

# Prototyping an app to assist game-based activities: co-design using a qualitative approach

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## Abstract

Qualitative approaches have gained prominence in the scientific community being important to develop studies that use them, namely to assist prototyping stages. This article seeks to contribute to the deepening of knowledge in the field of cataloging and evaluating educational games and describes the process of designing an application's wireframes. This allowed the gathering of the app's functional requirements, using a qualitative methodological approach through co-design: a focus group of eight experts from different fields such as geography, sociology, science, technology, engineering, art and mathematics was constituted. Considering the Communicative Design Paradigm and the Octalysis gamification model, the functional requirements were grouped, after analysis, into six domains – Games, News, Interaction, User, Evaluation and Language. The prototype design emerged from this process enabling the design of 47 wireframes.

## Keywords 1

educational games, game-based learning, gamification, functional requirements, prototype

## 1. Introduction

Incorporating games in the educational context seems to have a positive impact on the motivation, learning, behavior and attention of students [1]. By associating a playful component, enriched by visual and auditory tools, recognized for having a great influence on cognition [2], students can learn the topics addressed by the game more easily. Thus, when articulated with more traditional methodologies, the educational games seem to boost communication and produce excellent results in learning [3]. Games can also bring along a relational approach, improving relationships between students and between the students and the teacher [4]. From another perspective, the advantages of applying game-based learning (GBL) in education are also centered in the learning experience (of being more active), of the immediate feedback, of provoking behavioral changes and of being applicable in varied contexts [5].

Despite this scenario, it's critical to better understand the advantages of using games as tools to support learning and teaching strategies, namely in what concerns the conditions given to teachers when selecting a game. There are some obstacles which can lead to demotivation when the teacher is considering to use educational games in the classroom: the full compliance of the school programs indicated by the government education authorities; the lack of peer recognition of the strategy; the agitation caused by students; the process of choosing the game; and the technical and technological conditions, among other.

For teachers, it is complex to quickly identify how a particular game may be relevant to a curriculum theme, as well as the quality and accuracy of existing content within the game [4].

The creation of a digital application to support the seriation, cataloging and evaluation of educational games, based on practical and real cases and supported by evaluation models recognized by the scientific community, can make the process of choosing the game more robust. Thus, developing a



feasible and innovative application that can solve a problem in the educational community became a reason of interest and motivation to the research presented in this paper.

To answer the starting question “How to characterize a proposal for a digital application to catalog and evaluate an educational game?”, the experts, organized in groups, allowed the identification of requirements for the development of the wireframes and, to motivate future users-teachers to use the digital application, taking into account in its genesis: the gamification principles of the Octalysis model [11]. In addition to the cataloging items, the experts had to include, in the wireframe’s indicators, the following dimensions for the evaluation of the games: player 'Motivation' [6], 'User Experience' [7], [8] and 'Learning' acquired [9], exemplified for the Unlove [10] and Carmen Sandiego games. Thus, the gathering of the prototype functional requirements use a qualitative methodological approach through co-design; targets the interpretation and analysis of the participations of a group of experts.

The basis of this work, namely in what concerns its relations with an educational context, has been already discussed [12], [13] and there have been important recent developments regarding two main topics related to the study presented in this paper. Under this context, it’s worth mentioning: a proposal for the classification of digital and non-digital games used in the field of requirements engineering [14]; and a mapping of evaluation gamification models in the field of motivation [15].

There are several references to the terms Serious Games, GBL and Gamification and how they intersect when we focus on the theme of learning by using activities with a playful component. This was also already portrayed previously [16].

The main objective of gamification is to support and motivate users to perform a set of tasks [17]. The theoretical-methodological model Octalysis [11] reinforces that gamification goes beyond points, medals and rankings. Chou’s [11] tool is developed into eight cores ‘Epic meaning & calling’, ‘Development & accomplishment’, ‘Empowerment of creativity & feedback’, ‘Social influence & relatedness’, ‘Unpredictability & curiosity’, ‘Loss & avoidance’, ‘Scarcity & impatience’ and ‘Ownership & possession’ [16].

## **2. A research roadmap based on a Communicative Design Paradigm**

A multidisciplinary team of experts (in geography, sociology, science, technology, engineering, art and mathematics) was created aiming at enriching the domain under study and at bringing their empirical knowledge to the design of the prototype. The specialists were selected according to six inclusion criteria: (A) an expert in the field of developing educational resources or digital educational games; (B) a secondary school’s teacher whose class used the game or expert who participated in the study; (C) a secondary school teacher with a clear aptitude and predisposition for the use of differentiating methodologies in the classroom; (D) a teacher or interventional expert in reflection days, peer meetings, class council meetings, management meetings; (E) a teacher or interventional expert in actions of the school’s activity plan; (F) a teacher or expert who demonstrates being available to integrate the study. The focus group (FG) was set up to listen to and gather the opinions of the experts [18] and was mirrored in three training actions in the institution of the study.

From the point of view of the research objectives, the methodological design of this study is strongly influenced by the approaches of Educational Design Research [19].

Gustafson et al [20] refer to different classification approaches to the processes and models of instructional design and propose the creation of a conceptual framework - the Communicative Design Paradigm (CDP). With the CDP, consensus prevails among the professionals involved (specialists) throughout the process of developing an educational solution.

In this study, throughout the six stages of the CDP, the dynamics were established among the experts of the focus group and received input from the game sessions with the students and teachers. The Focus Group was used to, based on the opinions of the experts, gather the requirements for the model of the digital application to be implemented, considering its main objective: to be used as a gamified resource. This co-design was used to increase the degree of acceptance of the digital proposal [21]. This exchange of ideas among all enabled the consensual improvement of the proposal under discussion, as detailed below, following the procedures of the CDP framework.

In the 1st stage – Platform of Ideas, the focus group participated in an online explanatory session, defining the problem, identifying restrictions and fundamental assumptions, demonstrating existing digital solutions and attempting to conceptualize the problem.

In the 2nd and 3rd stage – Analysis of the problem and Reference framework – the experts were encouraged to share their views in a forum of the Learning Management System (LMS) platform of the institution under study, and, working in pairs, were invited to create mental maps representing the requirements (domains and indicators) they considered that should be included in the application (4th stage – development of Reports or Plans).

After sharing the electronic records on the LMS platform, moments of discussion and validation of mental maps took place among the experts (5th stage – Evaluation of decisions of other team members).

The current stage of this study is the 6th stage – prototyping and validation of the proposed application. Prototyping has been completed and its validation is currently underway by the focus group and in also involve a national publisher. This stage will promote the discussion and creation of new ideas until a coherent proposal is obtained.

### **3. Specification of requirements and wireframes**

The analysis of the requirements for the design of the digital application model was based on the mind maps and interactions created during the focus group experts on the LMS platform (Cf. 2). The listed indicators were grouped into six main domains: (1) Game; (2) News panel; (3) Interaction; (4) User; (5) Ranking; and (6) Language.

The domain (1) Game consists of the indicators: (1a) subject area (science, mathematics, technologies, languages, visual arts, social sciences and humanities, sport, citizenship and development, sexuality education, religions); (1b) Specifications – Fig. 1 Prototype wireframes, Games Details – (synopsis, release date, degree of interactivity, free of charge, usage tips, mobile or desktop format, tutorial, rules, operating system type, technical requirements such as memory / disk space, accessibility, related games); (1c) Level of education of the target audience (preschool, 1st, 2nd and 3rd cycle of basic education, secondary school); (1d) Type (quiz, strategy, memory/reasoning, simulator, board, family, puzzles, mime, crossword, motricity, coloring, letter soup); (1e) Number of players (single, multiplayer); (1f) Target audience age group (3-4 years, 5-6 years, etc., i.e. two-year grouped levels up to 18 years); (1g) Ordering (most played, newest, most popular, alphabetically A-Z and Z-A); (1h) Search (by game name, subject area, teaching cycle, release date); (1h) Online store (with access to game providers); (1i) Evaluation survey (according to the dimensions, motivation, user experience and learning).

For the domain (2) News panel – Fig. 1 Prototype wireframes, News – the following indicators are presented: (2a) News/Updates with the possibility for the user to insert comments (launch of new games; updates of existing games, sharing of experiences by users; key users, promotions, events related to the games, websites of interest); (2b) Non-educational games; (2c) Scientific publications in the GBL area; (2d) FAQs; (2e) Top 10 games.

Indicators for the domain (3) Interaction are: (3a) Public chat – Fig. 1 Prototype wireframes, Chat; (3b) Discussion forum; (3c) Pairing (suggestion of users with a similar profile for Private Chat); (3d) Platform notifications to the user (score status).

For the domain (4) User, the following indicators are listed: (4a) Identification (name, email, username, avatar construction / profile picture, age, gender); (4b) Interests (areas of interest, subject group, education levels, favorite games, followers and following); (4c) Status – Fig. 1 Prototype wireframes, Star Club – (beginner / junior / senior / expert user rating resulting from their interaction on the platform, badges awarded as for example the user of the month / the user who publishes the most / the user who shares the most, prizes such as discounts on the purchase of games or tickets for events on games / unlocking content / custom settings of the application).

Regarding the domain (5) Ranking on the game – Fig. 1 Prototype wireframes, Games Score – the indicators point to: (5a) Scale for each dimension under study (motivation, user experience, learning); (5b) Overall scale (not recommended / reasonable / optimal / good / excellent based on the overall assessment of the three dimensions under study); (5c) Platform interaction scale (most rated game, most

commented game); (5d) Scale of emotion regarding the effectiveness of the game applied in the classroom (went well / badly, liked / did not like).

Regarding the domain (6) Language, the indicators listed concern the five languages (6a) used in the application (Portuguese, English, French and Spanish).

After analyzing the requirements collected, each domain was graphically represented in 47 wireframes, of which we highlight (Fig. 1): the detailed information for game Unlove, the news panel for games and events, the creation of conversation groups between members, the game evaluation in the dimensions 'Motivation', 'User Experience' and 'Learning' and the members club and their benefits (mirroring the gamification principles).

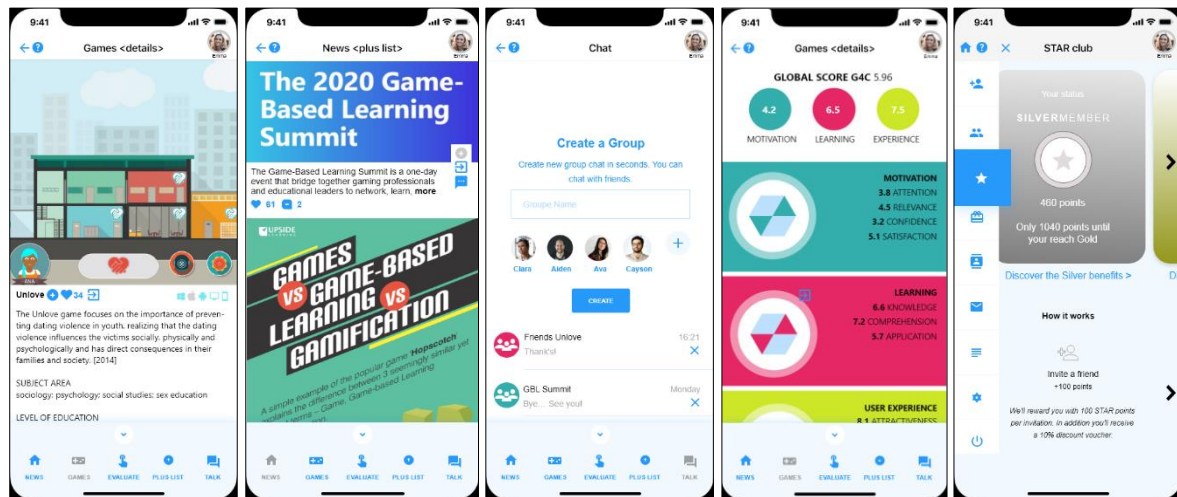


Figure 1: Prototype wireframes (Games Details; News; Chat; Games Score; Star Club)

## 4. Conclusions and future work

The prototype developed follows the requirements pointed out by the experts and is mapped to the cores of the Octalysis model.

Points and benefits are awarded to users through their actions within the application ('Development & accomplishment' and 'Ownership & possession'). Members are thus promoted in the app's private club evolving through different categories: Silver, Gold and Diamond. Customizing the application layout is one of the differentiating benefits of the best performing members (Empowerment of creativity & feedback'). The task assignment differentiation is observed according to the level of the member. An example of this is the embed of the game evaluation questionnaire on a website, which is only available to Diamond members ('Epic meaning & calling'). The model makes it possible to interact between users (chat and forum), create contact lists, follow and be followed. On the other hand, each user understands what type the other members are and may access their favorites lists of events and games ('Social influence & relatedness'). The user is surprised by unexpected prizes ('Unpredictability & curiosity'); on the other hand, it is alerted to the possibility of points losses due to its lack of interaction in the application ('Avoidance'). Finally, the user is informed that he is entitled to earning points, (for instance in the case of newsletter loyalty) but that obtaining it is conditional on the evaluation of games ('Scarcity'). In the future, an interview will be applied – Validation – to the experts and to a national editorial group, aiming to clarify their opinions and perceptions in the face of the prototype mockups, thus complying with the 6th and last step of the CDP framework.

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## 6. References

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