Pattern-Based Game Apps for Collaborative Learning About Sustainable Management of Public Space

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Abstract. The paper will introduce a research plan to establish dynamic learning experiences about public space management and the strategies selected. More specifically, we are concerned with an educational design approach for K-12 learners, focusing on sustainable use of public space, game-based learning with mobile devices, and integration of participants' viewpoints into building key elements of the digital environment that they will use to achieve specific learning goals. The research project aims to measure the concepts perception, related to public space use and management by participants through the proposed methodology. Additionally it aims, through that methodology, to highlight the conditions by which, a combination of digital game design for mobile devices based on basic design and narrative patterns, can be shown to be effective in approaching difficult concepts in a classroom setting.

Keywords: Game apps · Game design · Design patterns · Story patterns
Collaborative learning · Public space · Sustainability

1 Context

There is an extensive research for public space use in a way that public space is a sweeping array of settings, including urban streets, plazas and squares, malls, parks, and other locations, and natural settings such as aquatic environments, national parks and forests, and wilderness areas that demand the attention of many disciplines and researchers, designers, managers and policy makers [1]. Additionally, the "use" could be related to the duration and the number of functions which took place supporting the general activity of public space, guiding design approaches to improve senses and communication [2], reshaping, taking into consideration machine communication, information, administration and the "pristine state of man" [3], or combining planning and architectural pedagogy, theory and every day practice, with domains related to art, activism and alternative planning and design praxis [4] and counting factors like economy, social inclusion, cultural diversity, environmental care and governance [5]. Furthermore, by empowering dynamics of public space with smart technologies, it seems that even physical activity is the basis for public space interaction, and cyber activity could be beneficial from the point of view of an individual human being [6].

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Moreover research; about use and management of public space, we count on historical, cultural, natural dimensions, in interactive dynamics [7], as a means to empower civility [8]. Converging all the above to humanistic design principles inspires designers and we can say that public spaces exist, modified or created but in any case, a critical discourse configured around them leading to evaluation models developing, such as remote assessment methods [9] or assessment model based on facts, related to cultural and historical reality of public space [10].

Based on the aforementioned, a research about public space use and management is conducted based on sustainable use of public space. Due to vast and multidisciplinary concepts, a simplification is applied in order to make the content suitable for K-12 students. Additionally, the overview of public space dimensions which are presented above, lead us to the thought that pubic space assessment consists a secure context for developing educational activities focusing on sustainability.

2 Purpose

In the above described context, the paper introduces a research plan to establish dynamic learning experiences about public space management and the strategies selected. More specifically, we are concerned with an educational design approach for K-12 learners, focusing on sustainable use of public space, game-based learning with mobile devices, and integration of participants' viewpoints into building key elements of the digital environment that they will use to achieve specific learning goals. The necessity to adopt sustainable attitudes about public space follows a number of facts: public space is constantly changing; active citizens need to develop methods and strategies to participate in its management; sustainable management conditions need to be applied. The learning goals to be achieved include understanding that the use of public space involves many groups, developing a management strategy, reflecting on the strategy selected, realizing that each choice is leading to specific results, distinguishing the more democratic strategy, acquiring the ability to develop an action plan based on the strategy chosen, understanding that each option may need to be redefined due to changes that had not been taken into account at the time of decision making. These goals derive from a spectrum of public space management matters, drawn from literature on education for sustainability, as a changing procedure which enlarges the public sphere, in which citizenship is conceived and practiced to include the environment. Furthermore, it is connected with public space as an effort towards regulation, equality and democracy [11], integration into formal education and non-formal and informal [12] and supporting the possible need to engage new players and prepared to slide down, before we can go forward to create a more sustainable future [13], which makes public space an educational matter, a fertile place to develop educational plans.

3 Approach

Our approach is based on Digital Game Based Learning which is precisely about fun and engagement, and the conjunction of serious learning and interactive entertainment into an emerging and highly exciting medium, Digital Learning Games [14]. It also

makes kids able to do and understand so many complex things, achieving reasoning that the curriculum they are given appeared to be deteriorating their minds, [15]. Serious players of video games get their glory largely from being the first on the block to master the game that just came out, and this means that kids have a powerful incentive to get good at learning well and quickly [16]. Another dimension is mobile technologies, where mobile learning can be spontaneous, portable, personal, situational; it can be informal, unobtrusive, ubiquitous and disruptive [17]. Furthermore, many empirical studies have found mobile learning has positive influence on learning performance [18, 19] and it is suitable for communication establishment [20]. Taking into consideration the previous mentioned advantages and particularities of mobile learning, an approach was formatted to gain both from the mobility and digital games. In that line of thought, we consider that the creation of mini games, games with basic characteristics to support basic skills like a gaming environment promoting fast calculation [21], or conceptual mini-game focusing on a concrete concept to be taught, in order to transform the game into a learning object [22] can prove to be very effective. Scaffolding to learning experiences could also be the use of mobile devices in order to raise awareness of important social issues [23]. Moreover, in the field of social change, Villanueva [24] argues that mobile games in classroom allow players to experiment with different solutions to a problem, aiding in broadcasting their knowledge of the subject matter. Furthermore, a combination of collaborative learning [25, 26] and cooperative learning [27, 28], will be used depending on the way students react to their opinions' adoptions and modifications. Experience is going to be derived through applied cases in academic field of collaborative game based learning (CGBL) such as classroom actions with games [29], serious games building [30], serious games for collaborative learning [31] or collaborative models based on CBGL and motivation development. Critically approaching games narration as a considerable factor in game design, in order to show off its significant role, mini games will be connected to the same storyline, following Propp's model for storytelling [32]. Furthermore, these games will follow a game design model based on design patterns [33] as well as on learning patterns [34]. The design patterns to use can be negotiated with learners in order to accommodate the interests of the latter, whereas educational patterns will be selected by the teacher as a result of prior interaction with learners. We prefer the term educational because we consider that it contains all types of patterns which will be used in order to develop an educational context. In all cases, the mini games to be developed are based on the concept of "functional pattern". The latter is described as a game part which can be played as an autonomous game. A functional pattern, therefore, includes all necessary game elements like sounds, background, objects and heroes, together with their interactions, as well as tasks that should be accomplished. In this respect, a functional pattern looks like a game scene that could be played as a stand-alone game; still, due to its limited complexity, a functional pattern allows to integrate learning objectives and accommodate players' remarks more easily than in higher-complexity fully-fledged games. Connecting the term functional pattern with mini game, a mini game is composed of one or more functional patterns. With respect to research, an effort appears to understand the patterns in relation to the game mechanics, in a context that takes into account the design motifs, the framework, the mechanics and the code in relation to those in the processes involved that is to say players, designers, developers

and researchers [35]. This approach highlights the context where a game develops. Additionally, it creates a guideline for games targeting educational domain and specific educational objectives and our approach is considering simplifying a multidimensional space of relations. Narration operates as a grammar for story generation [36], functions like a connective element between different mini games and maintaining linear relations between games providing the grounds for a creative wondering experience among them. Alongside this approach, a digital storytelling tool could be used for editing, saving and modifying the story that will liaise with the mini games. This approach based on the idea that digital game design patterns are created on a case-by-case basis, is based on a narrative event that can be described as "Slice of Life" (SoL), [37]. Furthermore, narrative scaffolding supports a fundamental procedure in games problem solving. In that line of thought, narrative amended to game either with backstory in order to provide the dramatic context for the game [38] or with cut scenes in order to further the story line, reinforces the mood and tone of the game and provides multiple information such as new elements or information that should be decoded by the player in order to select the appropriate strategy [39]. In that way Propp's narrative model facilitates game evolution on a pattern base line. Each mini game has a thematic core based on the "star model" for public space assessment proposed by Varna [10]. Varna's model considers space to be "less" or "more" public according to the responses that can be given to issues of ownership, control, physical configuration, animation and civility. Each category is approached under the concept of sustainability and in this way the overall educational design approach follows basic game design concepts [40, 41] and cross-references these with Varna's star model for the assessment of space publicity. For each domain of public space assessment according to this model, a mini game is designed. All mini games encompass story, action and trial. Furthermore, mini games follow a model of players' enjoinment [42] based on a core of basic design patterns [43, 44]. The enjoinment model describes elements such as challenge, abilities, tasks that should be accomplished, feedback, social interactions, design patterns and narration motif. According to the above, each mini game is designed and created with the use of a platform for mobile apps, and then introduced to learners as a game app running on a mobile device. Each final game app may comprise one functional pattern or a limited combination of functional patterns. In all cases, for any given game app, learners will be able to propose, within the lines de-limited by the underlying functional pattern(s), modifications that can be effected easily, such as transformations of the hero or amendments to the environment space. This kind of learner participation permits modifications that can make the same game app look like a different game. This can meet the interest of participants and lead to game apps that acquire personal characteristics. Based on previous references, design process is presented as follows:

Initially, a story is developed with participants, based on Propp's model with thematic content "Public space". Working in teams a short story under the thematic content mentioned before is created. The different short stories will be adapted creatively into one basic story.

The story provides the main hero; therefore designing could proceed to the settings such as icon, characteristics, abilities and moves. Additionally, for each part of the story a space will be designed. The gaming experience will be under improvement

proposals by the participants, when played with mobile devices, respecting the story core and the functional patterns are used.

The following goal is to refine the educational orientation of mini game. In that domain, the work designed to be done contains only integration patterns and engagement patterns. Project focuses on finalization of these types of patterns in order to clarify that the educational goal is effectively perceived by the participants. The proposed design procedure considers that all the other types of learning patterns will be part of the whole effort and are not necessarily embedded in game design. That means that cognition patterns, social interaction patterns and presentation patterns will be developed during the procedure and participants could have an external assessment in order to evaluate the design process.

A monitoring process follows, in order to guide game design in sustainable concept. According to sustainable use of public space and the creation of such a context that could be embedded learning goals in educational patterns, as it was presented by education for sustainability references; matters for student development are critical thinking, awareness of complexity and active citizenship [45] in an uncertainty, ambiguity and complexity world [46]. Moreover, a method of digital games evaluation as a tool for sustainable development will be taken into serious [47]. But in our approach, it is expected that not all the sixteen evaluation criteria will be supported by the game itself but by the process that will be followed. Furthermore, each category of the public space assessment model based on "publicness", will be connected with functional patterns within a number of actions that could be performed. Therefore, the player should get decisions to provide those actions, modifying a given space more or less according to the characteristics of the model. In that line of thought, design will use the model in order to create a number of actions in mini games that they support more or less in each category. The above presented research plan will be conducted under an action research basis with K-12 participants. Due to difficulty of a serious number of concepts, and multidisciplinary approach, the research results will be deteriorating on the learning experiences that would be constructed based on K-12 dynamic participation as well as on the age restrictions on concept perceptions, which is measured.

4 Anticipated Outcomes

According to the above approach, we expect to come up with a series of mobile game apps for learning concepts and skills for public space sustainable management. These game apps are able to accommodate the following types of learning goals: Story-embedded goals which are similar to open questions and their purpose are to make the players aware and engage them in a critical discourse about issues of public space sustainable management. Goals of this type are initially set by the educator and cannot be modified; still, they could be placed at different parts of the story, if discussion with learners shows that this is advisable. Pattern-embedded goals, those goals are related to main areas of public space, sustainable management concepts and skills. They are set by the educator, and placed within certain parts of a functional pattern. Still, educators can propose different sequences along which pattern-embedded goals may appear during the course of a game, allowing in this way the game to better fit

personal preferences of learners. This is particularly important with reference to different skills of different learners in the game tasks that need to be accomplished. Meta-game goals are set as a result of social interaction between learners, under educator guidance. They are based on the cognitive reflection of learners during game app design, during play, and past play. The purpose of meta-game goals is to evaluate, in a public space setting that calls for sustainable management, all possible actions that could be taken at some point together with their consequences. The response of learners towards meta-game goals will be based on what they have learnt from game design and game play, as well as from their ability to transliterate this learning in a real world public space setting. The latter could be a real physical public space, augmented with information about sustainable management issues, or a simulated public space with realistic sustainability issues. Additionally, the concepts perception which are dealt with, apart from the other parameters mentioned above, constitute the core measurement object of the research. In other words, a combination of narration building techniques, with basic structural elements of digital mobile games in order to achieve complex concepts and decisions selections constitute the overall matter they deal with.

5 Summary

Summing up, this paper elaborates on a research plan based on the above and presents a method of implementing such a research action. In the long term, this research effort aims at delivering an innovative proposal towards ways for embedding learning goals in game design to support topics like the sustainable use of public space, which are too broad and loosely structured to be effectively communicated through conventional mini games for learning. In this line of thought, a continuous action research endeavor is needed to reveal difficulties, barriers as well as hidden opportunities for the effective design of educational games that allow collaborative and blended learning as well as concepts perception.

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