Scaffolding a technical community of students through social gaming: lessons from a serious game evaluation

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Abstract: In this paper we present and evaluate the serious game World of Operating Systems (WoUSO), designed to scaffold an emerging technical community of students. WoUSO is a voluntary, semester-long browser game that embeds quizzes and riddles in multiple forms of player interaction. Game evaluation indicates that WoUSO creates shared experiences in which classroom learning and technical skills become resources for fun and sociability. Competition and player interaction are two main motivational engines of the game; they need to be judiciously calibrated in order to reduce incentives for rule bending, to accommodate multiple styles of play, and to diversify resources for self-presentation and positive reputations.

Introduction

There is a rich thread of experimentation with games as motivation resource in computer science education. We have found several useful instances relying on individual play to foster concept learning (Hill et al, 2003; Eagle & Barnes, 2008; Maragos & Grigoriadou, 2007). Another relevant body of research examines educational social gaming as an occasion for engaging and meaningful interactions, which cultivate communities of practice and support different forms of distributed learning (Hicks, 2010; Whitson & Dormann, 2011; Trausan-Matu, S., Posea, V., Rebedea, T., & Chiru, C., 2009). Game play supports intrinsic motivation to engage with the curriculum – although it is often the case that students are required to play the games as part of coursework, and students' performance in the game is consequential for their grade – making the game extrinsically motivated, at least to some extent.

We tackle the motivation problem from a slightly different angle. Instead of making game play a means for the purpose of getting course credits, we make course learning a means for the purpose of play. We thus propose to put to use an introductory university course in Linux as a resource for free, fun, intrinsically-motivating and socially meaningful actions that rely on technical knowledge, constitute communities and create positive school-related self-images and reputations.

Since 2007 we have developed the World of Operating Systems (WoUSO) game (Deaconescu et al, 2011), associated with an introductory BS course in Linux for Computer Science students in an European University, in a team including faculty members, students (mostly former players) and alumni, organized on three directions: 1) Content generation, 2) Framework development, and 3) Evaluation & Motivation - which we have coordinated. We present here our recent work of evaluating the 5th edition of the game, implemented in the fall of 2011.

Game presentation

WoUSO is a browser game in which students compete individually and collectively by answering sets of questions about Linux, general CS concepts, computer science history and culture, as well as more whimsical or 'geek-ish' computer-related tests. The game is an open source project, and students may log in its development interface to report bugs and suggest features. In each edition the game also enrolls out-of-competition senior players, mainly faculty members and students in the 2nd and 3rd years. Players can use computers or other mobile devices at any place or time to access the game, which means that they are in complete control of their company, technology, and any other contextual elements of play.

The game taps several motivational sources to captivate players: competition, immediate feed-back, scaffolding, humor, curiosity, social interaction and self-assessment (Maragos & Grigoriadou, 2007; Whitson & Dormann, 2011; Malone, 1981). The 5th edition also had an elaborate story for 'extrinsic fantasy' allure (Malone, 1981) and a new visual interface (see Figure 1).

Figure 1. Visual interface of WoUSO

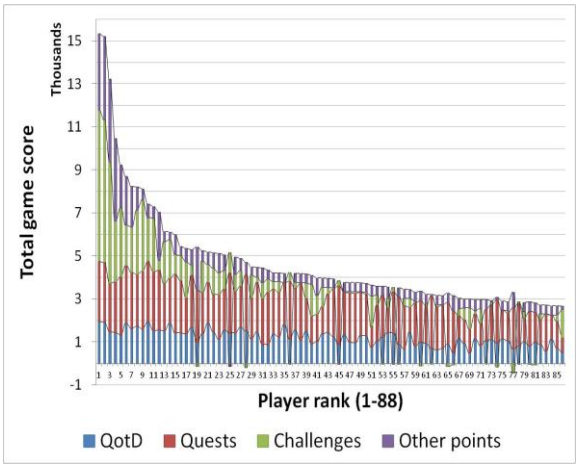

Figure 2. Distribution of total game points by source activity, for the 88 systematic WoUSO players

The main game components require different combinations of knowledge, timing and sociability for play. They are the Question of the Day, weekly quests, the final quest, challenges (duels) and special quests.

1) The **Question of the Day** (QotD) is a daily, individual, quiz-type question based on the course curriculum: "How many parameters may a bash script have?" [a) Unlimited b) None c) 1000 d) Only one].

2) **Weekly Quests** are series of weekly computer science-related riddles. There are no predefined strategies: players explore and test a wide range of interpretations and approaches, and they can also ask for hints on the game forum. Players usually have an answer time of 24 hours to complete the quest – a period in which team members attend to students' requests for clues. For example, one quest riddle was: "baabbeb0b6b1dfacb7adbbb3aaf2f5" with the answer "ETAOIN SHRDLU" (the ASCII message was translated to binary representation, negated, then formulated in hexa representation). The **Final Quest** is similar in style but more complex, and it requires Linux configuration skills. The weekly and final quests are supposed to be played individually; in practice, though, students often solve them collectively, especially those living in dorms. Players also clandestinely communicate their solutions to friends and colleagues, contributing to the game's social economy of exchange and generosity (Whitson & Dormann, 2011).

4) A player may challenge another one to a duel. Each participant may activate the duel within the next 24 hours; upon activation, s/he receives a set of 5 quiz-type multiple-answer questions, from the course curriculum, with 5 minutes answer time. One example of challenge questions is: "With what key combination can one enter the "Insert" mode in VI?" [a) a b) i c) eof d) q e) ESC f) ENTER]. The player with the higher score wins the challenge. In this edition a student could only initiate one duel per day – but s/he could accept an unlimited number of invitations from others.

Because duels could generate large amount of points, even up to 150 points, they have been the main battleground for those aspiring to win the game; duel scores differentiated the top players (see Figure 2). The most arduous players have also found solutions to push duels to the limits of game rules or beyond, by making alliances or by asking colleagues who were not playing to donate them their accounts, which they could then use to run fake duels. Such forms of rule bending have been, every year, a topic of controversy and also a reason of disenchantment for some players. Each edition has implemented solutions to combat point harvesting; in 2011 duels were scored in direct proportion to the ratio of loser / winner total points, thus discouraging the use of passive accounts and encouraging duels among players of similar rank.

6) The Special Quest has been introduced in 2011 to bring some off-line materiality to player interaction. It comprises 'adventures' such as borrowing a book from the University library, making a group photo with the coordinator of the development team, singing a song with a course professor, or getting 4 autographs from teaching assistants. Special quests are published weekly and are solved by teams of maximum 4 players, constituted by players at the beginning of the semester.

The student with the highest final score is the game winner, and the top 10 players receive special awards in a ceremony at the end of the semester. Also, there are prizes for the student series and group with the highest cumulated score. Interestingly, the winning series in 2011 did not include most of the top 10 players, winning through many lower-profile contributions.

Evaluation results and discussion

In the spring of 2012 we conducted the first systematic evaluation of WoUSO gameplay experiences, relying on

a) Our observation of gameplay, in 2011 and in previous editions;

b) A brief anonymous evaluation survey conducted after the game was completed;
c) Interviews with 20 student players and 4 team members.

Scale

Although we did not expect all students to play the game, given that participation is voluntary and completely unrelated to course assessment, we aimed to mobilize as many players as possible, in order to make the game an effective resource for casual campus talk and relationships. In search of a point threshold for measuring and comparing meaningful participation, we have decided to count players that have total scores equal or larger to a conventional level of 25% of the average of the first 10 players. This leads to an estimate of 88 systematic players in 2011, an increase in comparison to the 33 systematic players in 2010.

WoUSO as an experience of learning for fun

There are 175 students who have volunteered some open comments and / or suggestions concerning WoUSO in our anonymous evaluation survey, and 51 of these comments explicitly point to the usefulness of game play for learning, including learning the OS course content, more notions of Linux, and other knowledge of computer science and CS culture. There are only 8 comments that characterize the game as 'boring', 'useless' or 'a waste of time' – although, of course, it is plausible that this opinion is also shared by some students who did not write their evaluation. Another 4 students argue that questions were too difficult and thus unfit for 'simple beginners'. Therefore, as a rule, those who do express an opinion of the game see it in close connection to course learning; the game is said to 'stimulate the desire to learn', 'help students' development in the OS field', 'provoke users to learn more about OS', 'go through the entire course content' etc.

Besides positive evaluations, we have also expected, hoped for and received several enthusiastic comments about the game. Some students in the anonymous survey describe the game as "Addictive, useful, a good way of learning the course content"; "It was cool and it creates a type of addiction; "A good idea, interactive, a good place for making friends, creates addiction". Two other anonymous users write that WoUSO is "a captivating game which is mind blowing", "EPIC! It really is: this is all I did the entire semester and it was great: I learned a lot of new things, I made a lot of friends, it helped for my exam", and that "WoUSO was at first a shocking experiment because I didn't believe there can be so much interest from professors/TAs in the Romanian university system. WoUSO demonstrates the passion of the aforementioned and they make the faculty very attractive, in spite of its high difficulty level." We have also found such experiences in the interviews. One respondent [P3] describes the game as addictive – especially because of the challenges: "[P3] Really, you do become addicted to this thing, I mean… I know that in the last days I had a challenge, I played it, and then I looked for others that could duel with me, 'come on, isn't it that you can challenge me?'".

Game Reputations and Social Classification

Two WoUSO components contributed to the emergence of reputations: the forum, and the player ranking display. On the one hand, students posted on the dedicated game forum the results of their Special Quests – thus displaying their creativity, humor, and also skills to negotiate rule-bending, addressing topics such as: scheduling quests, fixing bugs, or unfair play. The main WoUSO reputation creation mechanism was the player ranking: the top 10 players were visible at any time on the front page of the game, while all players were ranked on a separate page, one click away.

What was the social meaning of this ranking in the student community? We can answer this question by looking at the '**types of people'** that students refer to. We notice two main interpretations of the hierarchy: some recognize it as a ranking of effort and merit, while others challenge it as rewarding unfair play. For example, students who wrote anonymous comments occasionally refer to various 'types of people' such as "those at the top", or "the interested ones". These expressions offer us clues for understanding game-related social classification and reputation. One comment, which is also echoed in interviews, says: "Although I didn't play I initially found the idea interesting, however my limited knowledge and the gap between myself and those at the top made me quit". A former player presents his game trajectory by saying that "[P2] Absolutely interesting but… at some point you lose… if in the first week you don't play it full speed, you lose a lot in the ranking and, if you are already on the 150th place, you don't feel like playing at all. But there, in top 10, they play all around, those were playing all the time, they had all sorts of discussions." "Those at the top" are thus a distinctive social category – loosely contrasted with those who lag, or drop lower in the ranking: "An interesting game, but not for those who don't keep it up", writes another anonymous student. "Those at the top" are often seen as the "best ones" [P2], or the "interested" students – contrasted to those who "don't even have Linux installed". This positive reputation of the top players is even more visible in the evaluations of the faculty and game developers; systematic WoUSO players are seen to be "[T2] people who are more competitive (…), those more involved in the things that they do in the University", and to constitute the alternative meritocracy for the OS course: "[T4] You don't get grades, but you win a score, you win a score to get to the top. Being in the top you are one of the 10 winners, the grade it's not the only [thing that counts, A./N.]… for the OS course."

Still, the overly competitive practices of the top players, who put in long hours of play and search for rule-bending opportunities that allow them a competitive advantage, make other students disappointed with game play, instantiating the "hard-core" versus "casual" player dynamics and discourse from MMORPGs. One anonymous comment says: "In the beginning I thought it's a very good idea and I still claim this, but I lost my interest because of the way it differentiates between players who know the course content and those who know how to get by". Another comment proposes that "A different scoring system should be implemented which wouldn't strongly benefit those who play obsessively".

Conclusions

The WoUSO game scaffolds a technical community of students by engaging them into a semester-long series of technical and whimsical tests and novel social interactions. Unlike other educational games, WoUSO play is voluntary and unrelated to formal student assessment, although it is closely linked with the course content. The game has attracted a systematic player community of around 88 players out of 347 registered students. Anonymous evaluations from 175 students have indicated that the game is widely considered useful for learning, fun, and a way of making new friends in the University; some of the most engaged players have even described it as 'addictive' and an out-of-the-ordinary academic experience.

One of the main motivational engines of the game is individual competition between players, locally (in duels) and globally (in the final ranking). The challenge for game designers is to carefully arbitrate it and balance it with collaborative activities. Various forms of 'cheating the system' are part and parcel of gaming for some, but disenchanting for others. In this edition, duels have been the center of rule bending but also, it seems, the most appreciated component of the game for the most engaged players. Future game development should improve duel scoring to lower incentives for fake duels, and it should foster player collaboration, for example by allowing team duels.

Because the main reputation-creation arena of the game was players' overall ranking, particularly the Top 10 list, self-presentation benefits were considerably larger for top players than for the more casual, lower profile players. Future improvements should include a wider array of formulating and making visible players' performances, on more dimensions (rapidity, perseverance, inventiveness, width of social network etc. – besides their total score), at a lower level of aggregation (per week, per game component, and per player team).

References

Deaconescu, R. et al. (2011). *World of USO*. ROSEdu. Available from https://wouso.rosedu.org (03 May 2012).

Eagle, M. & Barnes, T. (2008). Wu's castle: teaching arrays and loops in a game. *Proceedings of ITiCSE 2008* (Madrid, Spain, June 30 – July 2, 2008) (pp. 245–249). New York, NY: ACM.

Hicks, A. (2010). Towards social gaming methods for improving game-based computer science education. *Proceedings of the 5th International Conference on the Foundations of Digital Games* (Monterey, CA, USA, June 19-21 2010) (pp. 259–261). New York, NY: ACM.

Hill, J.M.D. et al. (2003). Puzzles and games: addressing different learning styles in teaching operating systems concepts. *Proceedings of SIGCSE'03* (Reno, Nevada, USA, February 19-23, 2003) (pp. 182–186). New York, NY: ACM.

Malone, T.W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science*, 5, 4, 333–369.

Maragos, K. & Grigoriadou, M. (2007). Designing an Educational Online Multiplayer Game for Learning Programming. *Proceedings of the Informatics Education Europe II Conference* (Thessaloniki, Greece, Nov. 29-30, 2007) (pp. 322–331).

Trausan-Matu, S., Posea, V., Rebedea, T., & Chiru, C. (2009). Using the Social Web to Supplement Classical Learning. *Lecture Notes in Computer Science,* 5686, 386–389.

Whitson, J.R. & Dormann, C. (2011). Social gaming for change: Facebook unleashed. *First Monday*, 16, 10.

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