

“The Magic Potion” – An Adventure Game for Learning

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Abstract. This communication presents the Magic Potion, an adventure game for learning that has been developed by the EPINOISI project in Greece for students with mild intellectual disability, and discusses in detail the design principles that have been adopted, and choices that have been made, regarding the game’s narrative and gameplay structure as well as the balance that it has been necessary to maintain between these two.

Keywords: digital games-based learning; interactive digital storytelling; gameplay design; narrative design; EPINOISI project; the Magic Potion game; mild intellectual disability

1 Introduction

The EPINOISI R&D project (<http://www.media.uoa.gr/epinoisi>) has been implemented by the Laboratory of New Technologies in Communication, Education and the Mass Media of the Faculty of Communication and Mass Media Studies of the University of Athens and funded by the Greek Operational Programme for Education and Initial Vocational Training 2000-2006 (EPEAEK II) during November 2007 – November 2008, with the objective to realize a specialized formation program for primary, secondary and special education teachers supporting students with mild intellectual disability (MID) and at the same time develop digital games-based learning material for MID students to be deployed and tested in-class.

The total duration of the EPINOISI formation program on DGBL for MID has extended to 400 teaching hours, of which 100 hours were allocated to seminars of theoretical formation and 300 hours to practical hands-on seminars, presentation of digital game-based educational material and supervised application of this material in the special classroom. Theoretical formation seminars have been realized during May

– June 2008, whereas practical activities and supervised classroom application of digital game-based learning material took place during September – November 2008. The 200 teachers that attended this formation program have been selected from schools and cities from all over Greece and grouped in 20 formation classes located in 15 cities all over the country.

This paper reports on the Magic Potion, an adventure game for learning that has been developed by the EPINOISI project, and discusses in detail the design principles that have been adopted, and choices that have been made, regarding the game's narrative and gameplay structure as well as the balance that it has been necessary to maintain between these two.

2 Serious Games, Games for Learning

Extended academic research [1],[2],[3],[4],[5],[6] has minimized the majority of the doubts related with the use of videogames as learning tools, on the basis. Those games have the potential to transform the way we educate and train people at all levels. There are a variety of videogames examples, commercial games included, which reassure their educational diversity.

In this perspective, it is considered that “Serious games” form a category that can be populated by any type of computer games, as long as they are used as learning tools e.g. in the domain of education, professional training, healthcare, advertising, cultural heritage, safety procedures etc. The target is to learn, while taking advantage of fun [7],[8], gameplay [10],[2] and narrative [11].

In this line of thought, the EPINOISI project has taken an edutainment approach to the development of educational material for students with mild intellectual disability (MID). Intellectual Disability (ID) is a term employed for children and adults with certain limitations in mental development, communicative and social skills. These limitations will cause a child to learn and develop more slowly than typical, while children with ID may take longer to learn to speak, walk and take care of their personal needs. Students with ID are often described as “slow learners” and cannot easily integrate to the normal curriculum. With an $IQ < 70$ and possible additional multiple handicaps, the need for special education adapted to their needs and capacities is essential.

So developed a game for learning which has been designed taking into consideration three important dimensions:

1. The way in which the evolution of games has related to the progression of learning theories [1] from first-generation behaviouristic games, to second-generation games based on cognitivism and constructivism and finally to third-generation games oriented towards socio-cultural and situated learning. The adventure game for learning developed through the EPINOISI project has mostly focused on player constructivism processes as well as on the social and affective settings of gameplay, to cater for different types of learning needs.

2. Design of the instructional process which is largely based on the theories of Bruner [12] and Gagne [13]. Gagne's theory in particular, spanning both learning and instruction, brings forward five types of learning capabilities: manipulation of verbal

information, both oral and written; manipulation of information in symbolic forms and problem solving; cognitive strategies involving creativity and control over one's own learning process; motor skills encompassing physical activities; and attitudes that influence one's personal choices. Each one of these learning capability types requires a different approach to instruction. In our case are the areas that should be improved for ID students. Even more the curriculum requires building in the previous knowledge, so MP designed for classes with ID pupils. Finally the ultimate goal of Special Education is to prepare every student for adult life at the highest possible level of autonomy. To this end, the special curriculum needs to be localized on what is needed to cope with the learner's natural and cultural environment [9].

3. The narrative-versus-gameplay debate, as articulated in the works of Frasca [14], Beavis [15] and Kafai [16]. The EPINOISI project, taking into consideration Bruner's arguments on the importance of narrative in the development and the maintenance of culture, has tried to keep a balance between narrative and gameplay.

In order to balance the fields that mentioned above, the game designed follows an adventure fairy tale structure and intends to create an easy understandable and engaged immersive environment. Moreover the design gives the opportunity to relocate ID students from everyday class environment. Furthermore SEN (Special Educational Needs) and ID students, in particular, can additionally employ educational software and digital games in order to experience everyday life subjects such as mathematics, reading and vocabulary, improve problem-solving skills and prepare themselves for personal safety, social integration and vocational training [17]. In the way it described in the previous topic, the game incorporates various sections related with the curriculum of ID students. Even more as indicated by Christou [18], the players of simple digital games seem to be more influenced by the special structural features of video games, whereas experienced players - mainly due to their feeling of mastery based on their skills and victorious experiences - seek pleasure in other elements, like graphics, script, weapon variety etc. The players approaches adopted in the design of game trials. Finally bearing in mind the eventual tendency of special education children towards repetition, game design has tried to (a) avoid treadmilling; and (b) make failure funny, and success even more funny than failure.

3 The Magic Potion - An Adventure Game for Learning for Students with MID

Development of "The Magic Potion" (tMP) game within the EPINOISI project for students with mild intellectual disability (MID) has been led by a twofold objective: from a learning outcomes perspective, to provide modular game-based material for basic literacy, numeracy and social skills that will contribute to everyday life autonomy, the ultimate goal of special education; and from a learning process perspective, to provide an amusing gameplay experience that will mobilize students and enhance their self-confidence, hiding the educational agenda and taking away the feelings of stress and failure often inherent in the special education process.

The plot of the game is simple (Fig.1), to eliminate risks of confusion: One day a dark cloud in the sky makes the rainbow disappear, and the elders of the village ask the children to go and bring back the four colors; once this is accomplished, the final test is to mix the colors following a secret recipe and come up with the magic potion that will bring the rainbow back to the village and make everyone happy again.

tMP is a stand-alone Flash application but not a single-hero game; there is a whole company of characters who alternate in the control of the player and aid each other. Therefore, the game itself delivers the social and affective setting that is necessary for learning to occur. Apart from that, a fundamental objective of game plot, dialogues and outcomes was to have fun. Still, as this is meant to be a game for learning, gameplay needs to progress towards the end. Bearing in mind the eventual tendency of special education children towards repetition, game design has tried to (a) avoid tread-milling; and (b) make failure funny, and success even more funny that failure.

The game is made up of four episodes (corresponding to the pursuit of the four colors) and comprising narrative scenes and some 20 micro-games in total (mathematics, language, everyday life skills). Yet, this structure is loosely-coupled; episodes can be entered and exited at any time and in any turn, narrative scenes and micro-games can be played or skipped, and there is no memory (objects gained etc.) persistent beyond the boundaries of any single episode, which would impose some sort of in-game linear dependencies. This is in line with the educational process itself for the game's intended audience, which is highly characterized by non-linear changes of focus on different learning subjects. tMP v1.0 has been released to the trainers and trainees of the EPINOISI project on September 2008, tested in-class by 200 special education teachers and about 500 students during October – November 2008 and recently (June 2009) released in its final version (tMP 2.0), which incorporates the feedback and improvement suggestions that have been obtained from in-class evaluation. Some significant remarks from the feedback were the follows: The fact that pupils having as starting point to create stories based on MP, lead to keep the length of fairy tale action (were the players didn't act) considerably extended.



Fig. 1. Welcome screen of the tMP game: gameplay is ready to start, whereas the game's narrative is already visualised.

There were improvements in some activities, they became more fun orientated. Furthermore it multiplied control capabilities (mouse or keyboard use, combination of them can work to achieve the same target). Minimized voice instructions, in order to achieve satisfactory, monitoring and immediacy.

Additionally the results, from the implementation of MP in the educational procedure, were very encouraging. Interesting increased, actions took, target concentration, pupils collaboration were some of the advantages occurred.

4 The Magic Potion Narrative

The structure that has been selected during design of the tMP game to host the narrative and learning activities is that of a fully developed adventure game, incorporating the main characteristics of this game type. This choice has been led by the expectation that players would need less or no instructions at all for proceeding with gameplay. Moreover, the sense of familiarity with the adventure story has been expected to provide the players with a sense of comfort and confidence, functioning as a reward in itself. Nevertheless, the tMP game comes with a simple tutorial mode for familiarization with the game controls (mouse and arrow keys), to cater for students not yet acquainted with these devices.

The choice of an adventure game type for developing tMP was also based on the emphasis that this allows to be placed on the story and the main characters. The game story acts as an element of cohesion between the player's tasks, which may be quite diverse, as well as an additional factor of motivation, since players are intrigued to proceed and see what happens next. Additionally, the game story provides designers with the opportunity to create new and rationally justified spaces for the player to anticipate and explore, thus enhancing motivation based on Malone's concepts of curiosity. Moreover, the existence of main characters, visible through a third-person perspective, is an element of motivation in itself by providing the player with figures to identify with and thus allowing a feeling of empathy to emerge.

Most importantly, the tMP game project has adopted a fairy-tale type of story, in order to incorporate the beneficial attributes of this kind of narrative: students are presented with a familiar story structure (a balanced situation, the emergence of a problem, a central goal, a quest, main characters, assistants and opponents) and can focus on the tasks that need to be performed, without being puzzled by the elements of narration. These elements worked as a stimulus to engage players and immerse them into the plot. In other words the narrative itself creates the available gameplay basis to do the game attractive and interesting, managed to combine serious games design and evoke the fairy-tale narrative dynamics.

In this line of thought, game graphics have enhanced the fairy-tale atmosphere, taking into consideration that certain players might be more sensitive with intense coloring and figures. On the whole, game aesthetics have been designed to deliver the feeling of a dream that has no room for realism (Fig. 2). Special care was also appointed to the existence of main characters of both genders, sharing on equal terms the burden to accomplish the main goal of the story. What is more, since this game

type does not focus on physical movement, the representation of game characters focuses mostly on their faces, with frequent gross plans, in order to maximize the players' experience on facial expressions and emotions (which, for special education students, can be a learning goal in itself).

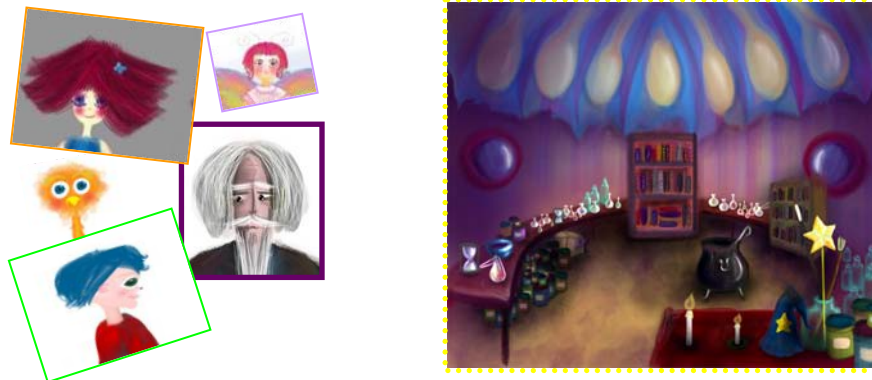


Fig. 2. Characters and immersive environments of the Magic Potion game.

This fairy-tale type of story has been considered to be most appropriate for the game's audience (K-12 and pre-adolescent students), since it reflects the duality of right and wrong that already dominates in children's minds. Since morality is developed in older ages, children in fairy-tale narrations identify with the main character not on the basis of him/her being just, but on the basis that this character is presented in a positive way. According to Bettelheim [19], this dualism allows children to understand the difference between right and wrong.

Most importantly, a "fairy-tale" structure suggests an imagery on which children can build their dreams and orientations in "life", and is open to interpretation. Fairy-tales create a universe of symbols wherein children, according to their needs, seek and find their own personal meanings and appease their own personal anxieties and fears.

It is from this perspective that it has been expected that the players' thoughts, judgments and feelings would have a lasting effect, especially when game situations were being discussed with peers or teachers and parents, thus becoming a point of reference. This is a type of post-gaming educational result that would be more difficult to achieve through another game type, since "The Magic Potion" game creates a multi-task environment that exposes children to a variety of situations and choices, especially in the chapters that focus on children's social skills. As an example, after playing "The King's Daughter" game chapter children might contemplate on the virtues of giving and sharing, an issue that can come up again in their everyday life. In fact children's expression on such matters should be definitely encouraged, to achieve a longer post-gaming educational effect.

5 The Magic Potion Gameplay

In order to provide school teachers with a tool that can be used in-class, a number of factors have been needed to be taken into consideration. Firstly, teachers need to be able to pick any educational task the game provides, without having to follow through the whole story. With this objective in mind the framework of the story is brought forward in the introduction of the game where, through narration, the player is informed of the time, the place, the situation and the main characters. Then the players can choose any chapter they want, since they all promote the game goal. A narrative link of general, non-linear information is placed in the beginning and the ending of each chapter, so that the player is reminded of this goal. Story cohesion is enhanced by the epilogue, where all characters that participate in the story meet again and offer the players the opportunity to remember and recall their gaming experiences.

Although non-linearity has had a cost regarding the adoption of exciting storytelling techniques, it has allowed players to try out their abilities without feeling trapped in one game environment. On the other hand, this game structure has enabled the use of language and mathematics micro-games as stand-alone games with an interface for loading dynamic content such as teacher-defined vocabulary and arithmetic problems (one of the most demanded features by the teachers that have evaluated the game) (Fig. 3).



Fig. 3. A parametric micro-game : word-find puzzle with an interface for loading new words.

One more issue that has had to be decided during design of the Magic Potion gameplay was the reward system that would be used. Many researchers support the idea that special care should be taken regarding reward systems, especially in the direction of multiple rewards, since people are motivated by different types of rewards. Additionally, they believe that multiple reward systems encourage continuous playing, since the same person is often motivated by different reward types in different stages of the learning and gameplay progress [20].

In the context of the EPINOISI project an effort was made to provide players with a gaming experience of multiple rewards at three discrete levels:

1. **Player Rewards.** These constitute rewards of a player's overall performance or a price for the successful management of special missions. The victorious experience of completing a game episode is yet enhanced by the imagery that depicts the empty

bottle getting filled with the appropriate color of the rainbow that was missing. However, and bearing in mind the eventual tendency of special education children towards repetition, game design has tried (a) to avoid tread-milling and, while keeping failure funny, (b) to make success even more funny than failure.

Apart from this, parenthetic narration scenes are to briefly shift the player from action to spectation, relieving him of gameplay stress and rewarding him for his progress; these usually depict some impressive scenes of journeys or distractions. At the same time, they offer the player the chance to closely observe the main characters, their facial expressions, their tone of voice and body movements and to watch them act autonomously, outside the player's will.

2. **Story Rewards.** Every success in any single task assures the players that they are moving one step closer to the solution of the initial problematic situation; this constitutes an additional level of reward and motivation. A special effort has been made on this issue to achieve a smooth incorporation of the parenthetic parallel stories, involving the main characters' assistants, into the main game story. Due to non-linearity this has only been possible in the game's epilogue, where, for instance, the bird assistant becomes a father.

3. **Meta-Rewards.** As discussed above, students are expected to participate in new media culture and special education students are no exception. An effort has been made within the EPINOISI project, therefore, to keep up with modern videogames culture through some additional game features. As an after-game experience, for instance, players are provided with brief biographical statements of the game characters, encouraging them to contemplate on who these characters are and what they are going to do next.

6 Future work

The EPINOISI R&D project has tried to enable special education teachers employ the potential of digital games-based learning as a supplementary in-class tool, in a blended learning approach which still maintains the social and affective aspects of learning. Two major observations have arisen in this effort: (a) special educators have needed motivation and effective empowerment to employ digital games for learning and create their own learning content; (b) special education students, on the other side, have not found it difficult to establish an engaging and recurring relationship with digital content and engage in interactions during which learning has occurred.

Following success of the EPINOISI project and the Magic Potion game at this level, the current efforts of the project team and the Laboratory for New Technologies in Communication, Education and the Mass Media are oriented in two directions: (a) further evaluate the conditions for successfully applying digital games for learning in class settings, and (b) further expand and investigate the possibilities for combining gameplay and narrative, with an objective to establish a cross-fertilization relationship between these two. To this end, the authors are currently looking at the different ways in which digital games and traditional storytelling and orality can interact, incorporate and inspire each other.

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