, New York, USA. https://doi.org/10.1093/oxfordhb/9780195187243.013.0018

Neeli, B. K. (2012). A Method to Engage Employees Using Gamification in BPO Industry. 3rd International Conference on Services in Emerging Markets, 142-146.

Nicholson, S. (2012). A user-centered theoretical framework for meaningful gamification. Proceedings GLS, 8.

Passos, E. B., Medeiros, D., Neto, P. S., & Clua, E. W. (2011). Turning Real-World Software Development into a Game. 2011 Brazilian Symposium on Games and Digital Entertainment, 260-269.

Post, J. E., Preston, L. E., & Sachs, S., (2002). Managing the extended enterprise: the new stakeholder view, *California Management Review, 45*(1), 6-28. https://doi.org/10.2307%2F41166151

Prensky, M. (2001). Fun, play and games: What makes games engaging. *Digital game-based learning, 5*, 1-5.

Rapp, A., Marcengo, A., Console, L., & Simeoni, R. (2012). Playing in the Wild: Enhancing User Engagement in Field Evaluation Methods. In Proceedings of the 16th International Academic MindTrek Conference, p. 227, ACM, New York, USA. 227-228. https://doi.org/10.1145/2393132.2393180

Sweetser P., & Wyeth, P. (2005). Game Flow: A Model for Evaluating Player Enjoyment in Games. *Computers in Entertainment. 3*. https://doi.org/10.1145/1077246.1077253.

Yusoff, Z. A., & Shamshirband, K. S. (2018), A survey of educational games as interaction design tools for affective learning: Thematic analysis taxonomy. *Educ. Inf. Technol. 23*(1), 393-418. https://doi.org/10.1007/s10639-017-9610-5

Zaichkowsky, J., L. (1994). The Personal Involvement Inventory: Reduction, Revision, and Application to Advertising. *Journal of Advertising, 23*(4), 59-70, https://doi.org/10.1080/00913367.1943.10673459

Zichermann, G., & Cunningham, C. (2011). *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps.* (1st ed.) O'Reilly Media, Sebastopol, USA.