The use of gamification to increase the users' empowerment in health-related behaviors

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Abstract

Social marketing aims to affect users' behaviors through various tools and one of these tools which is gamification has gained increasing attention in many behavior-changing programs. Gamification has been widely used, mainly to affect users' levels of capabilities to address various issues in their lives. Gamification has been highlighted as an important tool to support users in developing, shaping, and altering their cognitive and behavioral skills. Although gamification has provided evidence in addressing different psychological, cognitive, and behavioral issues, such systems rely more on extrinsic motivations. Then, more research should be directed toward understanding how gamification and different gamified mechanics can fulfill the needs or intrinsic motivations, and empowerment, of users to affect their behaviors. This issue made us find out considering the relationship between gamification and empowerment, which brings novel thoughts to the field of gamification and changing behavior. This research has employed three gamified mechanics, which had been found in previous research and deployed them in our developed gamified application, Gametunut. Seven scenarios, in the form of experimentation, have been created based on the combinations of the three mechanics. We have run quantitative analysis in each of these scenarios and compared the results attained in each of them. 55 responses have been gathered in each of the scenarios ($N_{total} = 385$) and the results have been analyzed through SPSS and Smart PLS. The results showed that there is a positive and meaningful effect of gamified experience created by the different mechanics on empowerment. This study provides a number of theoretical and practical contributions that might help practitioners in marketing and business experts to design and have more effective gamified programs addressing users' psychological and behavioral changing behaviors.

Keywords: gamification, empowerment, gamified experience, social marketing, users' motivations, changing behavior

Résumé

Le marketing social a pour objectif de modifier les comportements des individus en mobilisant différentes techniques. Parmi les techniques les plus récentes, la gamification, a fait l'objet d'une attention croissante dans de nombreux programmes visant à changer les comportements. La gamification est largement utilisée, principalement pour influencer l'aptitude des individus à faire face à divers problèmes dans leur vie. Il est apparu que la gamification est un outil efficace pour aider les individus à développer, façonner et modifier leurs compétences cognitives et comportementales. Bien les systèmes gamifiés aient montrer leur efficacité dans les différents problèmes psychologiques, cognitifs et comportementaux, ils reposent essentiellement sur des motivations extrinsèques. De nouvelles recherches sont donc nécessaires afin de comprendre comment les différents mécanismes de gamification peuvent agir sur les besoins ou les motivations intrinsèques, ainsi que sur l'empowerment de l'individu, ceci afin d'influer sur les comportements. Cette question nous a amenés à réfléchir à la relation entre la gamification et l'empowerment, et son effet sur le changement de comportement. Notre étude de terrain mobilise trois mécaniques de gamification, identifiées dans des recherches précédentes, et déployées dans une application gamifiée que nous avons développée, appelée Gametunut. Sept scénarios ont été créés sur la base des combinaisons des trois mécaniques. Nous avons effectué une analyse quantitative dans chacun de ces scénarios et comparé les résultats obtenus dans chacun d'entre eux. 55 observations ont été recueillies pour chaque scénarios ($N_{total} = 385$) et les résultats ont été analysés à l'aide de SPSS et de Smart PLS. Les résultats ont montré qu'il existe un effet positif et significatif de l'expérience gamifiée créée par les différentes mécaniques sur l'empowerment de l'utilisateur de l'application. Enfin, cette étude fournit un certain nombre de contributions théoriques et managériales qui pourraient aider les praticiens du marketing à concevoir des programmes gamifiés plus efficaces visant les processus psychologiques et les changements des comportements individuels.

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Introduction

Social marketing has been used widely to address a broad scope of health-related issues by using various practical tools (Giles and Brennan, 2015). In the field of social marketing, using new technologies such as gamification has gained much attention due to their availability and widespread usage by users (Saleme et al., 2020). This is particularly true for young people. Game technology can be referred to as an engine that is used to develop computer-based video games by integrating visual and aesthetic technology, digital platform, simulation, intelligent technology (or artificial intelligence), interactive technology, network technology, and multi-user operating technology (Guo et al., 2012; Zyda, 2005). Gamification, one subcategory of game technology, has been highlighted as a tool to support users in developing their cognitive behavioral coping skills in different health-related issues. Gamification has demonstrated direct and positive impacts on users' well-being, personal growth, and flourishing in the mental health domain (Johnson et al., 2016). Although there is strong evidence indicating the usefulness of gamification in addressing these issues, much work needs to be done to examine if the experience created by gamification can affect users' desires and motivations. In particular, these persuasive systems mostly rely on extrinsic motivations like social pressures or overt rewards (Oinaskukkonen and Harjumaa, 2009). So, more research should be directed toward understanding the effects of gamification mechanics on innate needs or intrinsic motivations, which might finally encourage health behavior changes (Johnson et al., 2016). Furthermore, the majority body of literature in the fields of gamification and healthy behaviors focused on behavioral reinforcements. These reinforcements are emphasized improvements in behavioral outcomes or reward systems, which are extrinsically motivating. So, there are still gaps in addressing the intrinsic motivation support, empowerment as an intrinsic motivational orientation (Johnson et al., 2016). Here, our main concept emerges: empowerment. Empowerment means giving power to somebody and more specifically, increasing intrinsic task motivation (Thomas and Velthouse, 1990). Psychological empowerment is not solely a sort of internal motivation, but also an active motivational orientation which are both necessary elements of proactivity (Seibert et al., 2011). Empowerment is seen as a motivational process whereby individuals' self-efficacy is enhanced, enabling them to accomplish an activity more effectively and efficiently or achieve their goals successfully (Hancer et al., 2005). Psychological empowerment differs from general intrinsic motivations since empowerment is an active internal motivation unlike other intrinsic motivations that are passive (Deci and Ryan, 2000). Empowerment has been clarified as an individual's experience of motivation that is based on cognitions about himself or herself in relation to his or her position (Spreitzer, 1995). So, this research is going to see how different gamification mechanics can affect users' health-related behaviors through empowerment. This research makes use of the previous literature and the existing gap to examine the effects of gamified experience (from different gamification mechanics) on empowerment toward the gamified application.

Gamification as a promising technique

Social marketing has been used by many scholars and practitioners as a framework dealing with changing unhealthy behaviors in users' lifestyles (Rundle-Thiele et al., 2015). Using gamification, social marketing adapts the game studies to improve social, environmental, and health-related behaviors (Dietrich et al., 2018). There is also growing evidence that gamification (game studies in general) can be effective for social marketing programs that aim to change target groups' behaviors (Yam et al., 2017). Gamification has been expressed as a process of enhancing services and behaviors with motivational affordances in order to create gameful experiences and further behavioral outcomes (Huotari and Hamari, 2012;

Robson et al., 2015). Nowadays many businesses use such game-like experiences to control and change the behaviors of the customers and to increase their loyalty and engagement (Zichermann and Cunningham, 2011). It has been affirmed that users are more willing to disclose more information and then feel secure when the gamification systems can create them a kind of necessary gamified experience (Trang and Weiger, 2020). According to the MDA framework (mechanic, dynamic, aesthetics), gamification includes three components which are: mechanics, dynamics, and aesthetics (Hunicke et al., 2004). Mechanics refer to the decisions that designers make to specify the goals, rules, settings, contexts, types of interactions, and boundaries of the situation to be gamified (McCarthy and Gordon, 2011). Gamification dynamics are set by how players follow the pre-defined mechanics selected and implemented by the designers (Robson et al., 2015). Dynamics are difficult to predict and therefore they lead to users' unintended behaviors and outcomes, which can be positive or negative. So, it is difficult for gamification designers to know what exactly will happen in regard to dynamics. The third element, which is aesthetic, refers to how the game looks, sounds, and feels (LeBlanc, 2004). Based on DDE framework (design, dynamic, experience), the term design has been used as an equivalent to the term mechanic, while dynamic is the same as the one in MDA framework. Aesthetic is changed into a more specific term called experience (users' cognitive, emotional, behavioral, sensorial, and social responses) in order to include various aspects of experiences that a player does have (Walk et al., 2017). In order to provide and reach more intense and interesting contributions, we aim to merge both MDA and DDE frameworks to reach MDE as abbreviated for mechanics, dynamics, and experiences. It should be mentioned that the MDE framework has already been proposed by Robson et al. in which emotions were used instead of experiences (Robson et al., 2015). We aim to focus on and develop this framework. As previous literature indicated, gameful experience arises from players' interactions with both game mechanics, and dynamics. These experiences would define the gameplay and lead to the player's experience (Werbach and Hunter, 2012).

Gamified experience and empowerment

User experience is defined as individual's perceptions and responses that result from the anticipated use of a product, system or service (Moizer et al., 2019). User experience is individual's *cognitive (the way individuals think), emotional (the way individuals feel), behavioral (the way individuals react), sensorial (the way individual's senses solicited) and social (how individuals interact with surroundings)* responses arising from the use and interaction with the system (Lemon and Verhoef, 2016). This research tries to make a link between the experience created from the gamified system to empowerment which might lead to changing behavior. Empowerment is to be considered as giving power to somebody and more specifically, an increased intrinsic task motivation (Thomas and Velthouse, 1990). Psychological empowerment is defined as individuals' experience of motivation which is based on cognitions about himself or herself in relation to his or her role. Psychological empowerment is defined as a form of intrinsic motivation that reflects a proactive orientation toward and sense of control over activity (Spreitzer, 1995). Four cognitions make up the concept of psychological empowerment: *meaning, self-determination, competence, and impact*. This research uses the dimensions of self-determination (autonomy, competence and relatedness) following the other dimensions of meaning, impact and competence. However, since we'll have two competences (which is repetitive), we omit one of them and the results would be five dimensions of *meaning, autonomy, competence, impact* and *relatedness* (Lee and Nice, 2014). Meaning refers to the degree to which the activity itself is meaningful for the users, self-determination relates to the perception of autonomy and independence when performing an activity which itself includes three sub-dimensions of autonomy, competence

and relatedness. Competence is the degree to which the user is confident about one's ability to perform the required tasks, and impact is the feeling that an individual's accomplishment contributes toward the unit goals (Seibert et al., 2011). Previous research has shown that meaningful gamification can be used to mobilize users' intrinsic motivations through appropriate mechanisms to produce real and lasting influences on user's behavior (Nicholson, 2015). Based on this knowledge, this research investigates whether gamified experience can enhance the level of empowerment among the users, and how. (Appendix 1) The main proposition of this research is that gamified experience affects empowerment positively. To consider it, we are going to run a quantitative analysis in the following.

Methodology – Study design

In this quantitative study, we analyze statistically the relationships between our two main concepts. For the purpose of the research, we developed Gametunut, a gamified and nutrition-based application[1] in which three mechanics of goal (G: establishing goals to be achieved), award (A: being rewarded) and storytelling (S: being exposed to a narrative context) have been implemented (Appendix 2). Based on a previous research (netnography), these mechanics had been selected as the most relevant gamification components in wellbeing-related behaviors for practical reasons, we decided to use the screenshots of this developed application in seven scenario-based questionnaires indicating seven different combinations of the mechanics. Seven questionnaires have been completed each by 55 young adults (N_{total}= 385; from 18 to 25; M_{age}=22; ~43% male; ~56% female). Experience and empowerment were measured through Likert scale, based on reference scales taken in literature (Schmitt, 1999; Brakus et al., 2009; Bleier et al., 2018; Spreitzer, 1995; Xi and Hamari, 2019). In the exploratory factor analysis, we first examined the dimensionality of our three constructs of experience, empowerment and users' motivations. We validated our 5-dimension scale of experience (83.02% of variance explained; KMO=.849; Bartlett p<0.001), and 4-dimension scale of empowerment (86.07% of variance explained; KMO=.782; Bartlett p<0.001). Then, we conducted a reliability and validity analysis of our scales through calculating Cronbach's alpha, Joreskog *rho* and AVE (see Appendix 3).

Data analysis

We analyzed the data obtained from these seven questionnaires through SPSS and Smart PLS4. We used regression analysis to analyze the relationship between the dimensions of gamified experience and empowerment in each of the seven gamified conditions. In other words, we used the latent scores of gamified experience and empowerment to see if gamified experience does affect empowerment or not (Sarstedt and Cheah, 2019). To compare the efficacies of the seven scenarios, we compared the tables of coefficients and the ANOVA summaries. To check the relationship between gamified experience and empowerment, we run ANOVA and coefficient analysis in Smart PLS. Also, we ran structural equation modeling to check the moderating effect of users' motivation.

Results and discussion

After analyzing the data through SPSS and Smart PLS, we go through the details of regression analysis and structural equation modeling to see the direct effects of gamification mechanics on experience and experience on empowerment to the application. It is worth mentioning that we hold two direct effects of gamified mechanics on experience, and experience on empowerment to the application, as full mediation and the direct effect of gamified mechanics on empowerment is rarely explained. However, the table of gamified

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mechanics on empowerment is provided in Appendix 5 and 6 (Zhao et al., 2010). Previous literature showed that the combination of mechanics affects the level of users' empowerment (Hanus and Fox, 2015). Following these results, this research also showed that the combination of two mechanics of 'A+G' has the most significant impact on empowerment (A: $\beta=0.049$, p-value=0.642; G:$\beta=0.661$, p-value=0.000, R-square= 45.1%), whereas using each of these mechanics solely has a lower impact on empowerment (A: $\beta=0.459$, p-value=0.000, R-square=21.1%; G:$\beta=0.302$, p-value=0.025, R-square= 0.91%),

Regarding *the effect of gamification mechanics on experience*, we see that all the seven scenarios did create meaningful experiences (Appendix 7 and 8). However, the mechanics in the scenario of 'A+G+S' have the most significant impact on experience (A:$\beta=0.532$, p-value=0.000; G:$\beta=0.416$, p-value=0.000; S:$\beta=0.281$, p-value=0.000). Experience did have the highest proportion of explained variation in the scenario of 'A+G+S' which is equivalent to 60.1%. It means that the combination of 'A+G+S' affects users' way of thinking (*cognitive*), way of feeling (*emotional*), way of sensing (*sensorial*) and way of interacting (*social),* and more significantly, way of reacting (*behavioral*). It is concluded that a deep *vs.* thin level of gamification enriches the user experience by expanding the interactions. It is consistent with previous research that established a relationship between deep gamification and intrinsic *vs.* extrinsic motivation in doing an educational task. This effect was mainly imposed on behavioral dimension of experience (A:$\beta=0.394$, p-value=0.001; G:$\beta=0.288$, p-value=0.011; S:$\beta=0.440$, p-value=0.000) with the highest proportion of explained variation (r-square= 40.7%) (Appendix 7) (e.g. [EX13] "*Cette application essaie de me faire réfléchir à mon style de vie*"). The combination of 'A+G' also significantly affected experience (A: $\beta=0.341$, p-value=0.003; S:$\beta=0.474$, p-value=0.000) with the proportion of explained variation of 39.6%. This effect mostly imposed on nearly all the dimensions of experience indicating that '*Award+Goal* affects all dimensions of experience, significantly on emotional dimension (r-sqaure=41.2%%) (e.g. [EX7] "*Cette application me semble amusante à utiliser*"). Consistent with the existing literature, it is confirmed that gamification mechanics can have various impacts on experience (Hammedi et al., 2017; Oliveira et al., 2023). Besides, this research tried to go in depth and examine the effect of each mechanic (and each combination) on each dimension of experience to see the differences among the effects of mechanics on each dimension.

 One step further, we analyze *the effect of experience on empowerment to the application* (Appendix 9 and 10). Interestingly, it was in the scenario of *'Award+goal+storytelling'* that the gamified experience did have the least effect ($\beta=0.395$, p-value=0.003), explaining a tiny 15.6% of its variation. This result shed light on the fact that the combination of three mechanics of 'A+G+S' could create a significant experience for users, however this scenario is not successful in empowering them to the application. On the other side, experience did have the most effect on empowerment in the scenario of *'Award+storytelling'* ($\beta=0.834$, p-value=0.000), with the highest proportion of explained variation (r-square =69.5%). Also, we checked the impacts of each dimension of experience on each dimension of empowerment to the application. As can be seen in the Appendix 11, all the five dimensions of experience (emotional, sensorial, cognitive, social and behavioral) did have significant impacts on almost all the dimensions of empowerment to the application (meaning, competence, autonomy and relatedness). It means that this experience in the scenario of 'A+S' is more efficient in affecting users' cognitions (meaning, self-determination theory, competence and impact) which leads to feeling psychologically empowered. Users feel more empowered when they have a gamified experience created by both mechanics of *'Award+ storytelling'*. This combination is interesting given the nature of each mechanic: "Award" holds an extrinsic

feature (a reward to be obtained) whereas "Storytelling" mostly focuses on an intrinsic content (a narrative context to be explored). This result adds to the existing literature in a way to show that gamified experience created by each mechanic (scenario) would have various effects on empowerment to the application. Previous literature showed that gaming experience did have impact on empowerment, however this research precisely defined gamified experience, different dimensions of experience and their effects on different dimensions of empowerment (D'Aprile et al., 2019; Li et al., 2021). Another research cited that gamification can help to make knowledge workers feel empowered. This research also made use of different gamified mechanics as a gamified system which attribute to game-like experiences and this gamified system (game-like experience) empower users (knowledge workers) (Spanellis et al., 2020). Following the mentioned citations, this research proposes that gamified experience created by specific mechanics is able to affect the level of empowerment and in other words, empower users.

Theoretical, practical contributions, limitations and further research

The research tried to make a link between gamified experience and empowerment. Although previous research made a link between gamification and empowering vulnerable target groups of people, it is still unclear and hard to understand the role of certain game mechanics in empowering users (Corepal et al., 2018; Van der Lubbe et al., 2021). We tried to make use of this limitation to add to the value of our research in a way to study the roles of each gamified mechanics in creating a relationship between experience and empowerment. Moreover, researchers tried to consider gamification as a whole and consider its relationship with empowering people; however, this research made use of the results in order to fill the gap of how gamified experience in each mechanic (scenario) would trigger the levels of empowerment (Li et al., 2020). Although gamification has been shown to create positive impacts on users' emotional and physical well-being, previous research noted that no exact intervention studied intrinsic motivation support, or empowerment (Johnson et al., 2016; Ludden et al., 2014). So, this research adds to the existing knowledge of gamification by considering the intrinsic motivation support (or empowerment). The results of this research can be used in developing psychological and behavioral changing practices mainly through gamified applications. Also, in this research, we did try to consider the relationship between experience and empowerment in seven different scenarios indicating seven different conditions of mechanics. This would give practitioners new and practical insights into the process of gamified experience and empowerment. This study shows what degree and how the experience of seven scenarios of gamified mechanics would trigger the empowerment. However, as we used a relatively small sample size in each scenario, further research can make use of a bigger sample size in order to validate the results of this research. Moreover, as we took three mechanics identified in the previous qualitative research, further research can investigate other gamified mechanics and their effects on empowerment as well. We analyzed the moderating effect of users' motivations; however, more study might be needed to understand other different categories of users' motivations. Other methodologies might be used, such as observation of users and in-app interactions in real conditions and maybe interviews to elaborate the results of the research.

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APPENDICES

Appendix 1: Research proposed model

Appendix 2: Gametunut screenshots

Gamenut, votre réseau social sur la nutrition !

LovelyStone
Aujourd'hui

Ça fait déjà une semaine que je marche et je ressens une petite fatigue poindre de plus en plus souvent.

Welcome

C'est la première fois que tu lances Gamenut, un réseau social basé sur la nutrition. Tu seras en charge de créer des recettes afin d'aider certains utilisateurs à mieux consommer selon leurs besoins. Ces recettes seront ensuite postées sur ton profil pour les partager à tes followers.

Tu pourras naviguer à travers les différents onglets de l'espace information pour t'aider à réaliser ces menus.

Le bot te donnera quelques conseils quand il pensera que c'est nécessaire.

Amuse-toi bien !

Continuer

peuvent représenter un risque pour la santé dans certains cas

VitalPops
Aujourd'hui

L'OMS (Organisation Mondiale de la Santé)

Suivez des histoires passionnantes

LovelyStone
Aujourd'hui

Ça fait déjà une semaine que je marche et je ressens une petite fatigue poindre de plus en plus souvent.
Je me suis demandée d'où ça pouvait venir et comme j'ai un excellent rythme de sommeil je me suis questionnée si ça pouvait venir de carences dues à mon alimentation.
Je me suis dit que j'allais voir comment je me sentirai demain avant de m'assurer que ça vient bien de mon alimentation.

Aimé par 617 autres personnes

Lovline: Fais attention à toi, les carences alimentaires peuvent vraiment être un poids et peuvent représenter un risque pour la santé dans certains cas

Marmita

Retrouvez votre page perso

KingOfDishes

2 Publications   Cuisiner   771 Abonnés

KingOfDishes

Contient : Brochette de boeuf, Yaourt nature, Café, Eau, Pâtes blé, Œuf au plat

Aimé par GtunutBot et 8 autres personnes

GtunutBot: Ce menu risque d'inspirer beaucoup de personnes !

KingOfDishes

Contient : Ananas, Ananas, Ananas, Banane

Aidez votre communauté en répondant aux missions

< Retour

Bonjour, je me présente je m'appelle Eva, j'ai 25 ans, et je viens vous voir aujourd'hui parce que j'ai l'impressio...

Pierre
Bonjour, je viens vers vous car j'ai souvent des problèmes de constipation, mon médecin m'a conseillé de boire beau...

TruckDino
Salut, avec mes copines on a pris la décision de devenir végétarienne, le problème c'est qu'on y connait rien à cet...

Emma
Hey, ça fait 1 mois que j'ai commencé mes études supérieures en archi, j'ai pris un appartement et qui dit vivre se...

CrazyLag
Bonjour, mon problème c'est que je ne bois pas assez d'eau et je le sais, mais franchement j'ai pas le temps. Ma gr...

RiderBest
Bonjour, mon médecin a analysé ma prise de sang et il a remarqué que j'avais un taux anormalement bas d'hémoglobine...

PickleDela
Salut, je vous parle actuellement avec un paquet de chips à côté de moi, je vous laisse deviner mon problème ! et o...

Tristan
Salut, je ne sais pas si vous allez pouvoir m'aider, j'ai été diagnostiqué par mon médecin, il y a seulement une se...

SkyWhite
Salut, depuis quelques temps je perds du poids de manière involontaire. Je me suis parti voir un médecin et il m'a dit...

DelaZero
Salut, je viens à contre cœur vous voir car ma copine me rend ouff !! elle m'en veut car je ne mange jamais de lég...

Aidez votre communauté en répondant aux missions

< Retour

DelaZero
Aujourd'hui

DelaZero
Salut, je viens à contre cœur vous voir car ma copine me rend ouff !! elle m'en veut car je ne mange jamais de légumes ou fruits, pourquoi? c'est simple je déteste ça. Moi ce que j'aime c'est la viande, mais je veux lui faire plaisir, vous pensez que vous pouvez me proposer un repas avec des fruits et légumes s'il vous plait?

Accepter   *Plus tard*

Trouvez la recette qui répond aux besoins

Brocoli

FRUITS LÉGUMES
VIANDES
POISSONS
CÉRÉALES
LÉGUMINEUSES

Proposer ce plat

Bravo, vous avez réussi !

Raisin

Félicitations!
Je poste ça sur votre page personnelle tout de suite !

Valider

Proposer ce plat

Gagnez de nouveaux ingrédients et débloquez des récompenses

Récompenses
Accumule des points pour débloquer les récompenses!

+50 SUBS

+50 SUBS   +150 SUBS

Points Actuels : 320

Aimé par GtunutBot et 26 autres personnes

GtunutBot: Si tu proposes les mêmes menus pour les requêtes d'utilisateur je comprends mieux pourquoi il y a autant de demandes !

KingOfDishes

Contient : Ananas, Banane, Myrtille, Pomme

Appendix 3: Scale validity and reliability results

Table 1 Validity and reliability results

Construct	Dimensions	Cronbach's alpha	Joreskog Rho	AVE
Experience	Sensorial	.927	.948	.821
	Emotional	.892	.933	.822
	Cognitive	.888	.931	.817
	Social	.880	.926	.807
	Behavioral	.883	.919	.741
Empowerment	Meaning	.884	.928	.812
	Competence	.864	.917	.786
	Autonomy	.885	.929	.813
	Relatedness	.913	.945	.851

Appendix 4: Effect of gamification mechanics on empowerment to the application

Scenario	Standardized coefficient	P value	Confidence interval (CI)	R-square (experience)
Award (A)	0.459	0.000	[0.205, 0.662]	0.211 (21.1%)
Goal (G)	0.302	0.025	[0.033, 0.470]	0.091 (0.91%)
Storytelling (S)	0.358	0.007	[0.064, 0.392]	0.128 (12.8%)
A+G	0.049 (A) 0.661 (G)	*0.642* 0.000	[-0.117, 0.188] [0.346, 0.667]	0.451 (45.1%)
A+S	0.125 (A) 0.401 (S)	*0.326* 0.002	[-0.085, 0.251] [0.122, 0.537]	0.175 (17.5%)
G+S	0.252 (G) 0.213 (S)	0.061 *0.112*	[-0.012, 0.530] [-0.038, 0.354]	0.126 (12.6%)
A+G+S	0.604 (A) 0.016 (G) 0.023 (S)	0.000 *0.841* *0.889*	[-2.625, -0.641] [-0.155, 0.179] [-0.139, 0.170]	0.361 (36.1%)

Appendix 5: Relationships between gamification mechanics and dimensions of empowerment to the application (ANOVA)

		Sum square	df	Mean square	F	P value
Storytelling	Total	54.999	54	0.000	0.000	0.000
	Error	45.892	53	0.866	0.000	0.000
	Regression	9.107	1	9.107	10.517	0.000
Goal	Total	54.996	54	0.000	0.000	0.000
	Error	45.902	53	0.866	0.000	0.000
	Regression	9.094	1	9.094	10.501	0.000
G+S	Total	55.006	54	0.000	0.000	0.000
	Error	46.119	52	0.887	0.000	0.000
	Regression	8.886	2	4.443	5.010	0.000
G+A	Total	54.998	54	0.000	0.000	0.000
	Error	33.241	52	0.639	0.000	0.000
	Regression	21.757	2	10.878	17.017	0.000
Award	Total	55.000	55	0.000	0.000	0.000
	Error	42.418	54	0.786	0.000	0.000

		Sum square	df	Mean square	F	P value
	Regression	12.582	1	12.582	16.018	0.000
A+S	Total	55.002	54	0.000	0.000	0.000
	Error	37.330	52	0.718	0.000	0.000
	Regression	17.672	2	8.836	12.308	0.000
G+A+S	Total	55.001	54	0.000	0.000	0.000
	Error	21.964	51	0.431	0.000	0.000
	Regression	33.037	3	11.012	25.571	0.000

Appendix 6: Effect of gamification mechanics on experience

Scenario	Standardized coefficient	P value	Confidence interval (CI)	R-square (experience)
Award (A)	0.478	0.000	[0.225, 0.677]	0.229 (22.9%)
Goal (G)	0.407	0.002	[0.129, 0.547]	0.166 (16.6%)
Storytelling (S)	0.407	0.002	[0.099, 0.419]	0.154 (15.4%)
A+G	0.341 (A)	0.003	[0.088, 0.408]	0.396 (39.6%)
	0.474 (G)	0.000	[0.195, 0.531]	
A+S	0.194 (A)	0.095	[-0.023, 0.281]	0.321 (32.1%)
	0.535 (S)	0.000	[0.251, 0.628]	
G+S	0.266 (G)	0.044	[0.008, 0.539]	0.162 (16.2%)
	0.261 (S)	0.048	[0.002, 0.386]	
A+G+S	0.532 (A)	0.000	[0.279, 0.564]	0.601 (60.1%)
	0.416 (G)	0.000	[0.178, 0.442]	
	0.281 (S)	0.000	[0.159, 0.404]	

Appendix7: Relationship between gamification mechanics and experience (ANOVA)

		Sum square	df	Mean square	F	P value
Storytelling	Total	54.999	54	0.000	0.000	0.000
	Error	45.892	53	0.866	0.000	0.000
	Regression	9.107	1	9.107	10.517	0.000
Goal	Total	54.996	54	0.000	0.000	0.000
	Error	45.902	53	0.866	0.000	0.000
	Regression	9.094	1	9.094	10.501	0.000
G+S	Total	55.006	54	0.000	0.000	0.000
	Error	46.119	52	0.887	0.000	0.000
	Regression	8.886	2	4.443	5.010	0.000
G+A	Total	54.998	54	0.000	0.000	0.000
	Error	33.241	52	0.639	0.000	0.000
	Regression	21.757	2	10.878	17.017	0.000
Award	Total	55.000	55	0.000	0.000	0.000
	Error	42.418	54	0.786	0.000	0.000
	Regression	12.582	1	12.582	16.018	0.000
A+S	Total	55.002	54	0.000	0.000	0.000
	Error	37.330	52	0.718	0.000	0.000
	Regression	17.672	2	8.836	12.308	0.000
G+A+S	Total	55.001	54	0.000	0.000	0.000

	Error	21.964	51	0.431	0.000	0.000
	Regression	33.037	3	11.012	25.571	0.000

Appendix 8: Effects of gamification mechanics on dimensions of experience

Scenario		Dimensions of experience									
		Emotional		Sensorial		Cognitive		Social		Behavioral	
		β	R^2	β	R^2	β	R^2	β	R^2	β	R^2
Award (A)		0.261*	6.8%	0.237*	5.6%	0.402**	16.3%	0.262*	6.9%	0.498***	24.8%
Goal (G)		0.210	4.4%	0.303*	9.2%	0.400**	16%	0.163	2.7%	0.357*	12.7%
Storytelling (S)		0.228*	5.2%	0.284*	8.1	0.238*	5.7%	0.366*	13.4%	0.130	1.7%
A+G	A	0.150	41.2%	0.310*	23.1%	0.249*	20.7%	0.238*	13.4%	0.284*	17%
	G	0.599***		0.317*		0.333*		0.240*		0.254*	
A+S	A	0.205	12.7%	0.160	12.5%	0.039	63.9%	0.270*	12.8%	0.040	19%
	S	0.295*		0.317*		0.799***		0.238*		0.434***	
G+S	G	0.278*	17.4%	0.184	11%	0.145	3%	0.061	3%	0.179	6.9%
	S	0.270*		0.238*		0.076		0.151		0.165	
A+G+S	A	0.513***	32.5%	0.210*	22.2%	0.414***	33.4%	-0.003	6.6%	0.394***	40.7%
	G	0.197*		0.324*		0.384**		-0.254*		0.288*	
	S	0.242*		0.263*		0.195		-0.019		0.440***	

*** p≤0.01, ** 0.01<p≤0.05, *0.05<p≤0.1, Φ p>0.1

Appendix 9: Effects of experience on empowerment to the application

Scenario	Standardized coefficient	P value	Confidence interval (CI)	R-square (empowerment)
Award	0.787	0.000	[0.617-0.957]	0.619 (61.9%)
Goal	0.650	0.000	[0.441-0.860]	0.423 (42.3%)
Storytelling	0.773	0.000	[0.599-0.948]	0.598 (59.8%)
A+G	0.690	0.000	[0.491-0.889]	0.476 (47.6%)
A+S	0.834	0.000	[0.682-0.986]	0.695 (69.5%)
G+S	0.766	0.000	[0.589-0.943]	0.586 (58.6%)
A+G+S	0.395	0.003	[0.142-0.648]	0.156 (15.6%)

Appendix 10: Relationships of experience and empowerment to the application, ANOVA

		Sum square	df	Mean square	F	P value
Storytelling	Total	54.996	54	0.000	0.000	0.000
	Error	20.866	49	0.426	0.000	0.000
	Regression	34.130	5	6.826	16.030	0.000
Goal	Total	55.007	54	0.000	0.000	0.000
	Error	30.022	49	0.613	0.000	0.000
	Regression	24.985	5	4.997	8.156	0.000
G+S	Total	54.998	54	0.000	0.000	0.000
	Error	21.926	49	0.447	0.000	0.000
	Regression	33.072	5	6.614	14.782	0.000
G+A	Total	54.998	54	0.000	0.000	0.000

	Error	23.890	49	0.488	0.000	0.000
	Regression	31.109	5	6.222	12.762	0.000
Award	Total	55.004	54	0.000	0.000	0.000
	Error	19.005	49	0.388	0.000	0.000
	Regression	35.999	5	7.200	18.563	0.000
A+S	Total	55.003	54	0.000	0.000	0.000
	Error	15.390	49	0.314	0.000	0.000
	Regression	39.613	5	7.923	25.225	0.000
G+A+S	Total	54.997	54	0.000	0.000	0.000
	Error	43.788	49	0.894	0.000	0.000
	Regression	11.209	5	2.242	2.509	0.015

Appendix 11: Effects of experience dimensions on empowerment dimensions (to the app)

Effect on dimension 1 : **Meaning**					
	Emotional exp.	*Sensorial exp.*	*Cognitive exp.*	*Social exp.*	*Behavioral exp.*
Award (A)	0.477*** (0.228)	0.430*** (0.185)	0.377** (0.142)	0.493*** (0.243)	0.380** (0.144)
Goal (G)	0.225* (0.051)	0.610*** (0.372)	0.502*** (0.252)	0.347* (0.120)	0.455*** (0.217)
Storytelling (S)	0.247*** (0.061)	0.533*** (0.284)	0.465*** (0.216)	0.479*** (0.230)	0.179* (0.032)
A+G	0.513*** (0.263)	0.532*** (0.283)	0.276* (0.076)	0.345* (0.119)	0.279* (0.078)
A+S	0.569*** (0.324)	0.584*** (0.341)	0.475*** (0.226)	0.522*** (0.272)	0.431*** (0.186)
G+S	0.553*** (0.306)	0.596*** (0.355)	0.302* (0.091)	0.250* (0.062)	0.553*** (0.306)
A+G+S	0.172 (0.030)	0.332* (0.143)	0.339* (0.115)	0.002 (0.000)	0.234* (0.055)
Effect on dimension 2 : **Competence**					
	Emotional exp.	*Sensorial exp.*	*Cognitive exp.*	*Social exp.*	*Behavioral exp.*
Award (A)	0.175 (0.031)	0.187 (0.035)	0.151 (0.184)	0.224* (0.050)	0.211* (0.045)
Goal (G)	0.305* (0.093)	0.161 (0.026)	0.229* (0.052)	0.362* (0.131)	0.109 (0.012)
Storytelling (S)	0.165 (0.027)	0.361** (0.131)	0.370** (0.137)	0.255* (0.065)	0.205 (0.042)
A+G	0.513*** (0.263)	0.213* (0.045)	0.277* (0.077)	0.237*** (0.056)	0.200 (0.040)
A+S	0.546*** (0.298)	0.527*** (0.278)	0.278* (0.078)	0.204 (0.042)	0.506*** (0.256)
G+S	0.391** (0.153)	0.499*** (0.249)	0.506*** (0.256)	0.44² (0.194)	0.302* (0.091)
A+G+S	0.234 (0.055)	0.117 (0.014)	-0.153 (0.024)	0.026 (0.001)	0.250 (0.062)
Effect on dimension 3 : **Autonomy**					
	Emotional exp.	*Sensorial exp.*	*Cognitive exp.*	*Social exp.*	*Behavioral exp.*
Award (A)	0.510*** (0.261)	0.331* (0.110)	0.314* (0.098)	0.256 (0.066)	0.410** (0.168)
Goal (G)	0.330* (0.109)	0.343* (0.118)	0.299* (0.090)	0.523*** (0.273)	0.296* (0.088)
Storytelling (S)	0.409** (0.167)	0.195 (0.038)	0.179 (0.032)	0.286* (0.082)	0.396** (0.157)
A+G	0.495*** (0.245)	0.180 (0.033)	0.201 (0.040)	0.428** (0.183)	0.297* (0.088)
A+S	0.500*** (0.250)	0.521*** (0.272)	0.142 (0.020)	0.308* (0.095)	0.543*** (0.294)
G+S	0.335* (0.112)	0.336* (0.113)	0.198 (0.039)	0.017 (0.000)	0.323* (0.104)
A+G+S	0.323* (0.104)	0.190 (0.036)	0.317* (0.100)	-0.102 (0.010)	0.379* (0.144)
Effect on dimension 4 : **Relatedness**					
	Emotional exp.	*Sensorial exp.*	*Cognitive exp.*	*Social exp.*	*Behavioral exp.*
Award (A)	0.278* (0.077)	0.278* (0.077)	0.395* (0.156)	0.415*** (0.172)	0.179 (0.32)
Goal (G)	0.357* (0.127)	0.340* (0.116)	0.435*** (0.189)	0.357* (0.128)	0.346* (0.120)
Storytelling (S)	0.333* (0.111)	0.409* (0.167)	0.153 (0.023)	0.503*** (0.253)	0.252* (0.064)

A+G	0.481*** (0.231)	0.553*** (0.306)	0.390* (0.152)	0.409* (0.167)	0.350* (0.122)
A+S	0.307* (0.094)	0.436** (0.190)	0.458*** (0.210)	0.549*** (0.301)	0.248 (0.062)
G+S	0.419*** (0.176)	0.464*** (0.216)	0.306* (0.094)	0.465*** (0.217)	0.219 (0.048)
A+G+S	-0.022 (0.000)	0.007 (0.000)	-0.020 (0.001)	0.306* (0.093)	0.025 (0.001)

*** p≤0.01, ** 0.01<p≤0.05, *0.05<p≤0.1, Φ p>0.1   r-square in parentheses