AN ONLINE GAME FOR TEACHING BUSINESS MANAGEMENT CONCEPTS

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Abstract: In this paper, we describe the result of a multi-disciplinary approach to designing a particular class of educational games: business management games. The approach was based on intensive collaboration and co-design meetings with business management researchers. The result was a Web-based game called "SimCompany", aimed at teaching children about business management concepts, thus promoting an entrepreneurship culture in classroom settings and beyond. "SimCompany" proved effective as a teaching tool about business management concepts, and initial evaluation showed a positive increase in students' rate of learning, compared to traditional teaching methods.

1 INTRODUCTION

The power of games as learning instruments has become unquestionable. Our students have changed radically and today's students are no longer the people our educational system was designed to teach. Today's students represent the first generation to grow up with the new digital technology, having spent their en-tire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. Today's average college grads have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). This is one out of many reasons why both researchers and practitioners have started to embrace games as educational tools, as opposed to the traditional vision of games as merely entertainment instruments.

In this paper, we describe "SimCompany", a fun, educational game designed to instill the entrepreneurship spirit in children (9-14 years old). As the young player progresses in the game, the basic concepts of consumer behavior, marketing and strategic management are described, illustrated and reinforced in a fun, easy and engaging way.

The goal of the game is to reach the last level and complete it with the greatest amount of points accumulated and before time expires. As an example, we provide a brief description of four levels of this game, taken from the game's script, which was outlined through a multidisciplinary design approach involving designers, programmers, user interface experts and - most importantly - entrepreneurship and management experts.

2 BACKGROUND

Some authors observed that computer games have achieved their massive reach without going through the education system. While games may be an ideal companion to classroom instruction, they do not have to go through the classroom to access students. Other educational reforms depend on the teacher as the medium and do not necessarily take into account the many demands and constraints already faced by educators. Video games give teachers and parents the ability to reach students where they live, bypassing many of the challenges associated with restructuring the education system from the inside out.

2.1 Games for Learning

Using games as an educational tool is not a novel approach. Their true potential emerged from the fact that 50 to 60 percent of all Americans play games and the typical game players are relatively young computer users (Kafai, 1995). Particularly popular games include the simulation genre, e.g. The Sims and SimCity, which allow players to create and

manage simulated communities and worlds. Spore is another title aimed at simulating evolutionary adaptation (Maxis, 2006).

Games have also been used for serious purposes. Early examples include games that promote health behaviour change and management for children, such as Packy and Marlon, and adventure game for children to learn about diabetes self management skills, and Rex Ronin, a smoking prevention video game. Games have also proven effective in teaching children a foreign language (Baltra, 1990).

Serious games have also been developed for adults to train personnel in a variety of areas. Examples include Visual Purple's Angel Five, modelling a weapons of mass destruction terrorist attack with the trainee coordinating resources between federal, state, and local agencies; BreakAway's Incident Commander trains first responders and federal employees in the new National Incident Management System for standardized response methods dealing with terrorist attacks or natural disasters; and Tactical Iraqi which uses artificial intelligence and computer gaming techniques to make learning languages quicker, more effective, and fun for military personnel.

In terms of games related to business concepts, which form the core of this chapter, researchers as well as industrial practitioners have made several attempts to create entertaining forms of educating business concepts. For instance Zhou and colleagues (2008) describe and demonstrate an Internet based supply chain simulation game. The innovation presented in this game stems from a comprehensive set of supply chain (SC) management strategies which can be tested in the game. The key functionalities of the game were designed to increase players' SC awareness, facilitate understanding on various SC strategies and challenges, foster collaboration between partners, and improve problem-solving skills. The authors concluded that such a game could be used as an efficient and effective teaching tool as well as a research tool in operations research and management science. They also observed problems and obstacles detected while engaging in the SC business scenario game. Actions were proposed and implemented to solve these problems, which resulted in improved SC performance.

Another example very close to the spirit of Sim-Company is Disney's game Hot Shot Business (Everett, 2003), a simulation game designed to teach basic business concepts and encourage entrepreneurship. The authors emphasized the importance of play testing, with tight cycles of design-and-evaluate sessions, which were crucial to the game's success and to the development process itself.

It is also well known that one appealing way to motivate children to learn using technology is to apply games, which are well known, exploiting the power of popular TV shows. With the goal of minimizing the amount of effort and requirements to set up a situated learning environment, Lin (2007) integrated scenarios of the popular video game Pokemon in classroom education of 2nd grade math concepts. Observations showed that, in such arrangement, they could engage some students into the scenarios where math is applied. Since most children inevitably spend much time playing digital games, it is argued that digital game-based learning is one way to involve kids to do the right things with computer (Lin, 2007). Lee et al. (2004) performed a study to investigate whether educational video games could be integrated into a classroom with positive effects for the teacher and students. They conducted the study with 39 2nd grade students using their mathematic drill software "Skills Arena" (Lee et al., 2004). Early data from the study suggested that not only do teachers and students enjoy using "Skills Arena", students even exceeded expectations by doing three times more math problems in 19 days than they would have using traditional worksheets. Regardless of the popularity that games exhibit when it comes to teaching children, there is a lack of research towards design approaches that can prove useful when conceiving and designing such games.

2.2 Conceptualizing the Educational Game Experience

Papert (1996) refers that "learning is more effective when the apprentice voluntarily engages in the process" (Papert, 1996, p. 43). The best learning experiences are the ones that "motivate and are pleasurable" (p. 43). Motivating the learners is therefore a crucial factor to increase the possibility of action and discovery, which in turn increases the capacity of what some researchers call learning to learn.
In this sense, the novel constructionist-learning paradigm aims to adapt and prepare tomorrow's schools to the constant challenges faced by a society, which is currently embracing and accelerating pace of profound changes.

The contact kids have with computers today is a fascinating experience, as anyone can easily attest by simply speaking to any of those children, questioning them about their computer usage experiences. The computer represents the possibility of

occupying their time with activities that allow them to learn about many issues. But it's also an exploration and play space where children can challenge the logic, feeling they possess magical powers, and where they feel that the decisions they take have an effective immediate impact over the actions, thus determining the flow of events.

Vygotsky's (1978) social cognition learning model asserts that culture is the prime determinant of individual development. Humans are the only species to have created culture, and every human child develops in the context of a culture. Therefore, a child's learning development is affected in ways large and small by the culture–including the culture of family environment – in which he or she is enmeshed.

In this context, the creation of collaborative learning groups, which bring together children with different learning levels, can prove useful. Currently, public schools have ever-larger numbers of students per classroom, with more diverse backgrounds. This poses some difficulty to attending every student's individual needs. One possible solution lies in methods employed by the students themselves, i.e. students learn and teach each other, collaboratively. This kind of learning, called peer-mediated instruction (Campbell et al., 1991), is an alternative classroom arrangement in which students take an instructional role with classmates or other students. Many approaches have been developed in which students work in pairs or small cooperative learning groups. To be most effective, students must be taught roles in the instructional episode; to be systematic, elicit responses, and provide feedback. Research supports the use of these approaches as alternative practice activities, however, does not condone the use of peers for providing instruction in "new" instructional content.

Gardner (1983) centred his investigations on multiple intelligences and the implication they have on educational practices. Garner suggested the IQ-tests notion of intelligence is too limited and proposed eight different kinds of intelligence (Gardner, 1983). The important issue, according to Gardner, is not the number of different intelligences we have, but the actual development of all of them, according to our skills. Despite being anatomically separated from each other, Gardner declares the several intelligences rarely work independently. They are competitors but complement each other. We all possess the same intelligences but not in the same way or same proportions (Gardner, 1983).

Scholar learning requires the student to deeply understand the subjects. Gardner advocates one of the best ways to accomplish this deep understanding is to approach the same subject through different entry points (music, language, spatial, etc.). Therefore, we should use an approach that covers not only the specific field of the subject at matter, but also other fields. This multidisciplinary approach Gardner recommends to schools is a better way to transfer knowledge.

If the child doesn't understand through the intelligence we elected to inform her, then the teacher can consider there are other different intelligences to explore. Based on this approach, our research that employs augmented reality and a physical user interface, allows a deeper understanding of the learning experience, using one of those multiple entry points.

3 DESIGNING SimCompany

There are several user-centred design approaches to designing interactive systems, such as the ones described in, e.g. (Dix et al., 2004). When it comes to game design, however, we verify that the process is largely driven by actual practice. Academic researchers have mainly focused on the theoretical issues regarding the game design process, and the practitioners' concerns are very different from the researchers'. Therefore, there is a tendency to work in isolation.

While many performance arts such as screenwriting, acting, filmmaking and cinematography have produced theories to explain and direct creative processes, game design is still in its relative beginning and there aren't yet many theories about its process.

During the design of the game SimCompany, we followed an approach inspired by the best practices in user-centred design, but along the specific lines of human-work interaction design (Clemmensen et al., 2005). This lead to a novel multidisciplinary approach we found particularly useful when designing business management games.

The main actors involved in such an approach are:
- Interaction and visual designers;
- Computer programmers;
- Human-Computer Interaction researchers;
- Business Managers;
- Entrepreneurship academic researchers;
- Children (the end-users).

Figure 1: Overall look of the game "SimCompany" at its first level.

However, simply joining these different-background, different-age actors into a single meetings room is obviously not enough to guarantee that a successful game is created. What we propose is a multi-disciplinary approach that focuses the game's design and implementation on the actual learning goals that are desired. By centring the whole game project on the actual work performed by real business managers, the gaming experience will become particularly educational, since players will be faced with game decisions very close to the core of a business manager's everyday tasks and decisions.

3.1 Design Approach

The approach we followed was based on analyzing the work that managers do when conducting their business and from that point we established a creative game script aimed at engaging children but also making them learn the day-to-day real work of a businessman. The approach followed for each of the game's levels was divided into three stages: (i) cognitive analysis, (ii) definition of learning objectives and (iii) translation into a game script.

Stage (i) was directly concerned with outlining the kind of decisions that are made by business managers and entrepreneurs, when leading their operations. Stage (ii) focused on the learning objectives, which were derived after consulting with different business managing experts in the field and also according to some interviews with business leaders and general research literature on the subject. The final stage, translation into a game script, was focused on writing a compelling script that children would enjoy. At the same time, the script would need to meet the learning objectives stated during

stage (ii). The final game script document served as a game design document and formed the basis for the user interface design of the game.

3.2 SimCompany, the Game

"SimCompany" is a fun game designed to instil in children (9-14 years old) the entrepreneurship spirit. As the young player progresses in the game, the basic concepts of consumer behaviour, marketing and strategic management are described, illustrated and reinforced in a fun, easy and engaging way.

The goal of the game is to reach the last level and complete it with the greatest amount of points accumulated and before time expires. As an example, we provide a brief description of three levels of this game, taken from the game's script, which was outlined through a human-work design approach.
Some of the game's levels are described in the following paragraphs.

Level 1: Getting to know the Consumer. At the first level, the young player will be faced with a roll of different people (consumers). Based on the description of these characters (age, sex, social class, profession, interests, etc.), the player will have to associate the various products that appear onscreen (e.g. skateboards, neckties, candies, etc.) to the most likely consumer. Figure 1 illustrates this level's user interface.

The learning objective is to show the player that there are various factors (demographic, geographic, personal tastes, lifestyle, etc.) that determine the choices of consumption, the ways that each person chooses to spend time and money and that should be taken into account when attempting to open the right

business. To move to the next level, the player must accumulate a minimum number of points directly related to the number of correct associations made between consumer-product.

Level 3: Knowing the Consumer – Part 3. At level 3, the consumer's needs change and the player must figure out the best way to deal with these changes. He will have to define the product's characteristics that meet the consumer's needs and set prices. Advice will be given to the player so that he can change the course of business in light of new information…

Depending on the decisions the player makes, he will be able to gather a number of points which may or may not ensure his transition to the next level.

The learning objective, once again, is to demonstrate that the knowledge of the consumer is essential to anticipate and respond to changes in its needs/expectations. One must always be alert!

Level 9: Competition. At this level, the competition increases… New organizations start to emerge, which are direct competitors… To worsen the situation there is also an increase on the number of substitute products. The player must be able to identify situations where the threat of substitutes and rivalry in the industry increases and choose the scenario where his/her organization will have better chances to survive. The learning objective is to demonstrate the importance of being aware of the threats of direct competitors and substitute products for the survival of the business.

Level 10: Let's make a Trip! The Big Finale! The business has been a success and now the player has the opportunity to diversify it in geographic terms. But, how? Several scenarios and advice will be given and the player must use his incredible management abilities to internationalize his business in the best possible manner... It will be a difficult task but we know that he will make it...trying is all that matters!

The learning objective of this level is to show children, in very simple and captivating way, the most basic concepts of internationalization of a business.

In conclusion, the game SimCompany was co-designed by a team composed of programmers, game de-signers, scriptwriters, business managers and teachers, as well as HCI and Entrepreneurship researchers. The final product is a set of levels each with its own learning goals, and therefore with its own game variables (points, money spent, etc.). By putting the player in the central role of a business manager, the game succeeds at conveying the learning issues in a "do-it yourself" manner.

4 EVALUATION

The evaluation of this game has been initially conducted with two classes (children aged 9-11) at a local school. Overall there were 28 females and 21 males. In both classes, participants were randomly divided into two groups of equal dimension: a control group, composed of students who took a lesson on managing a business using traditional methods – blackboard, books and the lecture itself – and the experimental group, composed of students who played "SimCompany". Each class was divided into three phases: a *pretest* phase, when students answered a random set of questions about the subject being taught (management) without being taught anything about it. Then came the learning phase itself. It consisted of a traditional lesson in the control group and a "SimCompany" playing session, in the experimental group.

At the end of the class, students performed a similar *posttest*, so that we could quantify their average degree of learning obtained by each of the groups. One way to measure the degree of learning (how much the students knowledge improved) obtained through a particular mode of education is quantified by the <g> score (Mayo, 2007), which is calculated the following way:

$$<g> = (posttest\% - pretest\%) / (100\% - pretest\%)$$

where *posttest*% is the percentage of correct answers in the posttest and *pretest*% is the percentage of correct answers in the pretest. The procedure for the control groups was similar, except that the teacher was asked to give the class about the exact same subject but using traditional methods like the white-board.

Table 1 shows the evolution from pre-tests to post-tests for each of these groups of students. The results refer to the pre and post-test percentage of correct answers; the right-most column shows the <g> value.

Table 1: Evolution of the students' degree of learning <g>.

	Pre-Test	Post-Test	<g>
Control	59.1	70.3	27%
Experimental	57.2	77.4	47%

From this initial evaluation, it became clear that SimCompany is an effective game for teaching children general business management concepts: results showed a higher <g> value for the experimental group than the control group. This is a step forward in designing technology that really helps children learn. Future work will include evaluating the game in more schools and students, as well as outlining general principles that can prove useful when designing this kind of games. This will also contribute to a growing body of knowledge based on human-work interaction design.

5 CONCLUSIONS

The main goal of this research was to conceive a new game that could promote the entrepreneurial spirit in children. However, during that process we ended up collecting a body of knowledge regarding how business managers and teachers can act effectively, during a UCD game design process.

It is now clear that as a result of the present ubiquitous environment and the sheer volume of their interaction with it, today's students think and process information in a fundamentally different way from their predecessors. In this context, computer games have the potential to act as an effective learning tool. Some of the reasons that show its potential were analyzed through this research, and include the following:

• *Scale*: an online-based educational game can reach a much higher number of students than traditional educational methods. Its effectiveness also seems promising and shows positive improvements on the students learning rates, although more research is needed in order to correctly assess it.

• *Availability*: traditional educational lectures only occur at a pre-fixed time point, whereas educational games can be played during the children's spare time at anytime. This is even more important if we think about the percentage of students who own smartphones, PDA's and other computing devices that can also be used as effective ubiquitous learning tools.

There are reasons to believe that the business, technological and social dimensions of games will continue to be key driving factors of the gaming billion-dollar industry. The process of creating those games, however, is still far from being optimal. One of the reasons for this is simply that professional designers often don't have one of the following

skills (although some have most of these and very few have all the skills): (i) visual design skills; (ii) programming and technical skills; (iii) knowledge of the educational curriculum and contents – and ideally they should all present these skills. However, it's more natural to simply bring different-background persons to the project. Therefore, novel design approaches are needed, especially those approaches which are capable of effectively bringing together all these very different skills.

As for future work, there are certainly many avenues of research on game design for educational goals. Whichever design approach is followed, it is essential to regard the game as an additional educational tool, rather than a solution for all problems. In particular it would be very interesting to study how can we design educational games that promote a more collaborative style of learning. Putting students interacting with each other would be particularly useful for learning complex sets of concepts, such as those present in the business management fields.
One of the most interesting success factors of educational games like SimCompany is related to its availability, as we mentioned previously. This opens up the power of educational mobile games as another promising field of research, since it could exploit this factor to a further extent.

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