

Using Player Profiles and Learning Styles in the Design of Educational Games

Renato Echeverría, Francisco Jurado

Escuela Politécnica Superior
Universidad Autónoma de Madrid
28049 Madrid, España

Renato.Echeverria@estudiante.uam.es, Francisco.Jurado@uam.es

Abstract — In the development of any educational game the educational and entertainment values it provides should be balanced. In this contribution we propose that the adaptation rules in Adaptive Educational Games are based on both the player profile, to motivate the student in the use of the tool, and the learning style, to help determine the best teaching/learning method to use and what learning objects and services that best suit the learning process for each particular student are.

Keywords— *Educational Games, Adaptive Systems, Player Profiles, Learning Styles*

I. INTRODUCTION

Games are geared primarily to entertainment; however, its use for educational purposes is becoming common [1]. The use of games in education offers students the opportunity to explore, make mistakes and learn from them to reaching greater experiences and achieve the learning objectives [2].

Thus, Educational Games (EG) [3] provide an excellent opportunity for teachers to implement student-centred learning methods, where students are immersed in an active learning process through their experiences. The scenarios created through Virtual Worlds provide the opportunity to interact EG giving the user a sense of presence, unlike other tools lacking this feature [4].

Together with Adaptive Educational Systems (AES) [5], a synergistic effect is created, which allows adapting the content and presentation of scenarios according to prior knowledge and different learning objectives. The result of this synergy is known as Adaptive Educational Games (AEG) [6].

However, when addressing the development of an EG, it should be taken into account the main challenges that may cause its success or failure. In particular, the educational and entertainment values should be balanced in the design stage [7-8]. These two factors are critical to the success of the game, because if students do not fun they will abandon it, and if the game is exceedingly entertaining (too playful) the educational value may decrease.

Also, in order to implement and deploy an EG, nowadays we count with a lot of platforms for designing Virtual Worlds and Educational Games. We can highlight Active Worlds [9] Second Life [10] OpenSim [11] OpenCobalt [12], 3DVIA Studio [13] among others.

Although all the above-mentioned platforms are generalists and require some technical knowledge, fortunately we can also find platforms specifically designed to develop Educational Games in 2D like e-adventure [14-15]. e-adventure is a platform for developing conversational adventures, one of the most suitable genres for the development of Educational Games [16]. Because it is aimed particularly for teachers, no technical background or programming skills are necessary [16], and it has even been used for the development of AEG [17].

However, e-adventure continues leaving the difficult task of Game design on the hands of the teachers, and they ultimately are responsible for the success or failure when defining both the elements that motivate the student as well as the teaching/learning method to use.

To achieve an easily manageable solution for teachers without any technical skills or game design knowledge, what it is proposed in this paper is to perform an adaptation according to two kind of profiles for the students: the gamer profile according to the classification suggested by Bartle [18-19]; and the learning styles according to Felder [20-21]. Based on the player profile, it is intended to capture students' interest in the use of the EG. Meanwhile, identifying the learning style will help to determine the best teaching/learning method to use and what the learning objects and services that best fit each student in particular are. Merging this to development platforms specifically designed for teachers without a technical background, a whole framework for the implementation and deployment of AEG will be available.

The structure of the rest of the contribution is as follows: in section 2 the Bartle's player profiles are described; section 3 briefly discusses the learning styles proposed by Felder; in section 4, the proposed adaptation process is detailed; finally section 5 concludes with some final comments and points out the future work.

II. MOTIVATION: PLAYER PROFILE

In order to motivate students and prevent neglect, apathy and disinterest situations during the learning process, in this work we propose to use player profiles. In this sense, there are not many proposals regarding user models and guidelines to use. In this context, the most widely used model is the one defined by Richard Bartle [18-19], who identified four player types based on users' behavioural patterns in a multiplayer online game. Bartle noted that every player is mainly focused on specific interests within the game, namely:

- Achievements: players try to strictly achieve the goals of the game.
- Exploration: players look for finding out and know as much as they can about play.
- Socializing with others: players use the communication tools of the game and try to interact with others.
- Imposition on others: players use the tools of the game to disrupt other players.

Based on this, Bartle outlined a typology identifying four player profiles:

- Achievers: they earn achievements and points. Their main objective is to seek to reach the highest level in the game. They can perform exploration, socialize or impose in the game, only in order to earn more points and to achieve the goals of the game.
- Explorers: they seek to discover and understand how things work. They can perform actions of other sort of gamer profiles only to change the setting or level in order to continue their main goal, i.e., the exploration.
- Socializers: they are interested in communicating with other players. The inter-player relationships are important to them. They can perform the actions of other kind of players when looking to improve their social relationship within the game.
- Killers: they usually try to disrupt other players' game and try to impose to them. They can perform the activities proper of other type of players in order to wreak havoc on the game.

The above profiles emerged from a two-dimensional analysis according to pairs of interests in the game: *Action-Interaction* and *Players-World*. The first dimension is associated with how the players act with objects within the Virtual World, while the second is related to what receives such action within the Virtual World [22].

According to this two dimensions, Bartle identifies that *Achievers* are interested in acting on the world, making the game actions in order to master it; for this type of player it is important the hierarchy within the game and the speed with which they can achieve the status. *Explorers* are interested in interacting with the world, looking for surprises that can be

carried out throughout the game; they seek the secrets that serve as a knowledge base for other players. *Socializers* are interested in interacting with other players and somehow communicate with them to make friends. They are proud of their friendships, their contacts and their influences. Finally, *Killers* are interested in acting on other players, interfering or taking actions that might disrupt them; they seek dominance over other players and feel proud of their reputation and skills, which are often shown in battles.

It seems sensible to think that, within an educational context, the first three profiles would accommodate, but not *Killers*.

Taking into account the player profiles, we have the necessary elements to ensure that students are encouraged to use the EG, because it is more attractive according to their preferences as a player.

III. ADAPTION: LEARNING STYLES

In this particular work, we make use of the learning styles proposed by Felder [20-21], which can be seen as the students' preferences when they organize, process, perceive and understand the information.

Thus, learning styles indicate the students' preferences for the different ways the information can be presented, accessed and processed. For example, some students better capture the information in a sequential way, that is, step by step, while others prefer to access the same information in a global way regardless of the details.

Such is its importance that Felder points out that students who have a strong preference for an specific learning style may have difficulties in the learning process if the learning environment is not suited to them [20-21].

The Felder-Silverman model [21] identifies five differentiated dimensions. These dimensions provide insight into how students prefer to organize (inductive/deductive), process (active/reflective), perceive (sensing/intuitive), receive (verbal/visual) and understand (sequential/global) new information. According to this, from the adaption point of view we can use the guidelines provided by Felder-Silverman [21] and Felder-Solomon [22].

Thus, active students learn better by working with the learning material, applying and trying things. They are interested in communicating with others and prefer to learn by working in groups where they can talk and discuss what they have learned. Meanwhile, reflective students prefer to study and work alone. Sensing students have a predilection for learning facts, using their experiences on particular facts as the main source of information. They seek to solve problems with standard approaches and tend to be careful with details. They are considered realistic, sensible and practical, and they like to relate what they have learnt to the real world. Opposite, intuitive students prefer to learn abstract concepts like theories with general principles. They like discovering possibilities and relationships, and tend to be more innovative and creative.

Regarding the format data is displayed, visual students always prefer and will better remember the information they have seen in pictures, sketches, diagrams, graphs, etc., unlike a verbal student who prefers textual information, whether or not it is written or oral.

Considering the way information is understood, sequential students choose incremental steps, having a linear progression in the learning process. They tend to look for logical and structured solutions to any raised problem. However, global students use a holistic thinking process and learn by doing large jumps. They seek an overview to the problem, do not look at the details and are able to solve complex problems with innovative solutions; however, they have difficulties explaining how they have done it.

With these learning styles, we have the necessary elements for students to obtain a better use of the teaching materials provided to them, being more productive the teaching/learning process.

IV. DEFINING THE ADAPTION PROCESS

To facilitate the task of designing the adaptation rules and their subsequent implementation of the AEG, the simplest and most common way is to use Event-Condition-Action (ECA) rules. That is, triggering certain events in the system (either directly by users interaction or not) is subject to a condition, and according to its fulfilment some action is executed [23-24].

Thus, the values of such conditions associated with events can force the users in the game to overcome challenges and levels, guide them through more appropriate alternative paths according to their profile, include or remove items on the scene, etc.

As introduced in the previous sections, what we propose is to address an adaptation process from two perspectives. On the one hand, this adaptation should allow motivating the user in the use of these kinds of environments, avoiding situations of neglect, apathy or disinterest in using the educational tool. On the other hand, it must facilitate the user's learning process.

According to this, the proposed adaptation process is the one detailed in Figure 1. Initially, students must fulfil two questionnaires: one to determine the learning style according to Felder-Silverman [20-21] and another one to determine their player profile based on the classification proposed by Bartle [19-20]. With the results of these initial questionnaires we have a user model that considers both profiles.

Specifically, on the one hand, to obtain the learning styles we use the *Index of Learning Styles Questionnaire* defined by Felder and Soloman, which is available in <https://www.engr.ncsu.edu/learningstyles/ilsweb.html>, and that allows implement the strategies defined by the same authors [22]. On the other hand, we use the test defined by Bartle to identify the player profile, which is currently hosted in the gamerDNA servers (<http://www.gamerdna.com/>).

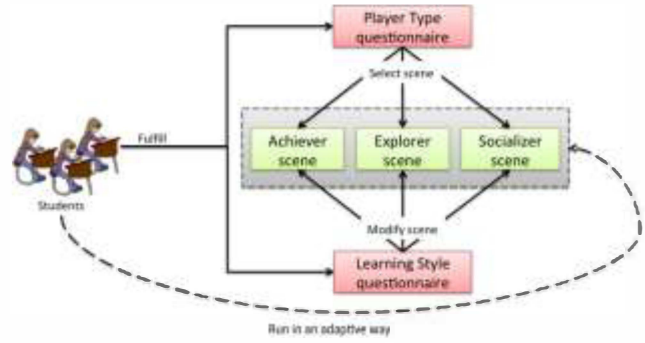


Fig. 1. Adaptation process in an Educational Game using player profiles to select the scenario and initial settings, and learning styles to suit the learning style.

With the information gathered from these questionnaires, the adaptation is performed in two steps. The adaptation rules defined for the initial setup of the AEG are similar to the specified in Figure 2. Thus, a first adaptation will cause the AEG presents a specific scenario according to the student's player profile, i.e., there will be a default game set up based on each player profile. Each scenario must be designed so that it has available those game elements that best define each player type, this way, their interest in the use of the tool is taken.

Later, we perform a second adaptation by altering the previously selected scenarios, to enable or disable learning objects and services they contains, according to the values that the students present depending on the dimension related to their learning styles.

Using this adaption rules, we can ensure that students are encouraged to use the AEG, because it is more attractive according to their preferences as a player, and also allowing them to obtain a better use of the offered teaching materials.

V. FINAL COMMENTS AND FUTURE WORKS

Educational Games and Virtual Worlds are good frameworks to perform adaptive content. The aim of this

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IF (profile == socializer)
THEN
    set_scene (socializer);

    IF (processing == active)
    THEN active_services (work in group);

    IF (perception == sensory)
    THEN show_information (facts);

    IF (input == verbal)
    THEN highlight (textual learning objects);

    IF (understanding == global)
    THEN active (map);

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Fig. 2. Simplified template of an adaption rule for scene selection and the corresponding activation of learning objects and services.

paper has been to identify those elements to capture student interest in the use of educational tools and to determine the best teaching/learning strategy to use, as well as the learning objects and services that best suit the learning process for each particular student. To this end, it has been proposed the use of player profiles and learning styles in the design of Adaptive Educational Games.

Preliminary experiences with users, which are allowing us to develop and analyse the approach, point to the fact that using Educational Games and Virtual Worlds as educational tools can make the peculiarities of the environment influence the learning process.

The player profile seems to be useful in identifying the scenario where students feel most comfortable. However, once there, those students who have a learning profile with a verbal tendency in their perception appear prefer visual elements, and likewise those with a sequential understanding seem to favour an experience more typical of a global understanding. This may be due to the fact that the users perceive the environment as a game but not as an educational tool, and they forget about the perception about themselves as learners, which has led them to answer certain responses in the corresponding questionnaire.

The aim of our current work is to empirically validate these preliminary insights from our initial prototypes, trying to analyse the mutual influence of both profiles.

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