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Children's perceived impact of gamification elements on engagement in a self-regulation intervention for healthy eating

Universidade do Minho

Escola de Psicologia





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**Children's perceived impact of gamification
elements on engagement in a self-regulation
intervention for healthy eating**

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Psicologia

Trabalho efetuado sob a orientação do
Professor Doutor Pedro Rosário
e da
Professora Doutora Paula Magalhães

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STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration.

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Impacto percebido de elementos de gamificação no envolvimento numa intervenção de autorregulação para a alimentação saudável em crianças

Resumo

Gamificação, isto é, a implementação de elementos de jogo em contextos de não jogo, tem sido explorada como uma possível forma de mitigar o *dropout* e o baixo envolvimento em intervenções. Poucos estudos analisaram o papel de elementos de gamificação individuais ou a sua eficácia em promover o envolvimento. Este estudo tem como objetivo explorar o impacto percebido de elementos de gamificação no envolvimento, no contexto de uma intervenção online de promoção de uma alimentação saudável em crianças através da autorregulação. Crianças (N=26) foram entrevistadas após a intervenção com perguntas sobre cada elemento de jogo e como cada um contribuiu para o seu envolvimento com a intervenção. A análise temática revelou seis temas principais (Narrativa, Equipas, *Feedback*, Pontos e Tabelas de classificação, Regras, e Pressão Temporal). Os resultados sugerem que todos os elementos tiveram um impacto no envolvimento dos participantes. Em particular, a narrativa pareceu ser o elemento mais impactante. Em conclusão, os elementos de gamificação criaram um ambiente de jogo que contribuiu para o elevado envolvimento dos participantes.

Palavra-chave: Crianças; Envolvimento; Gamificação; Alimentação saudável; Autorregulação; Intervenção com ferramenta narrativa.

Children's perceived impact of gamification elements on engagement in a self-regulation intervention for healthy eating

Abstract

Gamification, i.e. the implementation of game-like elements in non-game contexts, has been explored as a possibility to mitigate dropout and low engagement in interventions. Few studies have researched the role of individual gamification elements or their effectiveness in promoting engagement. The present study aims to address both by exploring children's perceived impact of individual gamification elements on engagement in the context of an online self-regulation intervention for healthy eating. Children (N=26) were interviewed post-intervention with questions about how each game element contributed to their engagement with the intervention. Thematic analyses revealed six main themes (*Narrative, Teams, Feedback, Points and Leaderboards, Rules, and Time Pressure*). Findings suggest that every game element had an impact on participants' engagement. Particularly, the narrative seemed to have been the most impactful one. To conclude, the gamification elements were key to create a game-like environment within the intervention and contributed to enhancing participants' engagement.

Children; Engagement; Gamification; Healthy Eating; Self-Regulation; Story-tool intervention.

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Children's perceived impact of gamification elements on engagement in a self-regulation intervention for healthy eating

Digital Behavior Change Interventions (DBCIs) can be defined as any service that promotes behavior change through the use of computer technology (West & Michie, 2016), and are typically delivered through computers, websites, and smartphone applications. These interventions seem to be effective in changing behavior in a variety of contexts and among diverse users. For example, Stockwell (2019) found that DBCIs with older adults helped improve physical activity and reduce sedentary time. An important characteristic of DBCIs is that they are mostly delivered through the internet. This offers several advantages, for example, eHealth interventions offer opportunities to reach otherwise unreachable populations, but also show some limitations, for example, the anonymity and limited face-to-face contact can lead to dropout (Eysenbach, 2005). Another important feature deeply associated with the effectiveness of the interventions and early dropout is participants' engagement.

Engagement has been measured and defined in a multitude of ways. Some authors follow a behavioral approach splitting the concept into two subdimensions, "breadth" (the length of the contact) and "depth" (the variety of the material) and measuring it through observation or with log data such as time spent online (Perski et al., 2017). Other authors define engagement more subjectively, as an aspect of user experience that is associated with factors as follows: the challenge, positive affect, durability, aesthetic and sensory appeal, attention, feedback, novelty, interactivity, and perceived user control (O'Brien & Toms, 2008). The most common way of measuring engagement within this approach is through self-report questionnaires (Perski et al., 2017). Recently, Perski et al. (2017) proposed an integrative definition of engagement, blending both previously stated definitions. That is, the extent of usage of the intervention tools but also the subjective experience associated with attention, interest, and affection. Concurrently, Yardley et al. (2016) warned of the need of focusing not on "engagement" but on "effective engagement", defining the latter as the amount of engagement needed with the intervention to achieve the desired outcomes. Importantly, these authors argued that more engagement does not equal to more effective engagement. The latter is expected to be defined according to the purpose of the intervention, and therefore it must be established empirically in that particular context (Yardley et al., 2016). To conclude, engagement is key to achieve high effectiveness on interventions (e.g., health-focused), especially so in DBCIs (Yardley et al., 2016). As aforementioned, previous research has shown that one of the biggest challenges with eHealth applications is users dropout (Eysenbach, 2005). Therefore, it is critical to continue researching engagement and find new ways to improve participants' focus and involvement in interventions, so we can reduce dropout and achieve the desired effectiveness. One such way might be through gamification.

Gamification can be described as the use of game elements in a non-game activity (e.g., school) (Deterding et al., 2011). The rationale behind gamification is to use elements that make a typical game appealing (e.g., points, badges, and leaderboards) in less engaging activities to help them become more engaging and fun. Literature in gamification has been increasing; particularly education and learning domains have been receiving researchers' attention (Koivisto & Hamari, 2019). This might be associated with the easiness to implement game elements in those contexts, and the existing evidence of its efficacy to improve engagement within these contexts (e.g., Huang et al., 2019). For example, recently Mitchell et al. (2020) have shown that while experiencing gamification, participants were able to satisfy their autonomy and competence needs and that translated into a positive association with intrinsic motivation. In contrast, a longitudinal study that applied leaderboards, badges, and competition mechanics in a communication course, found that the participants in the gamified course tended to decrease in motivation, satisfaction, and empowerment when comparing with the non-gamified group (Hanus & Fox, 2015).

Two recent meta-analyses focused on the learning context may help understand literature's mixed results (Bai et al., 2020; Sailer & Homner, 2020). The meta-analysis by Sailer and Homner (2020) showed a significant small effect size of gamification on cognitive, motivational, and behavioral learning outcomes. Importantly, the positive effect on motivational and behavioral learning outcomes was not stable. The second study including both a meta-analysis and a synthesis of qualitative data also showed that there was a significant medium effect size of gamification on learning outcomes (Bai et al., 2020). The synthesis of qualitative data showed four main reasons for the learner's enjoyment of the gamification experience: gamification fosters enthusiasm, provides feedback, satisfies the need for recognition, and promotes goal setting. This synthesis also presented two reasons for disliking the gamification experience: gamification does not bring additional utility, and it can cause anxiety and jealousy. Finally, Bai et al. (2020) indicated that shorter interventions had larger effect sizes, raising concerns regarding the "novelty effect", i.e., the fact that gamification may only engage participants in the short term.

Interestingly, a few studies have been narrowing research to the analysis of individual gamification elements. For example, Mekler et al. (2017) conducted an experimental study and found that leaderboards were the most impactful element, followed by levels and points, in terms of performance based on quantity, i.e. activities completed; however, no impact was found in intrinsic motivation, need satisfaction, or performance-based on quality, i.e. quality of the activities completed. Moreover, Groening and Binnewies (2019) found that participants' performance and persistence improved when digital

achievements (e.g., “Accomplish a total of 700 correct trials”) were present, however, no improvement was found in intrinsic motivation.

Other researchers have been studying these aspects following a qualitative approach. For example, Aldemir et al. (2018) assessed university students' perceptions of gamification elements in the context of a gamified course through the use of interviews. The authors concluded that participants reacted positively to most of the elements included. Furthermore, comments and critics provided relevant insights about the implementation of these elements. For example, the challenges presented should not be too easy or repetitive. Leaderboards were criticized for creating a competitive environment; still, and interestingly, this was also the reason why many individuals liked leaderboards. Lastly, rewards were criticized for being abstract (e.g., points). Consistent with this line of research, and following a mixed design, Souza et al. (2017) assessed the perceptions of students in a gamified software engineering course with surveys and interviews. The authors concluded that badges were understood as a positive element, particularly as social rewards or a public recognition of their effort. Leaderboards, on the other hand, showed conflicting data. The quantitative measure (surveys) showed a negative perception of this element; however, interview data suggested that students valued the opportunity to compare their performance with their counterparts. Moreover, participants reported feeling motivated to improve or reassess their learning strategies when they scored lower than their peers. Students also stressed the possibility of being recognized for doing well.

Despite the vast amount of data on gamification, extant research examining gamified interventions on healthy eating with children is still limited. For example, prior research shows a few quantitative studies conducted in naturalistic settings (i.e., Jones, Madden, Wengreen, et al., 2014; Jones, Madden, & Wengreen, 2014, Joyner et al., 2017). These studies designed a gamified intervention to increment the consumption of fruits and vegetables (FV) in the school cafeterias. The intervention was based on a school-wide cooperative game requiring participants to eat FV to advance the underlying narrative. Participants were told that they were helping a group of heroes fight against the villains, and also that the teachers would only read the next episode of the narrative when the school-wide FV consumption surpassed the goal set; otherwise, a message encouraging students to eat more FV to help the heroes was read instead. Moreover, virtual currency was awarded according to how much the goal was surpassed and could be used to buy equipment for the heroes, which slightly affected the narrative. On particular days, participants could also vote to influence certain events (e.g., which planet to search for the villains). The intervention had a clear and significant impact on the consumption of FV, despite the short duration (13 days). Interestingly, the duration of the interventions has been one of the biggest grips

of gamified interventions because of the aforementioned “novelty effect” (Jones, Madden, Wengreen, et al., 2014). Two other studies regarding the same intervention were conducted (Jones, Madden, & Wengreen, 2014; Joyner et al., 2017). In the first, the intervention was administered in a different school, with more participants, and for a longer period (six weeks). A competition with fictional schools was added to the script of the program. Participants were told that they had to eat more FV than the fictional schools, but in fact, they were held the victor if their consumption surpassed a set goal. Findings show that the efficacy of the intervention was preserved (Jones, Madden, & Wengreen, 2014). In the second study, the intervention was conducted in two different schools, with some changes in the protocol (e.g., the presentation of the game materials, such as the narrative, were presented on visual displays at the school cafeterias). Data show that the efficacy of the intervention was preserved; nevertheless, the FV consumption data were similar to those of baseline levels after the intervention ended (Joyner et al., 2017).

Purpose of the study

Overall, there is a fair amount of positive results stressing the impact of gamification (Koivisto & Hamari, 2019), with recent meta-analyses reporting small and even medium effect sizes of gamification on learning outcomes (Bai et al., 2020; Sailer & Homner, 2020). Still, some caution is advised since shorter interventions seem to have higher effect sizes which might suggest a “novelty effect” (Bai et al., 2020). Recently, Koivisto and Hamari (2019) warned that most research examines gamification as a whole (i.e., non-considering the number and the type of element included) instead of studying the role of individual elements on the output. A deep analysis of the contribution of each element might, therefore, shed light on the complex process of gamification and on the mixed results found.

A few experimental (e.g., Groening & Binnewies, 2019; Mekler et al., 2017; Sailer et al., 2017) and qualitative studies (e.g., Aldemir et al., 2018; Souza et al., 2017) explored the role of individual gamification elements. However, the corpus of data generated should be analyzed considering two aspects. First, the context in which the study is conducted, for example, the implementation of gamification in education is intuitive and simple, but clinical contexts may require extra effort (Seaborn & Fels, 2015). Second, the target population; a gamified intervention on children and adults is expected to produce distinct results. Thus, further investigation is needed to examine which components are better fit to contexts and users (Nacke & Deterding, 2017); and analyze the role played by gamification elements in the participants' engagement with the intervention. Research designs focused on the role of particular elements rather than on the whole process of gamification, and fit to the needs of particular individuals

and contexts (Aldemir et al., 2018), might shed light on the apparently incongruent findings reported by literature.

We addressed this challenge by exploring children's perspectives in the context of an online self-regulation intervention on healthy eating. To the best of our knowledge, there are only a few studies on gamified healthy eating interventions with children (e.g., Jones, Madden, & Wengreen, 2014; Jones, Madden, Wengreen, et al., 2014; Joyner et al., 2017); still none used a qualitative design to further examine the role of game elements in children's engagement in a healthy eating intervention. To deepen our understanding of the contribution of gamification elements to participants' engagement in an intervention is key to improve the efficacy of the interventions, because individuals' engagement is a strong predictor of the effectiveness of the intervention (Donkin et al., 2011; Perski et al., 2017).

Therefore, the main objective of this study is to explore children's perceptions of the role of individual gamification elements. More specifically, we aim to learn how each gamification element used affected children's engagement in the intervention. The following research question guided this study: "How do individual gamification elements affect children's engagement in an online self-regulation intervention for healthy eating?". Findings are expected to be useful to inform the design of new interventions of similar nature.

Methodology

Context of the study

This study was part of a project, the Healthy Eating Promotion with Self-regulation (HEP-S) program (Magalhães, Silva, et al., 2020) conducted in the online platform CANVAS®. HEP-S is a preventive educational program that aims to promote the agent role of the individual within a self-regulation framework. The program used the story-tool "Yellows Trials and Tribulations" (Rosário, Nuñez, et al., 2007) and "The Hill of Bald Trees and Other Stories" (Rosário et al., 2016) to promote children self-regulation skills and improve their healthy eating behaviors (Rosário et al., 2016, 2017). For every weekly one-hour sessions (20 total sessions), the narrative telling the adventures of the rainbow colors in search of Yellow that is lost in the forest was read out loud for the whole group and discussed. To foster participation, children took turns to read the text aloud. Moreover, the research assistant encouraged participants to discuss the self-regulation strategies embedded in the narrative and transfer the learning messages to their health; in addition, participants completed in-session activities with the same goal. Gamification strategies were embedded throughout the program. The gamification elements present in this program (see Table 1) were the following: narrative context, feedback, reputations/ranks/levels, competition under rules (explicit and enforced), teams, and time pressure (Magalhães, Silva, et al., 2020).

The following table was retrieved and adapted from Magalhães, Silva, et al. (2020) with authors' consent and summarizes the objective of and how each game element was implemented.

Table 1

Gamification Elements used in the enhancement treatment group

Elements*	Objective/rationale**	How it was implemented
Narrative context	The narrative provides information about the characters and instigates reflection, as well as the establishment of a parallel between the characters' actions and their own.	The narrative context within the intervention is created by the activities being conceived as an extension of the narrative/story-tool that children read during the program.
Feedback	Feedback allows the user to know how things are going and provides hints on what the user needs to address in order to reach their self-set goals.	The educational psychologist provides personalized feedback to each interaction that children engage in their online group
Reputations, ranks, and levels	These elements show the users their place in the hierarchy of the group, promoting competition. It also informs other users about particular competencies or talents and sustained achievements that a user might have.	Children can earn points for performing each activity suggested in the platform. Every week there will be a ranking with the children that acquired points that week and the corresponding badge, as well as with information regarding the cumulative rank of the class. By accumulating points, children will progress and become closer to the end-goal.
Competition under rules that are explicit and enforced	Rules contribute to a sense of fairness among users. Rules allow competition to work when they are evenly and impersonally applied.	The educational psychologist will oversee compliance with the rules and is the sole responsible for attributing points and badges, and making the ranking.

Teams	Teams allow interaction opportunities between members, who reveal their personalities and disclose personal experiences while collaborating to reach team goals.	Children are organized into small groups composed by classmates. By collaborating to reach team goals, each child will benefit with extra points in the cumulative rank.
Time Pressure	Time pressure contributes to users' competition; It creates the sense of "uncertain winning conditions".	Children will not be able to go back and complete activities that have already expired.

*These descriptors were retrieved from Deterding and colleagues (2011)

** The description of the descriptors was based on Byron Reeves and J. Leighton Read article summarizing the "Ten Ingredients of Great Games". [http://www.cedma-europe.org/newsletter%20articles/misc/Ten%20Ingredients%20of%20Great%20Games%20\(Apr%2010\).pdf](http://www.cedma-europe.org/newsletter%20articles/misc/Ten%20Ingredients%20of%20Great%20Games%20(Apr%2010).pdf)

Design and Procedure

The present study is part of a research project approved by the University of Minho Ethics Committee for Research in Social and Human Sciences (CEICSH) (CEICSH 032/2019). The project was found to comply with the requirements for good practice in human research in accordance with national and international standards for research in social and human sciences, including the Declaration of Helsinki. Prior to data collection, written informed consent from children and parents/caregivers was obtained. To protect confidentiality and anonymity of the data, identifying codes (e.g., BFM03) were assigned to participants. Data collection took place in online sessions. The research assistant conducted interviews.

Participants

Data were collected from 41 children belonging to three classes of the fifth grade. These children were divided into 11 small groups. Groups were composed of children from the same class, as literature suggests that social influence improves engagement (Poirier & Cobb, 2012); moreover, preliminary findings of a usability and feasibility study highlighted that children were more willing to participate in a program with their classmates (Magalhães et al., 2021). Of the 41 children, 15 dropped out (36,59%). Interviews were conducted with the remaining 26 children (63.41%), of which 17 were girls (65.4%). Ages ranged between 9 and 11 years ($M_{\text{years}} = 9.92$, $SD = 0.392$).

Instruments

Personal Information

Participants were asked to provide information on sex, age, grade, academic achievement, socioeconomic level, and healthy habits and behaviors (e.g., screen time, physical activity).

Semi-structured interviews

A semi-structured interview was developed for this program. The general purpose of the interview was to assess how participants' engagement was affected by the different game elements included in the program. The interview started with a probe to understand whether participants were aware of the game elements included in the program. Then, the remaining questions addressed each of the game elements (i.e., narrative, feedback, reputations, ranks, and levels, teams, competition under rules that are explicit and enforced, teams, and time pressure). The order in which the elements were presented was flexible and adjusted to the participants' discourse. Each interview lasted approximately 45 minutes.

Data Analysis

Interviews were transcribed verbatim, and a thematic analysis was conducted by identifying and interpreting pattern themes. We used phases of thematic analyses to guide this process (Braun & Clarke, 2006). Deductive and inductive approaches were used to analyze data. Regarding the former, we developed a codebook based on the theoretical background prior to starting the analyses. For example, the game elements used in the intervention were selected as themes (e.g., *Narrative, Feedback, Ranks [Points and Leaderboards], Rules, Teams, Time Pressure*).

Moreover, a deep examination of the literature focused on qualitative studies examining the role of the game elements found no studies conducted with children. Still, the analysis of available data (e.g., Aldemir et al., 2018; Souza et al., 2017) suggested a few codes that were added to the codebook (e.g., *Relationship and Interaction Between Teammates*). During the familiarization phase, while following an inductive approach, new codes were found and added to the codebook (e.g., *Learning, Induced Participation, and Organization*); moreover, some themes were merged into a single theme (e.g., *Points, and Leaderboard*). To ensure the trustworthiness of the analysis, two researchers worked on the coding scheme as follows: (i) researchers discussed the unique criteria for each of the codebook themes and codes and (ii) trained the application of the codebook to a selection of interviews comprising most categories and subcategories. Next, (iii) each researcher independently coded some interviews, compared coding, and resolved any differences through discussion. Importantly, (iv) training continued until consistency on coding was reached. Then, one researcher coded all the data and a second researcher

coded 30% of the material, independently. The two researchers then reviewed all themes and codes and discussed the differences found to reach a consensus. Inter-observer agreement was calculated and the interrater reliability between the two researchers was 0.934 which is considered “almost perfect” according to Landis & Koch (1977). To assist the qualitative data analyses, NVivo 10 software was used.

Findings

Seven main themes were found: *Narrative, Teams, Feedback, Points and Leaderboards, Rules,* and *Time Pressure*. All themes are game elements, and each theme has multiple codes that provide specific insights on how and why they affected participants' engagement in the intervention (see table 2).

Table 2

Themes, codes, respective response frequency, and representative quotes from a qualitative study on children's perceived impact of gamification elements

Theme	Code	Code frequency***	Example
Narrative	Learning*	24	"Ah, an interesting story educational (...) it leads us to learn besides the eating topic (...) [we learned] ways to more easily achieve our healthy eating and other things that we can do on a daily basis." (AFAA3)
	Enjoyment and Characters*	22	"it was fun (...) And I also liked it (...) Because they [the characters] were looking for Yellow and so it was cool that what the bird professor said, the riddles that the pirate tree did ..." (DGF6)
	Reading*	15	"reading the Yellow was very cool and I wasn't expecting it, but when we started reading I loved it (...) So that was a thing that I wasn't expecting, but a good thing." (IMSM12)
	Anticipation*	6	"I liked it very much and also every time I would be very curious because I always wanted to find [where was Yellow] because I always said "mom will we find Yellow today" and my mom would be confused because she didn't understand anything of the sessions" (BMM1)
Teams	Advantages*	26	"I think it makes the experience more interesting because this way we meet more people not only the student with the psychologist (...) this way we are with colleagues [in the sessions] provide our opinions, and I think that that is good (...) We help each other (...) In any difficulty the other person isn't making fun of us because we have difficulties he is helping us and giving us hints on how we can improve and such" (IPG10)
	Disadvantages*	17	"Because sometimes a lot of people were speaking. (...) And so I couldn't hear anything" (RPS19)
	Relationship and Interaction between teammates**	5	"It was even better because there were more students [in the sessions], more friends from my class, if it was only me it would have been always the same thing; we are many, we are four [moreover] my best friend is there, even better, I was immediately very happy." (LRSF15)
Feedback	Reinforcement*	19	"Sending messages means that the psychologist gives attention to what we do (...) and being with us so she can teach us for example. (...) That she would give us incentive to participate and do the activities." (DGF6)
	Improving*	19	"It was good because eh in the activities we had to always ask if it was correct and then we corrected it so next time we don't make any mistake. (AFLP1)"

Points and Leaderboards	Reinforcement*	15	"The more points I earned the more I wanted, I wanted to participate to express myself." (LSPC17)
	Self-assessment*	13	"I liked the points more because I liked to see how my participation was, if I was doing everything well, if I was not doing [the activities], and such." (BMM1)
	Competition**	8	"Yes because I put a lot of effort into it. I participated a lot [in the sessions] to try and reach first place." (BFM03)
	Teams**	8	"I always saw the ranking because I liked to see who was at the top, down and in the middle, and how many points we had." (LOS16)
Rules	Organization*	16	"Yes, because if there weren't those rules maybe I wouldn't be able to speak and then I would give up." (DGF6)
	Fairness*	4	"because for example, if we are playing for example Uno, supposedly the rule is we can't see each other cards, if we go there and see the cards of other players we know what move we have to make. That way its not fun; [the rules] also serve to have a fair game, a clean and fun game." (JSP11)
Time pressure	Induced Participation*	15	"[I think it was good] because if it was [the deadlines] like hand in whenever you want we most likely [wouldn't hand in at all]. So I think its good to be early accustomed to the rules (...) Ah, its that deadline and we have to comply until the deadline, we have to do everything right and [at worst] hand it in that day but usually always with a day in advance or so." (IPG10)
	Responsibility*	4	"Yes, I think its good because we also have to be responsible with ourselves and remember "Ah now I am growing more I need to have more responsibility I have that task and I can't play I have to do it first" (...) I think that this [the program] helped us be more responsible." (LOS16)
	Organization*	3	"Well, because... well, because it helped us be more organized." (MGS18)
	Overwork*	2	"I needed more time. (...) It was difficult. (...) Because I had a lot of homework and that way I didn't had a lot [of time]..." (AGCC2)

*Codes obtained from the data

**Codes obtained through Aldemir and colleagues (2018)

***Number of interviews in which the code appeared (26 total interviews).

Narrative

This theme included participants' perceptions about the narratives. Four codes were obtained: *Learning, Enjoyment and Characters, Reading, and Anticipation*.

The code *Learning* included participants' references to their learning experiences with the narrative (e.g., contents learned, contents value, and their impact on daily life). This code was one of the most prevalent, being present in 24 of the 26 interviews. Two key components comprise this code: the useful nature of the content of the program and the way it was delivered. Multiple participants mentioned that the learned contents helped them improve their healthy eating habits. For example: "Ah, the one [topic] I liked the most was *leave the laziness behind* because I had a lot of laziness to do the homework and to leave the laziness [out of my life]. CRAva and PLEE [acronyms standing for self-regulation tools delivered in the program] helped me a lot in my diet" (BMM1). Participants also mentioned that they could use what they had learned in other contexts besides healthy eating. For example, in their daily life planning as this participant's statement illustrated: "The PLEE [self-regulation cycle acronym]. (...) Because it helped me plan, execute, and evaluate my day-to-day" (RSP19). Importantly, participants highlighted the way the learning and teaching process were conducted. That is, participants emphasized that learning through the narrative helped them to be more engaged in the sessions when compared against more traditional approaches for delivering content, such as the simple exposition and explanation of the content. The following example illustrates this idea:

The "Yellows Trials and Tribulations" was a lot of fun to read, and I wasn't expecting to hear about so many things and learn things such as PLEE, CRAva, and such because I thought that it [this program] was going to be like just speaking of healthy eating. (IPG10)

The code *Enjoyment and Characters* included two main ideas. First, the idea that the narrative was fun and instrumental to deliver the healthy eating contents, and second the role played by characters in delivering important messages. Similar to the previous code, this was found in most of the interviews (22 out of 26). The following example illustrates participants' positive experience while reading and discussing the story contents. Participants reported that the narrative made the program more fun and useful to convey the healthy eating messages embedded in the narrative than other more conventional approaches, which are not perceived as facilitators of in-session engagement: "It was good because instead of being here speaking we were telling a story and we could read and during that story we were learning things about eating. (...) It was more fun" (DGF6).

The next example mentions how some of the characters made the story more enjoyable: "Because it was fun (...) And I also liked it (...) Because they were looking for Yellow and so it was cool that what the bird-professor said, the riddles that the pirate-tree did ..." (DGF6).

The code *Reading* was present in more than half of the interviews (15 out of 26). This code included general positive perceptions regarding the reading component of the narrative. Specifically, perceptions regarding the dramatic reading. The following statement shows how the dramatic reading could be perceived by the participants as a game and be quite fun, making the program more engaging: “When we read the chapters and pretended that we were the Colors and being actors and we choose “I am Yellow, and I am the Orange” I think that this also transformed [reading] into a game” (LOS16).

Teams

This theme included perceptions regarding the game element “Teams”, including the fact that the program was conducted in small groups in which participants should cooperate to gather more points. Three codes were found: *Advantages*, *Disadvantages*, and *Relationship and Interaction Between Teammates*.

The code *Advantages* included the benefits associated with the program being delivered in groups or teams rather than in a one-on-one mode. This code was reported in every interview (26 interviews). Multiple advantages were stated, the most common ones being the ability to help each other, and to share and listen to different opinions. Other less common included the opportunity to see each other, make new friends, and the ability to assign each person to a different character during the reading of the narrative.

The following comments illustrate these ideas:

I think it makes the experience more interesting because this way we hang out with more people not only the student with the psychologist (...) this way we have are with colleagues share our opinions and I think that that is good (...) We help each other (...) In any difficulty the other person isn't making fun of us because we have difficulties he is helping us and giving us hints on how we can improve and such. (IPG10)

“Because if I was here alone, I was the only one to speak it was going to be [boring]. (...) I think I had already given up” (DGF6).

The code *Disadvantages* included any disbenefit associated with the “Teams” game element, and was found in most interviews (17 out of 26). The most referred disadvantage was the fact that sometimes participants would talk over each other. Other disadvantages were that sometimes people would be late, miss the session, or even drop out. The following statements stress some disadvantages of the “*Team*” game element: “Because sometimes a lot of people were speaking [simultaneously] (...) and so I couldn't hear anything” (RPS19). “That some colleagues dropout” (AFLP1).

Feedback

This theme included perceptions regarding the feedback conveyed by the research assistant, such as written or verbal comments regarding the activities participants did on the CANVAS® platform or in the live sessions. Should be noted that the research assistant was referred to as a psychologist by the children. Two codes are included in this theme: *Reinforcement* and *Improving*.

The code *Reinforcement* describes participants' perception that the feedback delivered by the research assistant reinforced their participation, that is, reports stress that the feedback received helped improve their engagement and motivation to perform the activities and attend the sessions. This code also included general perceptions regarding the role of the research assistant in supporting participants; for example, by reminding them about the sessions and activities and encouraging them to attend and complete them, respectively. *Reinforcement* was found in 19 out of 26 interviews. There are a few examples showing that participants highly valued the research assistant's support and feedback. The following example illustrates this idea:

I think it was good, I liked very much that you [the psychologist conducting the sessions] participated because it's always good to have someone helping us in the things we need (...) I think that it influenced me a lot because I had a lot of help from you; if I hadn't, if I had another psychologist, that didn't help at all, I probably wouldn't be here even a day, not even a week. (LGC15)

The next example shows other relevant aspects, namely the gentle reminders sent by the research assistant about the sessions and activities, which helped improve participant's involvement in the program activities, and further understand how impactful the feedback was:

Very good [the feedback provided] because ... we could remember that we had the session. (...) Remember that we had tasks and activities (...) Well, ahm, it helped, it influenced me in me being more present, ahm and expressing myself better. (...) I think that the feedbacks that the psychologist [research assistant] gives, and gave, are very good and are things that will stay in our memories, things that we will be able to tell. (LSPC17)

The code *Improving* included the idea that the feedback helped participants improve or understand their performance in the activities. This code was found in 19 out of 26 interviews. Participants clearly expressed their enjoyment regarding the received feedback, and how it helped them improve their participation in the program. The next example is two-fold: it shows the improving nature of the feedback, but it also recalls the ideas from the previous code *Reinforcement*.

Yes, that [feedback] too it's good because also gives advice about what we did wrong and what we did, so next time we don't err in the same things. (...) Or [helps] improve our work and also say it's good and we become very happy because we put a lot of effort into it. (LOS16)

Points and Leaderboards

This theme included perceptions regarding the use of a point system and leaderboards. Four codes were found: *Reinforcement*, *Self-assessment*, *Competition*, and *Teams*.

The code *Reinforcement* included perceptions regarding the reinforcing nature of the points, in other words, participants reported that they felt more engaged and increased their participation because of the points. The code was found in 15 out of 26 interviews. Generally, participants reported that receiving points made them feel more motivated. More specifically, this game element helped them complete all the proposed activities. The following examples illustrate the previous ideas:

I liked it because this way also when we do it we know that we will win points and maybe this encourages us more" (DGF6). "The more points I gained the more points I wanted [to gain]. I wanted to participate and express myself. (LSPC17)

Another participant mentioned that everyone tried to gather as many points as they could which made the program a lot more fun: "I think that this way it made it [the program] more fun. (...) Because this way everyone wanted the maximum points. (...) Because everyone would try to achieve maximum points to get a lot of points in the end" (RPS19).

The code *Self-assessment* included perceptions regarding the role played by points and the ranking system as a way for participants to assess their participation. This code was found in half of the interviews (13 out of 26) and suggests that the point and ranking system helped participants to evaluate their participation. The following example supports this claim: "This way we could evaluate our participation and our progress from one week to another" (MSV20). The next participant further supported this idea, claiming that the anticipation of the ranking caused excitement, and explained how this assessment helped him plan the following week to obtain more points:

I think that it helped us become more excited because every week I would go to the ranking "How much did I have?" (...) In the last [ranking] I had a lot of points but I didn't get them because I didn't complete the diary. Damn! [next week] I will answer the diary (:..) I am going to do [everything well] so I can earn the maximum points on the next week. I would do everything [complete every assignment] and get the maximum points. (IPG10)

The code *Competition* included perceptions regarding how the points and the ranking system created a competitive environment and whether this was sensed as enjoyable and engaging. Note that there were two different instances of competition. One between teams and the other between teammates within the same team. The latter was particularly relevant since it created a very healthy competition intertwined with cooperation. As previously stated, participants would only be awarded bonus points when everyone from the same team complete all the tasks. This code was found in eight out of 26 interviews.

Participants reported that the competitive environment was fun and foster their participation. The following examples illustrate that: “It made the program more competitive (...) And more fun” (TMCM23). “Yes because I was there, I put a lot of effort into it I participated a lot to try and reach the first place” (BFMO3).

The code *Teams* included perceptions regarding the team-based leaderboards and comparisons between teammates concerning the accrued points. This code was also found in eight out of 26 interviews. In the following example, the participant mentions that he and some of his teammates would sometimes miss the activities and that was unfair towards their other teammate that completed all the activities.

They [counterparts] could have the most points of the class if they did all of the tasks, but [in the groups] in our class were some didn't have [worked] like J, and I wouldn't win points or E, but B deserved to win because she came to all [sessions] and always did everything., (...). B deserved to win and I was sure that she was going to win because she always did everything. (LRSF15)

Nevertheless, most references of this code were comparisons between teammates such as the following: “It was good because this way [we learn] who did more and who did less” (AFLP1).

Rules

This theme included perceptions regarding the rules that guided this intervention. Most rules referred to the online synchronous sessions; for example, speaking one at a time, raising their hand prior to intervene, be punctual. Two codes were found: *Organization* and *Fairness*.

The code *Organization* included participant's reports stressing that the rules were important to organize the participant's expectations and behaviors, and prevented problems, such as having several people speaking at the same time. This code was found in 16 out of 26 interviews. Most participants considered rules an important tool; usually stating that without clear rules the flow of the sessions would be compromised (e.g., people would talk over each other, arrive late, be unsure of their role in the sessions). The following example illustrates this idea:

Ah, the rules are very important because that way you guide everything and it is much easier. (...) imagine I want to speak, but, for example J is speaking over me and then I want to speak and then L wants to speak as well; that way, we could never understand each other and so you say “you speak, that one speaks” and so the participation it's a lot better and everyone can speak. (BMM1)

In the next example, another participant defended the importance of rules to assure order. Importantly, the participant rightfully claims that without rules the program would have not been a game:

I think that the rules are important, because without the rules it would be a debacle so I think that the rules are important. To have order and that. (...) A bit because I had to abide by the rules ... [moreover] a game without rules, would not be a game, it would be something else (...) Yes. I said that it influenced a

bit because there are no games without rules if it were if there was a game without rules it wasn't a game because games always need rules. (LGC15)

Time pressure

This theme included perceptions regarding the game element “time pressure”. Four codes were found: *Induced Participation*, *Responsibility*, *Organization*, and *Overwork*.

The code *Induced Participation* included the idea that the due dates for the assignments were important because without them participants would, most likely, forget or indefinitely postpone the completion of the activities. This code was found in 15 out of 26 interviews. Participants stated that the due dates were an important feature of the program. For example, the following participant, as most participants, claims very generally that without clear due dates for delivering the tasks most participants would postpone the activities until the end of the program.

Because if we knew that it [tasks] could be done until the end of the sessions everyone was going to always say “tomorrow I will do it, tomorrow I will do it” and then when we reached the end [of the program], we had nothing done. (DGF6)

Discussion

The purpose of this study was to understand the perceived impact of the different gamification elements on children's engagement in an online self-regulation intervention focused on healthy eating. From participants' perspectives, the different gamification elements had a strong impact on their engagement and in preventing dropout.

The most valued game element was the narrative. It is important to note that this intervention is part of a research line using story tools (Yellow's Trials and Tribulations; Letters from Gervase aimed for first-year college students) (Rosário, Nuñez, et al., 2007) purposely designed to promote self-regulation (Rosário et al., 2016, 2017, 2019). Research has shown that these tools are effective in promoting SRL strategies (Rosário et al., 2015, 2019; Rosário, González-Pienda, et al., 2010; Rosário, Mourão, et al., 2007; Rosário, Núñez, et al., 2010) and school engagement (Azevedo et al., 2019). Therefore, the use of these story tools to ensure the narrative context game element can be a good way to train important strategies and to further engage participants in the remaining components of the intervention. Nevertheless, as Tsay and colleagues (2020) warned, gamified interventions in which participants do not engage in the activities might be related not with the gamified systems but rather with the relevance of the content and the mode of delivery. In the current intervention, both content and mode of delivery were intertwined with the gamified systems, more specifically, with the narrative. The narrative was the source of the content and included: declarative knowledge regarding healthy eating, and the training on self-

regulation strategies likely to be useful to help participants attain their self-set goals on healthy eating. This set of strategies (e.g., self-management; goal setting, help-seeking) were important tools to help participants adapt their diet towards healthy goals as declared in the interviews. Declarative knowledge is important, but without displaying efforts to use this knowledge and improve healthy eating in this case, meaningful changes are non-expected. Conventional approaches (i.e., those relying on transmitting information, rather than reflecting on the information provided) may lack the procedural knowledge (i.e., training on how to use the strategies in real-life scenarios) needed to apply the learned content to practice. What is more, besides being meaningful, the content must be delivered in an entertaining way. Our program was delivered through the reading and discussion of the narrative, and children were encouraged to display an agent role to help the rainbow colors find their friend Yellow lost in the forest. Thus, the content was very relevant according to the participants, and it was delivered in a fun way, fostering participants' engagement in the program. Similar to current results, Aldemir et al. (2018) concluded that the narrative must be relevant for the participants to create an immersive state, which is necessary in gamified experiences to be effective.

The second most important game element was Teams. Participants reported as very positive to work in a team setting as they could interact and share opinions among each other. Although, there were some disadvantages expressed in the interviews, such as the lack of personal time and behavior management, the advantages of the use of this game element outweigh the difficulties reported. Aldemir et al. (2018) reached a similar conclusion and stressed the importance of communication in a team setting and recommended working in small teams to facilitate this process.

The third most relevant element was Feedback. In this element, participants valued the constant feedback and support provided by the research assistant. During the interviews, participants strongly suggested the very important role played by the research assistant in maintaining participant engagement, either through feedback or reinforcement. This, together with the fact that participants highly valued the Team game element suggests the need to provide strong social support in response to participants' educational needs. This finding is consistent with data from the work of Magalhães, Pereira et al., (2020). These authors conducted a gamified hybrid intervention to promote healthy eating and concluded the need to provide social support to participants by both the facilitators (e.g., research assistants) and other participants. Moreover, prior research suggests that social influence can be a way to increment engagement and reduce dropout (Poirier & Cobb, 2012).

While analyzing the gamification element Points and Leaderboards, participants reported that the reinforcing nature of points and the ability to evaluate their participation through the leaderboards were

very important for their engagement in the program. These data are not consistent with those of studies presenting leaderboards as simultaneously being valued for allowing participants to be recognized and being both valued and criticized by creating a competitive environment (Aldemir et al., 2018; Souza et al., 2017). Additionally, points and leaderboards in the latter study were used as a grading system since they were applied in the context of a course. Whereas, the present study did not use a grading system. Thus, the discrepancy between both results may be due to the between-teams leaderboards being only available at the end of the program, which may have diluted the competition aspect of the leaderboards.

Moreover, participants mentioned that Rules were important to organize the program. They elaborated that with no rules, it would have been difficult to participate which would likely have led to low engagement in the program. Furthermore, some participants referred that the program needed rules because without them this program would have not been a game. Finally, participants considered the time pressure game element to be very important in enhancing their engagement as it prevented them from indefinitely postpone their tasks. In some instances, participants also mentioned the points as a reason to do the activity prior to the due date; this interesting finding might suggest a positive interaction between the two elements.

Limitations and future studies

Some limitations must be acknowledged. First, the between-teams leaderboards were only available to participants at the end of the intervention, which might have diluted the competition aspect of the intervention. To further instigate competition, future studies may consider presenting a between- and within-team ranking list every session. Second, the intervention followed Deterding and colleagues (2011) proposal of game elements. Future studies may want to consider including other game elements to enrich the game-like environment. Additionally, to counteract the “novelty effect”, researchers may consider alternating active game elements throughout the intervention, similar to the approach followed by Joyner et. al. (2017). Finally, using a story tool to ensure the narrative context game element showed promising results. Therefore, researchers might consider using story tools to ensure the narrative game element; still, the use of this element should be further investigated using distinct story tools to deliver the intervention in distinct educational topics.

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Relatores: Emanuel Pedro Viana Barbas de Albuquerque e Marlene Alexandra Veloso Matos

Título do projeto: *In-person and Online Healthy Eating Promotion through Self-regulation (HEP-S): Assessing the Efficacy of a Narrative-based Intervention*

Equipa de Investigação: Paula Cristina Soares de Magalhães da Silva Correia, Investigadora de pós-doutoramento, Centro de Investigação em Psicologia, Escola da Psicologia, Universidade do Minho; Pedro Rosário (PhD), Professor Associado, Departamento de Psicologia Aplicada, Escola de Psicologia, Universidade do Minho; Paulo P.P. Machado (PhD), Professor Catedrático, Departamento de Psicologia Aplicada, Escola de Psicologia, Universidade do Minho; Sónia Gonçalves (PhD), Professora Auxiliar, Departamento de Psicologia Aplicada, Escola de Psicologia, Universidade do Minho

PARECER

A Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) analisou o processo relativo ao projeto de investigação acima identificado, intitulado *In-person and Online Healthy Eating Promotion through Self-regulation (HEP-S): Assessing the Efficacy of a Narrative-based Intervention*.

Os documentos apresentados revelam que o projeto obedece aos requisitos exigidos para as boas práticas na investigação com humanos, em conformidade com as normas nacionais e internacionais que regulam a investigação em Ciências Sociais e Humanas.

Face ao exposto, a Comissão de Ética para a Investigação em Ciências Sociais e Humanas (CEICSH) nada tem a opor à realização do projeto, emitindo o seu parecer favorável, que foi aprovado por unanimidade pelos seus membros.

Braga, 26 de junho de 2019.

O Presidente da CEICSH

Assinado por: ACÍLIO DA SILVA ESTANQUEIRO
ROCHA
Num. de Identificação Civil: BI042754054
Data: 2019.07.05 14:45:37 Hora de Verão de GMT



Anexo: Formulário de identificação e caracterização do projeto