An Application of a Gamification to Knowledge Management Teaching: A Qualitative Evaluation

Antonilson da Silva Alcantara[a] and Sandro Ronaldo Bezerra Oliveira[b]
Graduate Program in Computer Science, Institute of Exact and Natural Sciences, Federal University of Pará, Belém, Pará, Brazil

Keywords: Gamification, Qualitative Analysis, Affective Computing, Information Technology.

Abstract: The education area has been encouraging the adoption of innovative practices and methodologies for the teaching and learning process. Teaching in Information Technology (IT) courses brings several challenges. Thus, the objective of this work is to present a qualitative analysis of the application of a gamification, adapted for the remote modality, applied in the context of a software quality laboratory about knowledge management. A brief description of the gamified approach is made, followed by the application plan of this proposal. Then, a brief report about the analyzed case study is presented. Soon after, the qualitative evaluation is detailed as well as its results. Finally, conclusions and future work are presented.

1 INTRODUCTION

The education area has been encouraging the use of new practices and methods that contribute to the teaching-learning process. There is a need to innovate teaching processes, aiming to encourage students to participate more actively (Cardoso et al., 2018).

In this way, it is necessary to identify strategies and methodologies to support the student motivation process in a simple and effective way (Lopes et al., 2021). The use of gamification technique demonstrates a potential to stimulate people's commitment and motivation (Lopes et al., 2021).

Gonçalves et al. (2015) state that it is extremely important to plan the gamification process, in the educational context, that considers the objectives to be achieved, the contents that will be taught and the evaluation strategies with the expected results.

Thus, the need to innovate teaching processes is evident, with the use of new practices and methods, in order to encourage the student to participate more directly (Goulart, 2019).

Recent studies reveal the need for research on collaborative learning involving affective computing (Reis et al., 2018).

According to Oliveira et al. (2019), understanding affective computing and its application in academic contexts is a challenge. There are several ways to extract affective information from: vision-based information, brain signals, physiological measurements, and others (Batista, 2019). Another way of capturing is the collection of affective information based on discourse analysis, enabling analysis through both speech and writing (Batista, 2019).

Based on this, this work aims to present a qualitative analysis of the application of a gamification, adapted to the remote modality, applied in the context of a software quality laboratory about knowledge management.

In addition to this introductory section, this paper is structured as follows: Section 2 presents the research methodology, Section 3 presents the gamification for knowledge management teaching, Section 4 presents the application plan of this gamification, Section 5 presents the case study report, Section 6 presents the qualitative evaluation, and Section 7 presents the conclusions and future work.

2 RESEARCH METHODOLOGY

This work was developed from the following steps: (i) definition of research objectives and their

[a] https://orcid.org/0000-0001-8024-0220
[b] https://orcid.org/0000-0002-8929-5145

Alcantara, A. and Oliveira, S.
An Application of a Gamification to Knowledge Management Teaching: A Qualitative Evaluation.
DOI: 10.5220/0011058000003182
In *Proceedings of the 14th International Conference on Computer Supported Education (CSEDU 2022) - Volume 2*, pages 489-497
ISBN: 978-989-758-562-3; ISSN: 2184-5026

respective indicators, (ii) definition of the target audience, where the context of application of this proposal was selected, (iii) definition of the application model, where the periodicity and meeting models were defined, (iv) adequacy of the environment and instruments used for the virtual model and (v) analysis of the profile of the participants of the dynamics. These steps are detailed in Section 5.

According to the Silva and Menezes (2001), there are different ways of classifying a research. Thus, the scientific method applied is the inductive method, as it is characterized as a particular case study with the objective of elaborating a generalization.

From the Point of View of Nature it is classified as a Applied research, involving concepts and facts already explored, in addition to having as objective the advancement of science in the knowledge management of the Information Technology area.

From the Point of View of the Problem Approach, the research is classified as Qualitative, as it deals with data that change according to the context and, thus, creates a dynamism, requiring an inductive analysis to better understand its meanings.

The research is also classified as Exploratory, since it is intended to understand its origins and characteristics, generating mastery over the problem, making it possible to elaborate a possible solution.

Finally, from the point of view of Technical Procedures, this research is classified as Bibliographic, as it is based on articles published in conferences and journals, as well as books by reference authors in the researched area, and Case Study, because it performs the application of a gamification in a context to evaluate its results

3 GAMIFICATION FOR KNOWLEDGE MANAGEMENT TEACHING

The gamification to support the teaching and learning of Knowledge Management assets and process, described by Alcantara and Oliveira (2021), is composed of a workflow, consisting of seven steps. Figure 1 presents the flow of gamification.

The dynamic starts with the Beginning step, which is the initial phase of the game. Here the objective is to make the participants have an overview of the dynamics. Thus, a simulated round is carried out at this step, through the presentation of activities, work products, scores, and rules for participants to get used to the gamification.

The next step is called Knowledge Factory (KF), which is composed of the sub-steps: (i) Generate Knowledge and / or Comment Cards (GC), (ii) Evaluate Cards (EC) and (iii) Identify the Target Audience (IT). In this step, the objective is to lead participants to have their own experiences in relation to the process of creating knowledge items. Thus, participants are encouraged to participate in the process of creating knowledge, evaluating knowledge and identifying the target audience.

Figure 1: Knowledge Management Gamification Flow.

The next step is called Duel and aims to stimulate the student through competition so that he dedicates himself and develops in the knowledge creation steps. To this end, a comparison is made of the scores given by the participants and the expert for the same knowledge item, with the participant who replicated the score given by the expert being considered the winner.

The expert is one of the existing profiles in the dynamics, being responsible for evaluating all the knowledge generated. To act in this profile it is necessary that the participant has a strong knowledge of the subject adopted to generate knowledge during the dynamics.

The next step is called Pack Card and Communicate Target Audience, and aims to select the knowledge items approved in the expert's evaluation. Thus, in addition to rewarding the respective authors, this approved knowledge is organized so that it is accessible to the public of interest.

The Knowledge Repository step aims to provide participants with conditions for socialization, as a way of disseminating knowledge. Participants have the opportunity to consult the approved knowledge and request information from their respective authors about the knowledge items.

The next step is called Ranking, whose objective is to present the performance of the participants, being, therefore, considered a feedback step.

Finally, the last step is called Self-Evaluation. The objective is to direct the participant to carry out an evaluation of their performance at the end of each round and, based on that, set personal goals for the next round.

4 THE APPLICATION PLAN

The application of this gamified proposal was planned with the objective of supporting a dynamic whose objective was to implement the Customer and Market (CM) dimension of the MOSE (Guiding Model for Business Success) model, in the context of a software quality laboratory. The planning of this gamification is presented in the next subsections.

4.1 The Participants

The participants in the knowledge management gamification were the students/researchers of the software quality laboratory, who also participated in the dynamics that aimed to implement the Customer and Market (CM) dimension of the MOSE model, in the context of that laboratory.

The objective of applying knowledge management gamification with this target audience was to stimulate socialization and knowledge management at the end of the implementation of the CM dimension of the MOSE model.

The participants were master's and doctoral students, whose research lines were in the Software Engineering (SE), with professional experience in the Information Technology. In total there were nine (9) participants, being: one female and eight males. Table 1 presents the profile of each participant.

Table 1: Participants Profile.

	Student Degree	Research Line	Professional Activity	Time (years)
P1	Doctorate	SE	Researcher	4
P2	Doctorate	Education in SE	Researcher	6
P3	Doctorate	SE	Researcher	5
P4	Doctorate	SE	Analist of systems	4
P5	Master	SE	Researcher	1,5
P6	Master	SE	Researcher	3
P7	Doctorate	SE	Professor	10
P8	Master	SE	Technician	2
P9	Master	SE	Researcher	5

There are four profiles in the dynamics: (i) **Master**, responsible for timing each activity and signaling when to proceed to the next step in the flow, where one (1) participant acted in this profile, (ii) **Judge**, responsible for the Gamification Worksheet, recording the scores obtained by each Player throughout the steps and, at the end, presenting the Ranking of the participants, where one (1) participant acted in this profile, (iii) **Specialist**, expert in the knowledge area being studied, its function is to help solve doubts, evaluate and score Cards created by Players, suggest challenges, and indicate Cards that will be stored in the knowledge bank and disseminated in the group, where one (1) participant acted in this profile, and (iv) **Player**, participant in gamification and main actors in the knowledge creation process, where six (6) participants acted in this profile.

4.2 Application Period

The period of application of the dynamics occurred in the interval between 09/09/2021 to 10/07/2021, on Thursdays, from 16:00h to 18:00h. Table 2 presents the schedule with dates and iterations that took place for the conclusion of the Journey.

Table 2: Application Schedule.

Date	Activities	Duration
09/09/21	Dynamics presentation	4:00 pm to 5:20 pm
	Simulated Round	5:20 pm to 6:00 pm
09/16/21	Iteration 1	4:00 pm to 6:00 pm
09/23/21	Iteration 2	4:00 pm to 6:00 pm
09/30/21	Iteration 3	4:00 pm to 6:00 pm
10/07/21	Rating and Feedback	4:00 pm to 6:00 pm

4.3 Gamification Instruments and Support Tools

The case study took place remotely in line with the health restrictions imposed due to the covid-19 pandemic. Thus, all the instruments of this gamified proposal, originally planned for physical use, were adapted for use in the virtual modality.

Different tools were used to apply this case study remotely, they were: Google Meet to hold the necessary meetings to carry out the activities proposed in the gamification scenario, Google Calendar to manage the dates and times of meetings necessary to carry out activities during the Gamification journey, Google Drive to make work products available collaboratively, Google

Documents used in the adaptation of the individual monitoring form and the self-evaluation form, both for remote use, Google Sheets used in adapting the gamification spreadsheet for remote use, Google Drawings used in adapting Knowledge Cards for remote use, Google Jamboard used in adapting the Knowledge Framework for remote use and E-mail to send information to those involved.

These tools were chosen because they are: free, generating no burden for participants, for being known by the participants and, as most of them are available in the Google Drive environment, facilitating navigation between the different instruments.

4.4 Adopted Evaluation Criteria

The purpose of applying this case study is to evaluate how the methodology adapted by Alcantara and Oliveira (2021) is aligned with training in the Information Technology, in the remote modality.

To this end, some Research Questions (RQ) were defined, with their respective indicators that serve as a guide in the process of evaluating the results, as shown below.

RQ1 says *Do the instruments and activities developed fulfill the purpose of stimulating the knowledge management process?* The objective of this question is to evaluate the suitability of gamification as a tool to support the teaching and learning process of knowledge management.

QP2 says about *Did the participants show satisfaction during the application of gamified dynamics?* With this question, the objective is to evaluate the satisfaction of the participants at the end of the application of gamification.

The collection of qualitative data to evaluate the dynamics occurred: during the application of the case study, through the field Iteration Evaluative Report. These data will be evaluated through Affective Analysis through the text, with the objective of identifying the emotions aroused in the Players during the experience of the application of gamification; and, through a SWOT (strenghts, weaknesses, opportunities and threats) analysis performed during the final iteration of Evaluation and Feedback.

5 THE CASE STUDY REPORT

This work aimed to support a dynamic, which took place remotely, which aimed to implement the Customer and Market (CM) dimension of the MOSE model in the context of a Software Quality Laboratory at a Brazilian federal public University.

As it is a laboratory with a diversity of researchers in different areas of Software Engineering, it was identified the need to apply knowledge management at the end of the case study, so that all cataloged and learned information was directed and made available to its referred target audience.

The labor market has undergone major transformations that drive companies to adapt their organizational structures and production processes (SOFTEX, 2016). Thus, it is necessary to evaluate, over time, the knowledge items in order to evaluate their application, usefulness and compliance with what was initially proposed.

Based on this, it was necessary to apply knowledge management (through this gamified proposal), in order to catalog, identify, reevaluate and make the knowledge items available to their respective target audiences and, later, enable their management in terms of application, validity and meeting the objectives in the context of the software quality laboratory.

In addition, another characteristic that corroborated the application of this case study was the fact that in the research group there was a rotation of members, at different levels of research (undergraduate, master's, doctoral students, and professors), being, therefore, it is necessary to maintain a repository of knowledge with the solutions developed and the lessons learned by the group.

Another factor that corroborated the need to use knowledge management gamification was the need to classify the solutions and knowledge produced, in order to maintain a database, sorted by type of knowledge and classified by target audience. This facilitates both consultation and assignment of tasks and responsibilities.

Finally, the Software Quality Laboratory is made up of participants with different profiles and levels of responsibilities, thus making it necessary to identify knowledge based on the responsibilities and attributions of each member.

Based on the above, and knowing the effectiveness of this proposal in similar contexts (as presented in (Alcantara et al., 2019; Alcantara and Oliveira, 2019), we identified the opportunity to evaluate how the methodology adapted by Alcantara and Oliveira (2021) is aligned with training in the Information Technology area, in the remote modality.

6 QUALITATIVE EVALUATION

Qualitative data were collected in two ways: during the application of the knowledge management gamification dynamics, through the participants' evaluative reports, in the self-evaluation step, where these data were analyzed through the application of Affective Text Analysis, and, at the end of the dynamic, in a participatory evaluation and feedback meeting, focus group, where the SWOT matrix was used.

6.1 SWOT Analysis

Qualitative results were collected from interviews in the Feedback meeting with all Gamification participants. We analyzed, through the SWOT matrix, the proposal of Gamification to support the teaching and learning process of knowledge management, the instruments adopted, the self-evaluation process, and the adequacy of this gamified proposal for the remote modality.

According to Santos et al. (2010), the SWOT tool is used in the analysis of scenario or environment to define the strategic positioning of an organization.

Regarding the Gamification proposal, the following were presented as Strengths: (i) **competitiveness in the dynamics**, generating a healthy dispute between the participants, (ii) **possibility of self-analysis**, where the participant can perceive their performance and evolution within the dynamics, (iii) **definition of times to manage activities**, which helps members to participate in all activities in an orderly manner, (iv) **possibility of debates**, which is perceived in the knowledge repository step, where participants can present their produced knowledge and interact with other participants about the knowledge item, and (v) **participation of a specialist in the evaluation process**, which allows a more reliable evaluative parameter.

As Opportunities, the possibility of developing a system to automate several tasks present in the gamification proposal was highlighted.

Then, in the Instruments adopted criterion, the following were highlighted as Strengths: (i) the fact that the gamification worksheet **encourages the student to develop**, since it makes it possible to follow the scores as the worksheet is filled and (ii) **use of the ranking**, for monitoring by the student.

Still in this criterion, Weaknesses were highlighted: (i) the **gamification worksheet needs to be better organized**, so that the fields are easier to read, (ii) **many instruments**, which end up hampering the participant's performance, and (iii) **detailed description of the gamification worksheet**, since current descriptions are confusing.

As opportunities, still in this criterion, it was highlighted: developing a system to handle the different instruments and centralize the many work products in a single file.

As for the criterion of the Self-Evaluation process, the following were highlighted as Strenghts: (i) **it contributes positively to the objective of the dynamics**, generating a perception of the importance of the evaluation, (ii) **it enables the collection of important performance data**, which can be measured throughout the steps, and (iii) **it is important for all participants**, as they directly impact the participants' performance.

As Weaknesses, even in this criterion, were highlighted: (i) **the self-evaluation task is confusing**, generating many doubts during its execution, (ii) **need for detailing the scores**, to guide the mapping in the self-evaluation form, (iii) **it needs traceability and automation**, to fill in the points in the respective fields automatically at each step, impacting the evaluation process, and (iv) **the adoption of scores in a cumulative way**, causes difficulty in filling in scores in each iteration.

As an Opportunity, it was suggested to automate the recording of scores, speeding up the completion of the worksheet, leaving the participant only designated to develop their opinions and goals in the self-evaluation worksheet.

Finally, in the Adequacy criterion for the remote modality, the adaptation of the gamification worksheet for remote use was highlighted as a strength, helping participants to monitor the evolution of performance.

As for Weaknesses in this criterion, the following were highlighted: (i) **the alternation between several files and spreadsheets**, since the instruments were adapted for use in different tools, (ii) **absence of a single document**, which encompassed all instruments in the same tool, and (iii) **late feedback**, caused by the need to enter scores manually.

As an Opportunity, the need to create a system for automating activities and controlling dynamics was identified.

6.2 Affective Computing

Affective computing is defined as computing that relates to, arises from or is influenced by emotions and other affective phenomena (Pudane et al. 2018).

Emotions, according to Damásio (2006), are a set of bodily manifestations aroused after receiving a certain stimulus.

Thus, emotions are perceived by the words used in a given context, or even through the variations of the frequencies felt in certain parts of the speech (Batista, 2019).

In order to carry out the affective analysis through text, the text pre-processing steps were followed, an after that by a summary of the results.

In the text pre-processing step, the following activities were carried out: reading and text processing, class assignment, pre-processing and transformation;

Thus, in the reading and text processing activity, the reading and analysis of the texts informed by the participants in the self-evaluation steps was carried out. A pre-formatting was carried out to organize the texts and classify the answers, removing non-essential characters or words, valuing the content informed by them.

Then, the weights corresponding to each emotion were defined. This definition is necessary so that the different feelings can be cataloged and logically organized so that a general report of the predominant feelings aroused in the dynamics can be generated. Thus, the weights defined were: 3 for positive feelings, 2 for neutral feelings and 1 for negative feelings.

In the pre-processing step, answers were analyzed and feelings were identified, where the respective weights were assigned.

Then, in the transformation step the data were organized by weights in a spreadsheet to be worked on in the analysis process. Table 3 presents a sample of these data.

Table 3: Sample of feelings identified in the text with their respective weights.

Feelings	Weights
Goals **were not** achieved	1
My performance was **reasonable**	2
My performance was a **little slow**	2
I see it was quite **beneficial**	3
I **managed** to assimilate some knowledge	3
It **made possible** to achieve the defined goals	3
The dynamics became more **intuitive**	3
I didn't reach **any** of my goals	1
I **only** produced two cards	1

Finally, the results were summarized through the described analyses. Thus, in total, 50 feelings were identified, which correspond to the three iterations where the self-evaluation step took place, to which they received their respective weights.

The data collected in the first iteration resulted in 17 feelings which were categorized according to their respective weights. Figure 2 presents the result of this summary.

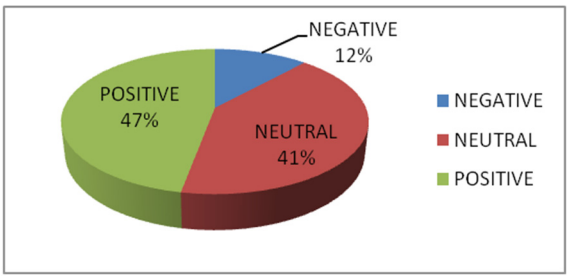

Figure 2: Summarization of feelings from the first iteration.

The first iteration took place at the meeting following the presentation of the dynamics and the simulated round. It is worth noting that in the self-evaluation step of this iteration, there was still no stipulated target. The evaluation was conditioned to the participant's own perception of their performance and, based on this, they could set a personal goal for the next iteration.

Thus, 47% of the feelings identified fit into the positive emotion, demonstrating user satisfaction, both in terms of dynamics and their performance.

The neutral emotion represented, in this iteration, 41% of the identified feelings. In this first iteration, doubts were still frequent, which showed a little insecurity on the part of those involved regarding their performance in the dynamics.

Finally, 12% of the feelings identified fell within the negative emotion. Here participants mainly reported cognitive difficulties (difficulties concentrating, slow thinking, and lack of creativity).

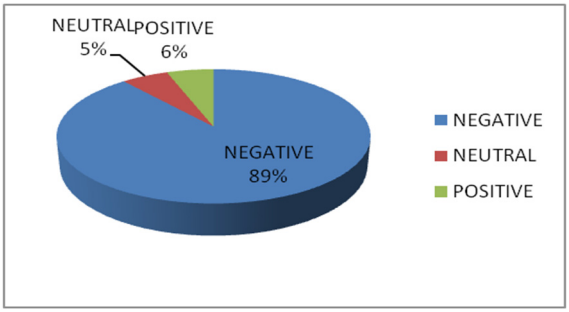

Figure 3: Summarization of feelings from the second iteration.

The goals defined by the participants in this iteration served as indicators in the self-evaluation step in the second iteration. Figure 3 presents a summary of this evaluation.

In the second iteration, 18 feelings were identified in the participants' evaluative reports. Unlike the previous evaluation, this time it was possible to evaluate the achievement of the previously stipulated personal goals.

Thus, in this iteration, 6% of the identified feelings fit the positive emotion and were related to satisfaction with the fluidity of the dynamics.

In the neutral emotion, 5% of the feelings identified in the participants' evaluative texts were framed. These reports of feelings alluded to the awareness that the stipulated goals were tangible.

Finally, 89% of the feelings identified in the participants' evaluative texts fit into the negative emotion. Mainly, difficulties in achieving the stipulated goals were reported. Dissatisfaction was also mentioned with the times of the dynamics, both the feedback and the ones destined to carry out the steps.

At the end of the Self-Evaluation step, in this second iteration, the participants defined personal goals for the next iteration. Figure 4 presents the result of this summary.

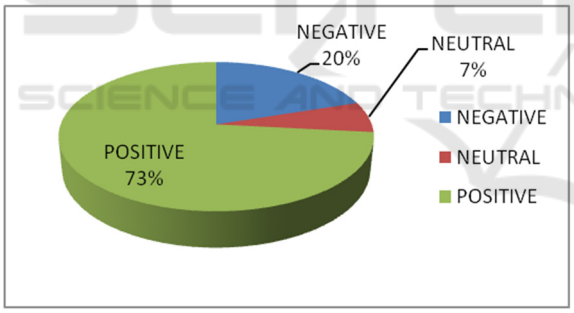

Figure 4: Summarization of feelings from the third iteration.

In the third iteration, 15 reports of feelings were identified in the evaluative texts informed by the participants. For this iteration, participants had the opportunity to define personal goals using the results of the second iteration as a parameter.

In this way, 73% of the feelings identified in the participants' evaluative reports fit into the positive emotion. The main reports of feelings alluded to the achievement of the stipulated goals. The perception of gamified dynamics as intuitive, easy and simple to understand was also mentioned in the reports.

The feelings identified in the evaluative texts of the participants who fit the neutral emotion correspond to 7%. Mainly, the proximity of reaching the stipulated goals were reported.

Finally, 20% of the feelings identified in the evaluative reports fell within the negative emotion. The reports of feelings classified in this emotion alluded to the failure to reach some of the defined goals. Cognitive difficulties (lack of creativity) were also reported.

Overall, the sentiments identified were homogeneous over the iterations. Figure 5 presents a summary of feelings throughout the application of gamification.

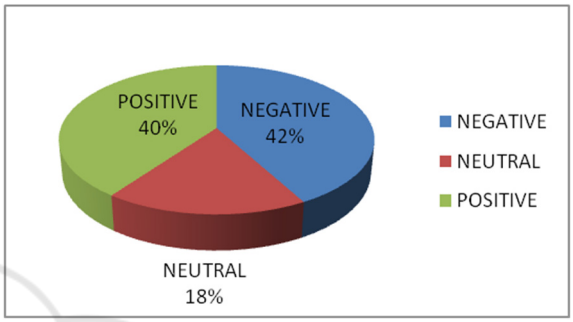

Figure 5: Summarizing feelings in gamification.

Thus, 40% of the feelings identified throughout the evaluative reports fit into the positive emotion, peaking in the third iteration with the achievement of goals, which were readjusted by the participants in the previous iteration.

The feelings that fit the neutral emotion correspond to 18% throughout the application of gamification, having its apex in the first iteration where, in the evaluation of the evaluative reports, a small insecurity in the participants was perceived.

Finally, the feelings that fall under the negative emotion, throughout the application of the case study, correspond to 42%, having their apex in the second iteration with the non-achievement of the goals, given that they were initially defined without the existence of a previous parameter.

Figure 6: Word cloud chart.

Thus, Figure 6 presents the word cloud chart that aims to present the terms according to their degree of occurrence in the participants' evaluative reports, evidencing the feelings most cited by the participants.

7 CONCLUSION

This paper presented the results of a qualitative analysis of a case study that aimed to analyze the suitability of a gamification to support the teaching and learning of the knowledge management assets and process, aligned with training in the Information Technology area, in remote mode.

The results obtained from the SWOT analysis with the participants make it possible to answer the RQ1: *Do the instruments and activities developed fulfill the purpose of stimulating the knowledge management process?* We conclude that yes, since the use of this gamification proposal allowed participants to produce and socialize different knowledge, positively impacting this process, as could be seen by the SWOT analysis. However, it is necessary to readjust several points regarding the adaptation of the instruments to the remote modality. In addition, for greater efficiency, it is necessary to implement a collaborative tool to automate the administrative routines of the dynamics.

In the same way, the results obtained with the affective analysis made possible the answer of RQ2: *Did the participants show satisfaction during the application of the gamified dynamics?* We conclude that yes, since the analysis pointed to an evolution of the feelings reported during the gamification iterations, corroborating the achievement of a better performance in the dynamics. In addition, participants could perceive the need to readjust personal goals so that they become tangible and satisfying.

As future works, the authors suggest: the implementation of a serious game based on this gamified proposal and the application in a group of the Information Technology course, in the remote modality, to verify its adequacy and efficiency in the knowledge management process.

REFERENCES

Alcantara, A. S., Oliveira, S. R. B., Rodrigues, E. A., Junior, R. V., Silva, J. C., Cardoso, W. R. (2019). Gamification and Evaluation of the Application of Knowledge Management in a Computer Science Class: An Experimental Study. In: *XVIII Simpósio Brasileiro de Jogos e Entretenimento Digital - SBGAMES*. Brazil.

Alcantara, A. S., Oliveira, S. R. B. (2019). Gamification and Evaluation of the Knowledge Management Application in a Software Quality Lab: An Experimental Study. *14th International Conference on Software Technologies - ICSOFT*. Czech Republic.

Alcantara, A. S., Oliveira, S. R. B. (2021). A gamification to support teaching-learning of knowledge management in information technology: a plan based on features of pedagogical approaches. *51th Annual Frontiers In Education – Fie'21*. USA.

Batista, A. F. S. (2019). EMOVERE: How we can use emotions and affective computing in game design? *Dissertação de Mestrado em Design de Comunicação e Novos Media*. Faculdade de Belas Artes, Universidade de Lisboa, Lisbon, Portugal.

Cardoso, W. R, Monteiro, R. S., Silva, A. M. M., Alcantara, A. S, Oliveira, S. R. B., Junior, R. V., Paiva, L. O. A. (2018). Quiz Teaches: A Tool to Support Basic Education Teaching (Elementary School II). *XVII Simpósio Brasileiro de Jogos e Entretenimento Digital*. Paraná, Brazil.

Damásio, A. (2006). *Descartes' error: emotion reason and the human brain.* London: Vintage.

Gonçalves, L. L., Giacomazzo, G. F., Rodrigues, F., Macaia, C. B. S. (2016). Gamification in Education: a conceptual model to support planning in a pedagogical proposal. *XXVII Simpósio Brasileiro de Informática na Educação*. Minas Gerais, Brazil.

Goulart, A. R. (2019). The Bankruptcy of the Current Model of Higher Education in Information Technology (IT). *Dissertação de Mestrado em Ciências*. Faculdade de Economia, Administração e Contabilidade de Ribeirão Preto, Universidade de São Paulo.

Lopes, W., Fernandes, I., Augusto, P., Madeira, C. A. G. (2021). Gamification strategy applied to emergency remote teaching in times of COVID-19. *XX SBGames*. Rio Grande do Sul, Brazil.

Oliveira, L. C., Oliveira, C. M., Oliveira, L. C., Pimentel, A. R. (2019). Challenges in Distance Learning: Computational Solutions for Collaborative Learning with Affective Computing. *VIII Workshop de Desafios da Computação aplicada à Educação (DesafIE)*. Brazil.

Pudane, M., Petrovica, S., Lavendelis, E., Anohina-Naumeca, A. (2018). Challenges in the Development of Affective Collaborative Learning Environment with Artificial Peers. *Applied Computer Systems*, 23(2), 101-108.

Reis, R. C. D., Isotani, S., Rodriguez, C. L., Lyra, K. T., Jaques, P. A., Bittencourt, I. I. (2018). Affective states in computer-supported collaborative learning: Studying the past to drive the future. *Computers & Education*, 120, 29-50.

Santos, M. de A., Grechi, J. G., Bermejo, P. H. de S. (2010). Evaluating the Impact of SCRUM on Software Development Using SWOT Analysis. *XXX ENEGEP*. São Paulo, Brazil.

Silva, E. L., Menezes, M. E. (2001). *Research Methodology And Dissertation Preparation.* 3. Ed. Rev. Atual. – Florianópolis: Laboratório De Ensino A Distância Da Ufsc.

SOFTEX. (2016). *MPS.BR - Brazilian Software Process Improvement*. Guia Geral. Versão 1.1, Brazil.