

Yazılım Mühendisliğinde Disiplinler Arası Bir Yaklaşım: Mühendisler Tasarımcılar ile Buluşuyor

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Özet. Bu çalışmada, Yeditepe Üniversitesi Bilgisayar Mühendisliği ile Görsel İletişim ve Tasarım Bölümleri lisans öğrencileri arasındaki ortak projeye Yazılım Mühendisliği alanında yürütülen disiplinler arası bir işbirliğinden kaynaklanan zorlukları inceliyoruz. İki bölüm arasındaki bu işbirliği iki yıl üst üste gerçekleştirilmiştir. Her yıl her iki bölümden öğrenciler de dahil olmak üzere belli sayıda grup oluşturulmuştur. Her grup, hem tasarım hem de bilgisayar programlama becerileri gerektiren bir oyun tasarlamayı hedeflemektedir. Sonuçlar, bu işbirliğinin hem öğrenciler hem de eğitmenler için faydalı olduğunu ortaya koymaktadır. Öğrencilerin bakış açısına göre, farklı geçmişlerden gelen insanlarla kurulan iletişim, onları gerçek yaşam durumlarına hazırlamaktadır. Ek olarak, bu deneyim, eğitmenlerin, öğrencilerin karşılaştıkları zorlukları yeterince anlamalarına olanak tanımaktadır ve bunun sonucu olarak, ders kalitesinin sürekli iyileştirilmesi için bir gösterge niteliğinde geri bildirim olarak kullanılmaktadır.

Anahtar kelimeler: Yazılım Mühendisliği Eğitimi, Disiplinler Arası Yaklaşım, Eğitimde İyileştirme.

An Interdisciplinary Approach In Software Engineering: Engineers Meet Designers

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Abstract. In this study, we examine the challenges that arise from an interdisciplinary collaboration in the field of Software Engineering through a common project between the undergraduate students of the Department of Computer Engineering and the Visual Communication and Design Department of Yeditepe University in Istanbul, Turkey. This collaboration between the two departments was carried out for two consecutive years. Each year a certain number of groups were formed including students from both departments. Every group had the objective to create a game as this type of application requires both design and computer programming skills. The results reveal that this collaboration is beneficial for both students and instructors. From the students' point of view, the contact with people from different backgrounds prepares them for real-life situations. Additionally, this experience has also an education impact as it enables instructors to understand the difficulties students are facing, which as a result can be used as indicatory feedback to constantly improve the quality of the course.

Keywords: Software engineering education, interdisciplinary approach, education improvement.

1 Introduction

The aim of this study is to demonstrate the benefits of having an interdisciplinary approach in the teaching of Software Engineering at undergraduate level. More precisely, in Istanbul, Turkey at the Yeditepe University, for two consecutive years, the students of the department of Computer Engineering (CSE) collaborated with the Visual Communication and Design department (VCD) for the creation of a game. In each year ten teams were created with members of both departments having as an objective to design and create a game that would be played on a smartphone. The Visual Communication and Design department students were assigned to propose an idea, design the characters, and create the scenario of the game. On the other hand, the students from the Department of Computer Engineering were responsible for carrying out these ideas, integrating the design and sketches to the game and propose corrections when the specifications were not realistic or too difficult to be realized. This study focused mainly on the challenges, difficulties and gains as experienced by the students of the Computer Engineering Department. The idea and the motivation for this collaboration is based on the challenges and difficulties that arise from cultural differences between different disciplines and giving the possibility of better under-

standing and collaborating with people from different disciplines is the main reason for this interdisciplinary project. Especially for the students of computer engineering, understanding professionals from other domains nowadays, became very important, because with the rise of new technologies, people from different professions have to collaborate and interact with each other.

The collaboration was organized as follows: in the beginning, a kick-off meeting was held with the participation of both students and instructors, having an aim to introduce the students to each other in order to form the working groups. After the groups were established, the communication between the students of both departments was facilitated via help of a web-based project management application, smartphone messaging, phone calls and weekly or biweekly meetings. After seven weeks, the teams had a presentation in front of the instructors in order to show their progress in terms of UML diagrams, videos, and their overall design. Finally, at the end of the semester, a presentation day was organized where the students presented their work, demonstrated their game and submitted their project report. The students of the Department of Computer Engineering filled out a questionnaire covering subjects as the organization of the project, its usefulness for their professional life in terms of new knowledge, and the communication between them and with the students with the other department.

The results extracted from the questionnaires and also from the personal experience of the instructors during the two consecutive years of the interdisciplinary collaboration showed that this project was very fruitful in terms of applying software engineering processes and participating in different phases of the project. On the other hand, the major problems were encountered in terms of communication, especially with the members of the Visual Communication and Design department. As the instructors have also verified that communications issues arose equally from both sides we have concluded that along with the contribution of a real-life experience for the organization and execution of a software engineering project, a major advantage of this type of interdisciplinary project is that it provides an educational method that can teach future professionals how to work and coexist with the “other” in the frame of a common project.

The rest of the paper is organized as follows: Section 2 presents the related works, Section 3 describes the methodology that was used during these two consecutive terms, and Section 4 illustrates some results and discusses the findings. Finally, Section 5 summarizes our conclusions and proposes some future works.

2 Related Work

Software engineering education represents a big challenge as a wide range of skills and talents is required [1]. As a result, various teaching methods were proposed [2-4]. Because of the particular nature of this course, emphasis is given to different aspects and compromises are done to balance the teaching time between theory, practice, development or management. Moreover, in an environment where interaction between users and developers is must, non-technical skills essential for a software engineer such as communication skills and the ability to work on a team are critical. Espe-

cially in the modern era, software applications necessitate the collaboration of more than one disciplines.

In an effort to address the problems arising from the lack of communication between users and developers, methods were proposed to reduce the gap between the education and the ‘real world’ conditions. In [5] this issue is addressed through an interdisciplinary approach and methods aiming to simulate the working environment are introduced. In general, the importance of interdisciplinary approach is being recognized as a tool of skill development for engineering education [6]. The collaboration of software engineer students with students from different departments provides a way of interdisciplinary work as shown in [7] where the Computer Science, the Business Management and the Product Design programs formed mixed groups for accomplishing common projects. In another study [8] the interdisciplinary work included vaguely formulated projects and collaboration with artists, thus revealing the wide and demanding area of software engineering. In [9], the advantages of implementing a game design for teaching software engineering are demonstrated as it is an attractive subject where all aspects of a software lifecycle can be represented. Finally, in [10], a design of a mixed-majors undergraduate course is presented including computer science and graphic design students. In this course the goal is to learn from each others’ expertises through the creation of mobile applications. This paper identified the challenges and opportunities that aroused from the cultural differences between the two departments.

3 Methodology

As mentioned before, for the case of our study the realization of the interdisciplinary approach in software engineering education is based on the collaboration between the Department of Computer Engineering and the Visual Communication and Design department. For this reason, we have concluded that an efficient and attractive way could be the creation of a computer game that would run on smartphones.

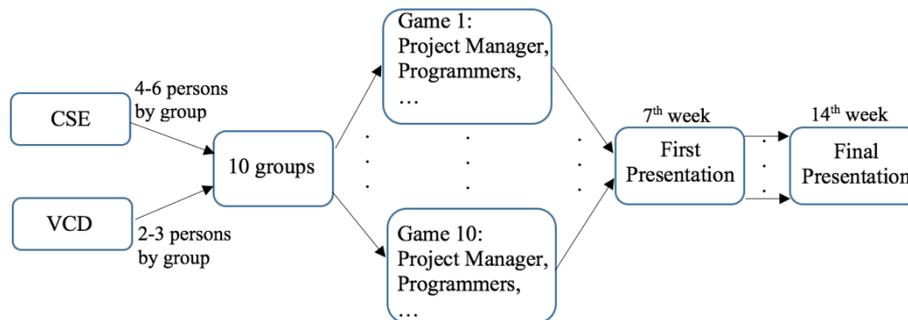


Fig. 1. Organization of the interdisciplinary projects. The CSE and VCD departments are forming 10 groups where the CSE members have distinctive roles. For each group, the objective is to create a computer game for smartphones. Their work is evaluated at two milestones – namely First Presentation and Final Presentation.

The advantages are multiple for students of both departments: from the point of view of CSE students the creation of such a game makes them more experienced in mobile programming, and game programming in general. From the point of view of VCD students, it challenges their creativity in terms of graphic design and game scenario. Moreover, it makes both students think together about the creation of an original game. At the early stages, we have witnessed a certain enthusiasm from the part of all students.

3.1 Groups

The collaboration is organized as follows: Initially, each department divides its students into 10 groups. Then, a common meeting is organized with students from both departments in a joyous and easy-going atmosphere, where the 10 teams of each department try to match with a counterpart from the other department. When the groups are matched, they result in 10 common groups with 4-6 students from the CSE department and 2-3 students from the VCD. In CSE department around 60 students are taking the course every year in their third year of their academic studies. Among them, 35% are female. In two consecutive semesters there was only one foreign student. Finally, the Software Engineer course has three credits into the curriculum of the CSE academic program.

From the Software Engineering course's point of view, the goal of this collaboration was not only the final product but the steps that the students would have to take in order to achieve the final product, which is the computer game. To do so, the students of the CSE department were asked to identify certain roles and missions for every member - such as designer, developer, and tester. This organization also included the post of the project manager that would lead the team. A person responsible for the communication with the partnering students from the VCD department. Furthermore, they had two or three programmers roles and a person responsible for writing the reports, preparing the presentations and demos in collaboration with the project managers. Figure 1 presents the organization of the groups from the two departments.

3.2 Communication

In terms of communication, frequent meetings (every one or two weeks) were organized between the teams of both departments. The goal of these meetings was to enhance the relations between students from two different departments, and also to evaluate their progress by communicating about the problems that they were facing. Additionally, a web-based project management tool was used in order to allow them to organize and check the progress of the project but also to give to the instructors the possibility to check if all necessary steps were taken. Finally, e-mails, phone calls, and messaging applications were also used. We have noticed that the messaging applications were the preferred medium of communication between students.

3.3 Software engineering process

All the teams have applied the incremental development method as their development process. The reason for this lies in the fact that the teams were small and the time for creating the product was short. More specifically, with this type of development highly priority parts of the game were developed first, like principal game functionalities and later other parts were delivered, like points system, ranking, etc.

3.4 Milestones and evaluation.

As presented in figure 1, there were two milestones in the lifecycle of the projects. The first one was scheduled seven weeks after the beginning of the project, which entailed an oral presentation for each group using slides, audio themes, and initial demos. At this stage, the instructors asked the CSE students to express their design with the help of UML diagrams, justify the selection of platform, and explain the reasons for choosing their proposed programming languages. The VCD students were asked to present their graphic design, the audio themes and the scenario of the game. Every group was asked to make a presentation shorter than 10 minutes.

The second milestone was the final common presentation with the presentation of the final product. This presentation was less technical and more focused on the live demo of the game. Together with the presentation, a technical report should be submitted, which included all details concerning the design, the implementation, and the tests that were carried out in order to verify and validate the product. Finally, the instructors evaluated and graded the project based on the presentations, the product, and the reports. Lastly, the CSE students were asked to fill in a questionnaire to collect additional information concerning the interdisciplinary experience, the benefits, and concerns that arose from this project.

4 Results & Discussion

After two consecutive years and 20 different teams, which accumulates to a staggering number of 200 students, we have made the following observations: firstly, on average the quality of the produced computer games was below the expected. Considering the number of people working on that project and the time given, it was expected that the games would be better in terms of graphic design, and complexity. Despite this fact, every term, there were one or two games that had an outstanding quality, which brings us to the conclusion that game programming as a task is not a straightforward procedure. Secondly, the enthusiasm that was observed at the beginning among the students of both departments decreased during the semester. The third observation is related with the application of processes of software engineering. For the last two consecutive years, the CSE students managed to apply with success the procedures related to the specifications, the requirements, the organization of the project and write relatively good reports. The instructors could verify the above by following the organization charts, the reports, and the meetings of the different teams. This achievement is one of the contributions of this interdisciplinary project because

it was carried out in a real-life environment with realistic constraints where students from other disciplines participated. This outcome is also reflected in the answers to the relevant questions of the student questionnaire, which was given to them at the end of the semester. Most of the students answered positively when they were asked about the organization of the project, the procedures followed and the overall contribution of this project to their knowledge. Table 1 presents some questions of the questionnaire related with their overall experience about this project. We can observe that in general the students were positive when asked about the benefits that had during this work.

Table 1: Some questions of the questionnaire given to the students related with their project experience. The results are the mean values of the answers of all students in Likert scale.

Question	Mean Value
Interdisciplinary project was a new experience for me	4.3
I would like to take part in a interdisciplinary project again in the future	4.4
I have experienced and learnt new methodologies to solve problems throughout a project lifecycle	4.5
This experience improved my understanding of project management	4.5
This experience improved my understanding of possible project development issues	4.1

Finally, the fourth observation is related with the communication between members of the CSE department and the communication and relations between the members of the CSE and VCD department. After personal discussions between the instructors and the students and according to the answers to the questionnaires, the personal communication was the toughest challenge of this project.

From the point of view of CSE students, the most commonly identified problems were the lack of responses that occurred when communicating through a messaging or email medium and the delay in the deliverables from the part of the VCD department. At this point, it is worth to mention that after speaking with the instructors of VCD department, the instructors of CSE department observed similar problems but this time from the students of VCD towards the students of CSE department. In a certain sense, it looks like the identity that is created to a student from his participation to a particular department influences his communication with the students of other departments and expectations or behaviors that are considered to be normal are not finding their correspondence when speaking to the “other”. The frustration that is created from this communication is eventually the biggest gain of this interdisciplinary project as it prepares them for the real-life environment. It may also explain the low quality of the projects and the reduction in enthusiasm during the semester.

5 Conclusion

In this study, we have described and presented the results of an interdisciplinary project between the students of the Department of Computer Engineering and the Visual Communication and Design department of Yeditepe University in the course of Software Engineering class. The results showed that this project was very beneficial in terms of learning the procedures and processes of Software Engineering. On the other hand, this project gave indications that the majority of the students were not ready to face professionals from different disciplines where different behaviors, attitudes or methods of work can be encountered and clashed. Preparing students for real-life conditions were the main objective of this project and the problems that have arisen during this endeavor showed that it has helped to contribute towards the right direction. Changing the number of students in the groups, considering different departments for collaboration and exploring new methods of communication and control are among the future work of this study in an effort to prepare the students for their future professional life and improve this experience for the students.

Acknowledgements

We would like to thank Assoc. Prof. Dr. Neda Üçer and Assist. Prof. Dr. Yasemin Ülgen Muluk of the Visual Communication and Design department for their overall collaboration, suggestions and very useful feedback that have provided us during the two terms of this interdisciplinary project.

References

1. Jazayeri, M. The education of a software engineer. In: Proceedings of the 19th IEEE international conference on Automated software engineering, pp. 18-27. IEEE Computer Society (2004).
2. Dahiya, D. Teaching software engineering: a practical approach. *ACM SIGSOFT Software Engineering Notes*, 35(2), 1-5 (2010).
3. Gnatz, M., Kof, L., Prilmeier, F., Seifert, T. A practical approach of teaching software engineering. In: Proceedings of the Software Engineering Education and Training Conference. IEEE, pp. 120-128, (2003).
4. Sureka, A., Gupta, M., Sarkar, D., & Chaudhary, V. A case-study on teaching undergraduate-level software engineering course using inverted-classroom, large-group, real-client and studio-based instruction model. *arXiv preprint arXiv:1309.0714*. (2013).
5. Schaetter, A., Koeglmayr, H. G., Blankenbach, K., & Nippa, M. Interdisciplinary approach to software engineering education. *The Journal of Systematics, Cybernetics and Informatics*, 7(5), 29-36 (2009).
6. Zeidmane, A., Cernajeva, S. (2011, April). Interdisciplinary approach in engineering education. In: *Global Engineering Education Conference (EDUCON)*, IEEE, pp. 1096-1101, 2011.
7. Vicente, A.J, Tan, T.A., Alvin, R.Y. Collaborative Approach in software engineering education: an interdisciplinary case. *Journal of information Technology Education: Innovations in Practice*. 17, pp. 127-152. (2018).

8. Jaccheri, L., Sindre, G. Software engineering students meet interdisciplinary project work and art. In *Information Visualization, 2007. IV'07. 11th International Conference*, pp. 925-934 (2007).
9. Claypool, K., Claypool, M. Teaching software engineering through game design. In *ACM SIGCSE Bulletin*, Vol. 37, No. 3, pp. 123-127, (2005).
10. Martin, F., Sherman, M. A dual-major course emphasizing computer science and graphic design, *Journal of Computing Sciences in Colleges*, Vol. 30, No, 6, pp. 24-31, (2015).