MANAGE. CREATE. PLAY. PRACTICES FOR TEACHING DESIGN PROJECT MANAGEMENT THROUGH THE CREATION OF BOARD GAMES

Maurício Moreira e Silva BERNARDES and Geísa Gaiger de OLIVEIRA
Federal University of Rio Grande do Sul, UFRGS, Porto Alegre, Brazil

ABSTRACT
In Brazil, it can be seen that courses and lectures in most undergraduate design programs usually focus more on design creation than on project management itself. As a result, undergraduate education and training promote the development of skills and abilities but fail to address project management tools. In an attempt to modify the context described above, a course on design-oriented project management was planned and implemented in an undergraduate design program in a Brazilian university.
The above-mentioned course is taught in the eight semester of the design program, and students are urged to develop a board game delivered in a marketable format that can be played within one hour. In the last eight semesters, 98 undergraduate design students developed 23 board games. The course taught the students how to lead a project while facing constraints and difficulties that resemble those found in the market; thus, they had to combine the creativity of design with the need to manage a design project efficiently. At the end of the course, students submitted a project management plan containing all documents generated, controlled and reviewed for the development of the game.
This paper describes the practices applied for teaching design-oriented project management, in order to make it more attractive to students. We reflect upon our experience with the course and the contents that the students have learned in order to review and update their managerial goals, based on the creation of the board game and the project management plan itself.

Keywords: Project management, board games, collaborative design, learning by doing, assessment and feedback.

1 INTRODUCTION

The year is 2168. The Earth's natural resources are nearly depleted. The four world's biggest economies have developed a joint project to build a large spacecraft to travel to a planet whose characteristics are similar to those of Earth. During the journey, these four economies must cope with various situations that will put the spacecraft at risk. Such situations produce conflicts that must be resolved by the travellers. If the conflicts are not resolved, part of the spacecraft will explode. When the conflicts are resolved, the members of the spacecraft gain resources and popularity marks. If the aircraft arrives on the new planet, the nation with the largest number of resources and highest popularity will be the one that will dominate the next Earth. However, if they do not settle the conflicts caused by dangerous situations that may arise, the entire spacecraft will explode and the human race will be annihilated. In this case, there will be only two outcomes: one nation wins and all travellers survive, or all of them die.
The above context is part of the game MAYDAY 2168, which was developed in the design-oriented project development management course of the university where the authors of this paper currently teach. The game was developed within four months and the design process was entirely planned and controlled using project management concepts, techniques and methods. This way, both by students and the course supervisor can experience learning-by-doing.
The course has been taught since the second academic semester of 2009, and it has been replicated and improved over eight semesters. In this period, 98 undergraduate students of graphic design and product design developed 23 board games. Throughout these semesters, the students learned to lead a project while facing constraints and difficulties that resemble those found in the market; thus, they had to combine the creativity of design with the need to manage a design project efficiently. In this sense,

this paper describes practices for teaching design-oriented project management, in order to make it more attractive to students by presenting contents and activities that resemble those actually found in the market.

2 LEARNING-BY-DOING

Politicians and researchers acting in the field of education claim that the use of unconventional teaching practices is important for students' learning process [1]. These practices have a positive impact on the quality of teaching and have urged the search for the necessary means to implement them in the classroom [1]. One way to achieve this is by developing learning-oriented projects. Such projects are very important because they have the potential to simulate the real world during design education and justify the development of tasks that enable students to deal with problems not previously discussed in the classroom [2].

It is known that design students have an intrinsic desire to develop things, always questioning how such things work and relate [3]. Thus, the search for elements that simulate real life requires the inclusion of other contents (not previously taught) in the course syllabus to provide students with the competencies and skills that will help them manage and develop design projects. Program contents should allow students to experience situations that would make them capable of dealing with strategic actions and change management, as well as to exercise the power of persuasion on their work team [4]. This corroborates our desire to develop a course on project development management focused on action learning, or learning-by-doing.

Taking into account that designers operate more and more collaboratively [5] and work in international environments which require a sound communication channel between suppliers and producers [6], efficient project management is mandatory. In this context, developing collaborative projects in the classroom is important to train students to solve complex design problems through team work[5], making them deal with different experiences and ideas [7]. This can minimize risks of loss or redundancies in the communication channel used by the members of multidisciplinary project teams, and also increase the efficiency of the process of development of a new product or service.

Thus, the course presented in this paper aims to discuss the students' appropriation of the theory by means of the practical application of project management methods and techniques in the development of a tangible product, i.e., a board game that could be developed during an academic term.

In social sciences, games and simulations are largely accepted as important learning elements, because they are considered unconventional teaching tools that complement those used traditionally [8]. Such elements motivate students because they form an action-based learning approach (learning-by-doing) through real life simulations [8]. Playing the game triggers the students' playful side, strengthens the team experience and deepens the sense of belonging of each member of the group [9]. In addition, the use of technologies with simulations and games reinforces the learning process oriented to real life experience, allowing students to interact socially with their peers [10]. Despite the existing awareness of such importance, it can be seen that the use of games as a teaching method has been sufficiently addressed in the literature, but not game design itself [11]. This suggests that game design should be worked on and explored, and it should also be more effectively integrated with the project management process.

Unconventional teaching methods also require that the assessment of each student and also their respective teams to which the student belongs be made in a differentiated, individualized manner. Thus, a key issue to be addressed during project development is how the supervisor will give feedback to students. In this case, the learning-by-doing approach has best results when supported by a regular process of reflection and feedback of students and their supervisors [12]. Thus, it is important to give feedback on the performance of the players, guiding them in their actions to achieve their goals, and this must be done throughout the development of the project [13]. Therefore, it is understood that the supervisors of the design project management course should provide constant feedback on the management process, because in doing so, the students will understand the effects of their decisions in (almost) real time.

3 COURSE STRATEGY AND DEVELOPMENT

The course whose teaching practices will be presented in this paper is called Design-Oriented Project Management. It is a mandatory course taught only in the penultimate year of the graphic design and product design programs, after students have attended prerequisite courses on design methods in the

first three years of their undergraduate courses. The course is taught over 18 weeks, with four hours of class per week. At the beginning of the semester, students are divided into groups that represent the teams of the project. Each team is urged to develop a product that must have the following characteristics: it has to be a board game playable in one hour; it cannot be a digital game; and it must be delivered in a marketable format. The project must be managed in accordance with the project management practices discussed in the classroom. In addition to designing the board game, the students also have to develop their project management plan.

Design students are grouped into teams of three to five members. Students' majors were graphic design and product design. As a rule, it was defined that each group should have at least one graphic design student and one product design student in order to foster integration between the two areas.

The development of the course was based on the strategy of dividing the modules into project management contents according to PMBOK areas [14]: integration, scope, time, cost, quality, risk, procurement, communication, and human resources. Each module was taught in three classes; the third class was devoted to practical application of the concepts previously seen in class for the management of the board game project. In the first class following the end of each module, the teams made presentations on how they applied the project management methods of the respective PMBOK area.

Figure 1 shows the framework that was created and improved over eight semesters, which is divided into three major areas, as follows: management, create and play. In the “management area of the framework, concepts of PMBOK are presented. Initially, the contents relative to the need to determine the stakeholders’ expectations are defined. In this case, stakeholders are the students and the course supervisor. During this first part of the semester, supervisor and students also define how the team members (students) will be coordinated. Thus, in the first classes of the course, each team chooses a student to be the manager of the project to be developed. The project manager assigns tasks, plans and controls the team’s activities and often prepares a progress report to be submitted to the supervisor. The theoretical content about quality is not reviewed in the course, because there is another course taught in the university that covers this subject. The students, however, seek to manage the process quality by performing a design critique as an attempt to deliver a product that will meet the specifications required by the supervisor at the beginning of the semester.

The course was designed to ensure integration of the project management theoretical content with the design methods used by students while designing the game. In this case, because it is a compulsory course at the end of the program, and taking into account that the students have already acquired knowledge on design methods discussed throughout the undergraduate program, each team can choose the methods they will use in order to develop the game.

The first disciplinary modules cover integration and scope (Figure 1). Students should then develop a project charter and the work breakdown structure to describe the scope of the project. Such deliverables must be developed in the “create” area of the framework. In parallel, the groups should begin a survey on board games in order to have insights for the game that will be developed.

Each group then presents the project charter and the scope of the project to the class using multimedia resources. At this time, the supervisor should give feedback on the process of construction of such deliverables. This also offers a learning opportunity to the other groups that attend the presentation. This moment is also important for the supervisor, who can see how students apply his teachings, so he can provide a learning-focused feedback [15]. After the presentation class, the course continues by following the same procedure. Table 1 shows the modules and their respective deliverables.

The students also have access to the board games developed in previous semesters as well as their respective project management plans. Then, in the first classes of the course, the “play” area of the framework begins. In this case, in some specific classes, or extra-class activities, the students play previous games, and analyse and reflect on what to do and not to do, thus gaining experience to develop their own project.

Development of the board game itself begins after the stage of research and insights, and after submission of the proposed Gantt diagram to the supervisor. Still in this presentation, the students should justify their initial insights, so that the game development process may start.

Table 1. Course modules and deliverables

Module	Deliverables
Integration and Scope	Project Charter and WBS
Time	Gantt Diagram

Cost	Cost Quotation
Risk	Risk Analysis
Procurement	Contract
Communication	Communication Plan
Design Process	Board game and manual

There are still two important stages to increase the chances of achieving quality deliverables: development of the game manual and testing the game that has been created. The manual begins to be drafted when the students have a more detailed concept of the game. The students then go on designing and testing the game with prototypes to enable them understand the problems, thus enhancing their critical thinking significantly [16]. The final stages of development of the manual are tied to the completion of the board game itself. Thus, the supervisor requires submission of a draft of the manual for his review three weeks prior to the final test of the product. Accordingly, the supervisor can provide feedback on the manual as well as on the game features so that the students can improve them until final delivery.

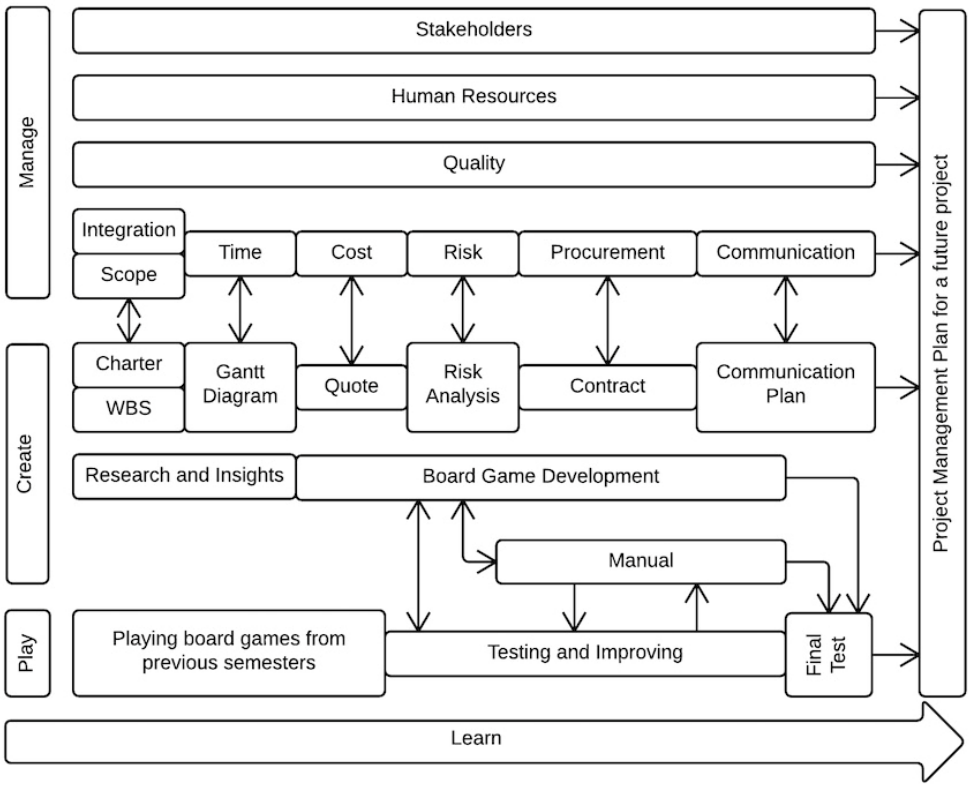

Figure 1. Course framework

A week before the final test, the prototype of each group is assessed by the students of the other groups. As a result, an informal evaluation takes place when the students play the games of the other groups. A member of the group that developed the game is required to stay next to the players, only watching but not allowed to interfere. Such observation allows the member of the group to take notes of the feedback for the final test of the prototype and to make minor modifications before the final product testing.

On the day of the final test, students are supposed to have submitted a project management plan containing all documents generated, controlled and reviewed for the development of the game. In addition, the game they developed is played by undergraduate and graduate students for evaluation purposes (Figure 2).

Figure 2. Example of games and playtests

Playing the game serves as market feedback from future consumers. Thus, as occurred in the prototype test, in the week prior to the final testing, the games of a group are assessed by students of the other groups. Students should assess the game in various aspects: ease of understanding the manual, packaging, graphic parts, and the game concept. The marks given by the students are anonymous and correspond to 5% of the overall mark that each student will receive at the end of the semester. The respective project manager also evaluates each student at the end of the course, and this mark corresponds to the performance of the team member in project development. On the other hand, the course supervisor evaluates the performance of the project manager. The final mark of each student ranges from zero to ten and is made up of the evaluation of five specific areas, as follows: project management and control plan (40%), board game (40%), student engagement (10%), performance of the team member in project development (5%), and assessment of the game by students of other groups (5%). The project management plan and the board game account for 40% of the overall mark each. The objective of this procedure is to make students aware of the importance of balancing efforts so that both the board game and the project management plan are delivered while fulfilling the scope, deadline, cost and quality requirements expected at the beginning of the course. In this case, the performance of team members is assessed on an individual basis. Each project manager evaluates the member of his or her team, and the course supervisor evaluates the project manager of each team according to the project management theory presented in class. The course supervisor checks if the contents from PMBOK [14] dealt with in class were properly learned during the course. For this purpose, the course supervisor assesses the documents submitted as well as the performance of individual students or the whole team.

In the last class of the course, which takes place after the game playtest day, the teams submit their proposal for the project management portfolio of another game to be developed in the future. They use what they have learned in the course to review and update their managerial goals, based on the creation of the board game itself.

4 FINAL CONSIDERATIONS

The framework of the project development management course enabled the teaching process to be carried out with more fun and associated with the development of two tangible products: the board game and the project management plan. Students lacking previous experience on project management contents usually consider project management practices as a difficult course to apply in the real world. In some cases, their previous experience was based on the management process practiced by the design offices where they worked as interns. Most designers who run these offices have not attended a project management course at university. As a result, their empirical knowledge has developed organically on a trial-and-error basis, thus leading to the establishment of an informal project management culture. The practices presented in this paper are an attempt to change this situation.

After the final test day, some comments made by students suggest that the course could help them in the future with actions that influence such culture. “Before this course, the quotations that I used to prepare for a freelance job were usually estimated based on what my colleagues said. I did not know exactly how many hours should be allocated to complete the project, and sometimes I ended up working more than I had anticipated”, said a student in the last class in the second half of 2014, showing his appropriation of the concepts that were taught on project management.

The development of the course has opened a possibility for students to work using both theory and practice. In addition, it has created a significant portfolio of board games. Out of a total of 23 games

created until now, one is registered under a patent application, two won a major Award on Design in southern Brazil, and two others got honourable mentions in other editions of the aforementioned prize. This has motivated students to develop, every new semester, quality board games that, to a greater extent, require planning and continuous control of their project management processes. Games are also paving the way for the conduction of experiments in the field of project management and design. The Mayday game, which was briefly described in the introduction of this paper, has been reformulated by one of the students who developed it, in order to enable us to examine how inexperienced (novice) and experienced students resolve conflicts. The aim, therefore, is to identify elements that can enable us to be knowledgeable about how to create a design team capable of dealing with different kinds of individual goals of each member of a project team.

REFERENCES

[1] Conklin H. G. Toward More Joyful Learning: Integrating Play Into Frameworks of Middle Grades Teaching. *Am. Educ. Res. J.*, vol. 51, no. 6, pp. 1227–1255, Dec. 2014.

[2] Novak M. and Dolsak B. How to define projects to teach design? in *Proceedings of E&PDE 2011*, London, UK, 2011, pp. 239–244.

[3] Pasman G. and Boess S. Involving design students in design research: making things for knowing things. In *Proceedings of E&PDE 2010*, Trondheim, Norway, 2010, pp. 486–491.

[4] Spruce J. An Integrated Approach to Developing Higher Graduate Skills in Design Education. In *Proceedings of E&PDE 2011*, London, UK, 2011, pp. 373–378.

[5] Liem A. Teaching Students How to Professionally and Persuasively Act as Design Consultants in Collaborative Industry Projects. In *Proceedings of E&PDE 2012*, Antwerp, Belgium, 2012, pp. 748–753.

[6] Loy J. Preparing Product Design Students for Working in the Global Production Environment through Practical Learning. In *Proceedings of E&PDE 2011*, London, UK, 2011, pp. 752–757.

[7] Wits W., Homminga J., Endedijk M., Visscher K. and Leonie Krab-H. Teaching Design Engineering in an Interdisciplinary Programme. In *Proceedings of E&PDE 2014*, Enschede, The Netherlands, 2014, pp. 377–383.

[8] Martin A. The Design and Evolution of a Simulation/Game for Teaching Information Systems Development. *Simul. Gaming*, vol. 31, no. 4, pp. 445–463, Dec. 2000.

[9] Ayers L., Beyea S., Godfrey M., Harper D., Nelson E. and Batalden P. Quality Improvement Learning Collaboratives. *Qual. Manag. Health Care*, vol. 14, no. 4, pp. 234–247, 2005.

[10] R. Hromek and S. Roffey, "Promoting Social and Emotional Learning With Games: 'It's Fun and We Learn Things,'" *Simul. Gaming*, vol. 40, no. 5, pp. 626–644, Oct. 2009.

[11] Boks C. and Mcaloone T. C. The design of Eco Board Games as an umbrella approach to sustainable product design education. In *Proceedings of the E&PDE 2009*, Brighton, 2009, pp. 390–395.

[12] Eggink W. and van der Bijl-Brouwer M. Grading Efficiency in Design. In *Proceedings of E&PDE 2012*, Antwerp, Belgium, 2012, pp. 275–280.

[13] Bedwell W. L., Pavlas D., Heyne K., Lazzara E. H. and Salas E. Toward a Taxonomy Linking Game Attributes to Learning: An Empirical Study. *Simul. Gaming*, vol. 43, no. 6, pp. 729–760, Dec. 2012.

[14] P. M. Institute. *A Guide to the Project Management Body of Knowledge: PMBOK(R) Guide*, 5 edition. Newtown Square, Pennsylvania: Project Management Institute, 2013.

[15] Okita S. Y., Turkay S., Kim M. and Murai Y. Learning by teaching with virtual peers and the effects of technological design choices on learning. *Comput. Educ.*, vol. 63, pp. 176–196, Apr. 2013.

[16] Isa S. S., Liem A. and Baggerud B. Facilitating Students' Design Sensitivity and Creativity in Design Detailing and Materialisation through Physical Models and Prototypes. In *Proceedings of E&PDE 2014*, University of Twente, The Netherlands, 2014, pp. 580–585.