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How to measure gamification experiences in nursing? Adaptation and validation of the Gameful Experience Scale [GAMEX]

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ABSTRACT

Background: There has been an increasing amount of research in the last few years on the use of gamification in nursing. However, there is not yet a suitable measuring instrument that fully captures the emotional qualities that arise with the use of gamification. Objectives: To culturally adapt and validate the Gameful Experience Scale used among nursing students as well as understand their game experience.
Design: The study was divided into two phases 1) cross-cultural adaptation and 2) validation of the scale and cross-sectional descriptive study.
Settings: Faculty of Health Sciences at the University of Almeria, Spain.
Participants: 226 students studying an undergraduate nursing degree.
Methods: In the first phase, a cross-cultural adaptation was carried out using a forward-back translation, with the collaboration of a panel of experts. In the second phase, the corresponding analyses were performed, to measure the reliability and the validity of the instrument.
Results: The Kaiser-Meyer-Olkin test that measures the appropriateness of the sample had a result of 0.875. Bartlett's sphericity test was significant ($X^2(351) = 3755.142$, $p < 0.05$). A structure of 6 factors was confirmed. The total Chronbach α value was 0.855. In the analysis of the test-retest reliability, a correlation level of 0.89 was obtained ($p < 0.05$). The participants showed high scores in all the dimensions, except that of absence of negative effects.
Conclusions: The adapted version of the scale showed good results in regards to reliability and validity, which indicates that it is an effective tool to be used to measure the game experience in nursing students' training.

1. Introduction

Gamification has been a growing trend for the last few years and is based on using gaming design elements in non-game applications to make the experience feel like a game and engage users (Deterding et al., 2011). The difference between a game and gamification resides in the fact that a game refers to the act of playing games, which can range anywhere from board games, puzzles, to videogames and role games, whereas gamification is a general term to describe the process of using games to involve people in non-gaming settings, even in medical care settings (Ferguson et al., 2015; King et al., 2013).

The authors of two books view gamification as an innovative and promising concept that can be applied in a variety of contexts (Werbach and Hunter, 2012; Zichermann and Linder, 2013), one of which is education. In the education sphere, this type of methodology has generated a high level of interest (Domínguez et al., 2013), seeing as, since the concept of gamification gained strength around 2010, the number of studies analysing its effectiveness in education have increased (van Roy and Zaman, 2018). Gamification, among others, has proven to be one of the most enjoyable ways of learning (Charlier and De Fraine, 2013) and strengthening knowledge retention (Brom et al., 2011).

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1.1. Background

In nursing, studies on gamification have been on the rise in the last few years (Gallegos et al., 2017). Nevertheless, literature on the subject still continues to be scarce. According to a systematic review, carried out with the objective of analysing learning in higher education through gamification, in the nursing field, there was only one publication on this topic in the last five years (Subhash and Cudney, 2018). However, it is true that interest in gamification has increased in recent years (Gómez-Urquiza et al., 2019).

In addition, in the field of nursing, students value immediate feedback, visual effects and the type of experience-based learning that games offer (Robb, 2013). Also, this methodology has been shown to increase knowledge understanding and retention in the nursing classroom (McCurry and Hunter Revell, 2011).

Some of the activities used in nursing include the use of serious games (Fonseca et al., 2015; Johnsen et al., 2016; Johnsen et al., 2018), escape rooms (Gómez-Urquiza et al., 2019), and card games (Milner and Cosme, 2017). Researchers emphasise that in all the cases, there have been positive results regarding satisfaction, motivation and learning (Davidson and Candy, 2016; Gallegos et al., 2017; Gómez-Urquiza et al., 2019).

Although gamification is a rapidly-developing concept in the nursing field, there is not yet a suitable measuring instrument that fully captures the emotional qualities involved in gamification; in other words, the game experience (Huotari and Hamari, 2017). Being capable of measuring this game experience is relevant in order to determine its success (Eppman et al., 2018). Due to these factors, the Gameful Experience Scale (GAMEX) was developed (Eppman et al., 2018).

The authors report that GAMEX is a reliable and valid tool, which is useful both for researchers as well as for professionals, and could be easily applied in different gamification contexts. For this reason, the objective of this study was to culturally adapt and validate the Gameful Experience Scale used among nursing students as well as understand their game experience.

2. Methods

2.1. Design

This study is a cross-cultural adaptation and validation of the GAMEX scale. The study had two phases 1) cross-cultural adaptation y 2) validation of the scale and cross-sectional descriptive study.

2.2. Participants

A total of 226 students from the Nursing Degree programme took part in this study and were chosen using a convenience sample. As inclusion criteria, the following factors were taken into account: a) being enrolled in the nursing degree programme and b) having had previous experience with learning through gamification. Those who did not agree to participate, as well as foreign exchange students, were excluded from the study.

2.3. Instruments

The first part of the questionnaire was made up of socio-demographic data. This included age, sex, and if they had previous experience with gamification.

The second part of the questionnaire was made up of the Gameful Experience Scale (*GAMEX*). This is a scale developed by Eppman et al. (2018) that measures the game experience, and it is made up of 27 items, divided into 6 dimensions: enjoyment, absorption, creative thinking, activation, absence of negative effects, and dominance. The responses were chosen on a Likert-type scale, with 1 (never) and 5 (always).

2.4. Procedure

Before beginning the study, the researchers contacted the original authors of the GAMEX scale (Eppman et al., 2018) who gave them their permission to use the scale.

2.4.1. Phase 1: Cross-cultural adaptation of the GAMEX scale

For the first phase, the forward-back translation method was used, following the standards set by Guillemin et al. (1993). For the translation from the original language to Spanish, there were three different translations done, from the original version, by three separate native translators, generating three versions of the same scale. This gave rise to the first unanimous version of the scale in Spanish. From this version, a back-translation was then carried out by two native British translators. To validate the content, the adapted and unanimous version of the GAMEX scale underwent evaluation by a panel of 18 experts made up of 6 nursing professors, 9 nurses, and 3 psychologists. To validate the scale, Lawshe's (1975) Content Validity Index (CVI) was calculated, and the experts considered all the items to be essential and relevant.

2.4.2. Phase 2: validation of the scale and descriptive study

For the pilot study of the questionnaire, first, approval was obtained from the Research Commission from the Department of Nursing, Physiotherapy and Medicine. Once this was achieved, the students were informed about the study via email. Then, the head researcher gathered all the students interested in participating in the pilot study (n = 30) in one classroom. The objective of the pilot study was to check the content and the understandability of the scale. Before filling out the scale, they were informed of the objective of the study and given informed consent forms, and reminded of the voluntary nature of their participation and the anonymous and confidential nature of their data. Three weeks after the pilot test was carried out, a retest was also carried out to evaluate if the responses remained the same over time.

Once the pilot study was completed, and the final version of the scale was reached, a descriptive study was performed, in which 226 nursing students participated. All of the participants had had some previous experience with learning through gamification during their training. This previous experience refers to using an app developed by researchers to improve the acquisition and retention of knowledge about basic and advanced life support in nursing students. Using this app, in pairs, students had to guess terms related to CPR, basic and advanced life support, and first aid. All of the participants were nursing students who had received information about the content of the game prior to starting. Once the subject was finished, in the class setting, the students played with the app and then filled out the GAMEX questionnaire.

2.5. Ethical aspects

The Research Commission of the Department of Nursing, Physiotherapy and Medicine approved this study. The researchers informed all the participants about the objective of the study. All the participants signed informed consent forms, and they were informed about the anonymous and confidential nature of their data. The study was carried out following the ethical aspects put forth in the Declaration of Helsinki.

2.6. Data analysis

For data analysis, the statistical software SPSS version 24 was used. First, a descriptive analysis was performed on the results. For the categorical variables, the frequency and percentage were calculated, while for the quantitative variables, measurements of central tendency and dispersion were calculated. To analyse the validity of the content, the CVI (Lawshe, 1975) was calculated. To determine the structural validity of the questionnaire, a factorial analysis was carried out,

through a principal component analysis. To determine internal consistency, Chronbach's alpha test was used, and values > 0.7 were considered acceptable. The measurement of temporal stability of the responses was analysed using Pearson's correlation test. A value of $p > 0.05$ was considered significant.

3. Results

3.1. Phase 1: Cross-cultural adaptation of the GAMEX scale

The first phase was carried out as previously explained in the method section. The CVI was calculated (Lawshe, 1975), and all items were deemed essential.

3.2. Validation of the scale and cross-sectional study

3.2.1. Validation of the scale

3.2.1.1. Validation. The result of the Kaiser-Meyer-Olkin (KMO) test to examine the sample suitability was 0.875, which is higher than the minimum acceptable value of 0.70. Bartlett's sphericity test was significant ($X^2(351) = 3755.142$, $p < 0.05$). The results of these tests demonstrated that the analysis factor was appropriate. A 6-factor structure was confirmed (Table 1).

3.2.1.2. Internal consistency. The total Chronbach α value was 0.855. In each separate dimension, the Chronbach α values were the following: 0.843 (enjoyment), 0.898 (absorption), 0.865 (creative thinking), 0.790 (activation), 0.841 (absence of negative effects), 0.860 (dominance) (Table 2). To assess the reliability of each item, the Chronbach α value was calculated as if the item were deleted, and it was shown that there was no benefit to eliminating any of the items, since all the values were between 0.840 and 0.888 (Table 3).

Table 1
Total variance explained.

Initial Eigen values				Extraction sums of squared loadings		
Component	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.459	31.331	31.331	8.459	31.331	31.331
2	3.339	12.368	43.699	3.339	12.368	43.699
3	2.280	8.444	52.143	2.280	8.444	52.143
4	2.234	8.276	60.419	2.234	8.276	60.419
5	1.345	4.983	65.402	1.345	4.983	65.402
6	1.076	3.984	69.386	1.076	3.984	69.386
7	0.928	3.439	72.825			
8	0.732	2.711	75.536			
9	0.687	2.543	78.079			
10	0.653	2.420	80.499			
11	0.595	2.204	82.703			
12	0.529	1.961	84.664			
13	0.513	1.899	86.562			
14	0.446	1.652	88.215			
15	0.430	1.592	89.807			
16	0.364	1.348	91.155			
17	0.345	1.277	92.432			
18	0.313	1.160	93.592			
19	0.269	0.995	94.587			
20	0.246	0.912	95.500			
21	0.244	0.902	96.402			
22	0.208	0.771	97.173			
23	0.202	0.749	97.922			
24	0.177	0.655	98.577			
25	0.152	0.561	99.138			
26	0.125	0.464	99.603			
27	0.107	0.397	100.000			

Extraction method: principal component analysis.

Table 2
Cronbach's α values for each dimension.

Dimension	α values in our study	α values in the original study
Enjoyment	0.84	0.96
Absorption	0.89	0.91
Creative thinking	0.86	0.88
Activation	0.79	0.87
Absence of negative effects	0.84	0.85
Dominance	0.86	0.84
Total	0.85	0.89

Table 3
Item-total statistics.

Item	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's Alpha if item deleted
Item 1	91.68	228.112	0.449	0.850
Item 2	91.70	226.601	0.478	0.849
Item 3	91.87	224.042	0.492	0.848
Item 4	91.77	227.126	0.473	0.850
Item 5	91.62	229.323	0.421	0.851
Item 6	91.92	202.723	0.228	0.888
Item 7	92.48	217.500	0.548	0.845
Item 8	92.71	216.851	0.545	0.845
Item 9	93.20	216.060	0.546	0.845
Item 10	93.03	215.746	0.582	0.844
Item 11	92.98	215.171	0.578	0.844
Item 12	92.37	213.791	0.597	0.843
Item 13	92.29	218.387	0.615	0.845
Item 14	92.54	218.983	0.588	0.845
Item 15	92.64	216.556	0.619	0.844
Item 16	92.74	211.669	0.711	0.840
Item 17	91.79	226.874	0.485	0.849
Item 18	92,70	232.192	0.110	0.859
Item 19	92.93	222.239	0.362	0.851
Item 20	92.43	216.844	0.571	0.845
Item 21	94.73	236.877	0.008	0.859
Item 22	94.79	237.869	−0.023	0.859
Item 23	94.55	236.565	0.011	0.860
Item 24	93.34	220.189	0.507	0.847
Item 25	92.94	219.254	0.544	0.846
Item 26	92,95	220,771	0.482	0.848
Item 27	92,59	224,995	0.402	0.850

3.2.1.3. Test-retest. In the analysis of the test-retest reliability, a correlation level of 0.89 was obtained ($p < 0.05$).

3.2.2. Cross-sectional study

226 students total participated in the study, of which 75.2% (n = 170) were female and 24.8% (n = 56) male. The average age was 22.07 ± 4.92. All participants had had some previous experience with gamification. Regarding the results of each item, the participants indicated high scores in all the dimensions, except that of absence of negative effects (Table 4).

4. Discussion

The objective of this study was to carry out a cross-cultural adaptation and validate the Gameful Experience Scale among nursing students, as well as understand their experience during the game. Firstly, as far as the reliability of the scale, the results of this study are consistent with the results the original authors also obtained (Eppman et al., 2018). More specifically, in this study, a Chronbach α value of 0.85 was found, which is very similar to that of the original scale, which was found to be 0.89. In addition, a 6-dimension structure was confirmed, as in the original scale, with Chronbach α values above 0.7. In particular, the original authors found that the established distribution into 6 factors was superior to alternative models and showed good

Table 4
Mean and standard deviation for each item of GAMEX.

Items	M*	SD**
Enjoyment		
Playing the game was fun.	4.60	0.69
I liked playing the game.	4.58	0.75
I enjoyed playing the game very much.	4.41	0.89
My game experience was pleasurable.	4.50	0.72
I think playing the game is very entertaining.	4.66	0.65
I would play this game for its own sake, not only when being asked to.	4.35	3.49
Absorption		
Playing the game made me forget where I am.	3.81	1.18
I forgot about my immediate surroundings while I played the game.	3.57	1.22
After playing the game, I felt like coming back to the "real world" after a journey.	3.08	1.26
Playing the game "got me away from it all"	3.25	1.21
While playing the game I was completely oblivious to everything around me.	3.30	1.25
While playing the game I lost track of time.	3.91	1.28
Creative thinking		
Playing the game sparked my imagination.	3.98	1.02
While playing the game I felt creative.	3.73	1.04
While playing the game I felt that I could explore things.	3.63	1.10
While playing the game I felt adventurous.	3.53	1.20
Activation		
While playing the game I felt activated.	4.49	0.72
While playing the game I felt jittery.	3.59	1.26
While playing the game I felt frenzied.	3.36	1.29
While playing the game I felt excited.	3.85	1.16
Absence of negative affect		
While playing the game I felt upset.	1.55	0.97
While playing the game I felt hostile.	1.50	0.90
While playing the game I felt frustrated.	1.74	1.06
Dominance		
While playing the game I felt dominant/I had the feeling of being in charge.	2.92	1.10
While playing the game I felt influential.	3.34	1.08
While playing the game I felt autonomous.	3.32	1.11
While playing the game I felt confident.	3.69	1.99

reliability of the factors, as well as the validity of convergent and discriminant factors (Eppman et al., 2018).

Although there are various scales that measure game experiences (Brockmyer et al., 2009; Jennet et al., 2008), the authors of this study have not found previous studies that use tools to measure the gamification experience in nursing. This would imply that this study would be a pioneer in taking a deeper look into the emotions and experiences developed while using gamification in the training of future nursing professionals.

The majority of studies performed in the nursing field have traditionally been focused on determining results obtained through gamification, such as knowledge, skills, and self-efficacy (Kim and Suh, 2018), or motivation and opinion, among others. (Gómez-Urquiza et al., 2019). However, one aspect that could be decisive for learning, the experience during gamification, has never been studied. Regarding the game experience, 226 nursing students took part in this study. This number of participants was slightly higher than the number used in the construction of the original scale (Eppman et al., 2018). As for the results about the game experience, in this study, the participants expressed having a good experience, emphasising positive emotions. Positive emotions make up an essential part of the game experience since they boost learning and satisfaction among students (McGonigal, 2011).

The students also reported higher scores in creative thinking. Along the same lines, it has been established that exploration and imagination are essential parts of the game experience for players (Korhonen et al., 2009). However, this aspect had not been considered in previous questionnaires (Brockmyer et al., 2009; Jennet et al., 2008).

On the other hand, the participants reported low levels of negative effects during the gamification experience. These results are consistent with the findings of the original authors, which indicate that is it important that negative emotions are absent so that the game experience can truly emerge (Eppman et al., 2018; Mullins and Sabherwal, 2018).

5. Limitations

There are several limitations that should be kept in mind concerning the results of this study. Firstly, the sample was based on convenience, which limits the generalisation of the results. Nevertheless, the recommended minimum number of participants to analyse the psychometric properties of an instrument was taken into consideration (Fayers and Manchin, 2007). Secondly, this is the first time that the scale has been used to measure the gamification experience in the field of nursing, which has made the discussion, as well as comparing it to other studies, more difficult. Lastly, with the objective of looking deeper into the results and effects of gamification on the learning of a nursing student, it would be necessary to carry out more research that takes these emotional aspects into account. In this way, it will be possible to determine the effects of gamification, not only on a student's learning, but also in their cognitive development as a future nurse.

6. Conclusion

The cross-cultural adaptation and validation of the Gameful Experience Scale has generated a scale of 27 items divided into 6 dimensions, the same as the original scale. This version has shown good results in reliability and validity, which proves that it is a suitable instrument to be used to measure the game experience in nursing students' training.

Declaration of Competing Interest

Authors declare no conflict of interest.

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