Classroom research using new hybrid Methodologies for the Computer Engineering Project Management course, ITCR: Case study

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Summary. The following article states that through classroom Research we can bring students closer to the industry, that is to say, use new methods and tools within the class through the use of Hybrid Project Methodology as a proposal for the course of Project Management of the Computer Engineering career based on a case study of the company Legadmi. The essential and functional components of agile methodologies such as Scrum and Kanban are addressed, as well as the Pmbok. The article proposes the identification of some instruments to give traceability to a project at all times, combined with iterative improvement cycles. It is described through a case study, how a Costa Rican company uses the different traditional and agile methodologies and combines them for its use and growth with tools and artifacts. Finally, it is analyzed how the continuous improvement processes should be included for this area of action.

Keywords: Improvement cycle, Artifacts, Traditional Methodologies, Projects, Agile Methodologies. Teaching-Learning Methodologies, Research in the Classroom.

1 Introduction

The software development industry is constantly changing and redefining its working methods. The most recently used methodologies indicate that the combination of agile with traditional methods is used more frequently in the national and international market.

The approach of a model that combines tools and artifacts from both methodologies facilitates the execution of software projects and offers a wide range of tools and processes. Likewise, through controls and monitoring, quality assurance and continuous improvement are guaranteed. This concept is commonly transferred from the good practices of the industry to obtain the proposed objective and that students have the necessary knowledge for their academic and professional development. Within the university courses it is necessary to incorporate the best market practices to bring the student closer to the business reality. Through Research in the classroom, we can propose the use of Hybrid Methodologies as the option to teach students the best of both worlds: traditional and agile.

2   Background

The teaching-learning processes according to Abreu, Y., Barrera, A., Breijo, T., & Bonilla, I. (2021). argue that the teaching-learning process is expressive, since the teacher provides the scientific and social contents to the students and these, in addition to building their own learning, interact with each other, with their peers and the environment, and then They are in charge of discussing, validating, or applying some knowledge. Based on this definition, we can indicate that when we get to know the companies in the software area that surround us and also know what methodologies, methods or processes are currently used, we realize that we must take these good practices into consideration and bring them closer to classrooms through research and the respective learning models. According to (M. Pérez-Sanagustín et al. 2022), "the role of Higher Education institutions is to develop practical knowledge to be transferred to their students to have qualified labor" the most significant thing is that they adapt to the market needs that are constantly changing. For our research we carried out a case study of a company in the Software development industry in order to learn about the use they give to project methodologies and bring a new and innovative approach to the classroom.

To guarantee the understanding of the project ecosystem of an organization, we have that according to the Project Management Institute 2017, a project is "a temporary effort that is carried out to create a unique product, service or result" (Project Management Institute, 2017 , p.4), because a project requires the investment of material, economic, human, and time resources, among others, a previous step must be carried out in order to determine its feasibility. The planning of a project consists of determining and estimating the activities, assigning the resources that will carry them out and defining how the management and administration will be carried out. (Figuerola, N. 2015).

The project management methodology specified by the PMI and the agile methodology of SCRUM determine according to (Sánchez, M. Á. R., & Ríos, C. E. U. 2022), in general terms, everything that a project manager must do to achieve Exercise effective project management. Agile methodologies are project management systems that help us use time effectively and creatively. According to (Arias, B., & Alvear, O. 2022), "Scrum is a software development methodology that is characterized by a set of rules, artifacts, and roles under an incremental approach, through self-managed teams." Scrum proposes to work in cycles (or iterations) on partial deliverables of a larger final product. Taking into account the agile methods according to (Betancur Morales, K. 2022)

At the beginning of a cycle, all pending tasks are reviewed with the team and roles are established for each one to play during it. At the end of the cycle, the team meets and an evaluation is made of what is going to be done during the new cycle. cycle. According to (Bermejo, M., 2011, p.8) the Kanban "is an approximation to the introduction of changes in the life cycle of the existing project management methodology", that is, to reduce it. Transparency allows all the actors to know the project, what happens and how it is presented, according to (Arcila Ramírez, P., Delgado Gélvez, M. L., Pulido De La Pava, E., & Martínez Bernal, F. O. 2023 .p.20).

3   Metodology

Research in the classroom is focused on carrying out a case study of relevant experience linked to practice, which leads us to systematize existing innovation experiences that are important for teaching and learning processes, such is the case of proposing a combined methodology. or hybrid of what the industry uses and its technical and methodological validity for use in the classroom. Special consideration is given to the narrative of the case and the firmness with the initial questions, and the recommendations that have been produced from the practice.

The Design As Hernández et al. point out, this is pre-experimental. (2014), which is a design in which a pretest is applied to a group with an experimental treatment, followed by a treatment and finally a posttest with an initial baseline to determine group dependency. 0: It is the measurement of the subjects of a group (questionnaires, observation, tests, etc.). It is a pre-test, if it appears before the treatment of a group. It is post-test if it appears after the treatment of a group. Regarding the design of the research, it starts with the application of a questionnaire to the students of the Project Management course, achieving the post-test design with a control group (control group and new experimental group). At the end, a post-test is applied.

For the sample, the Project Management group of the Computer Engineering career of the I semester of the TEC of Alajuela was taken. First, a questionnaire was applied with several questions about the knowledge of Project Management in students and their appreciation of traditional and agile methodologies and their opinion of the use of both. Subsequently, an interview was applied to the Costa Rican software development company Legadmi S.A., as a case study to determine the methods and practices that they currently use with their clients. The questions asked are closely related to the variables explored in the students, this so that the research in the classroom brings us closer to how the development methodologies used in the industry work, which help us to determine the use of hybrid models in Software according to (Hernández León, J.J., & Gómez Soto, C.A. 2021).

Questions applied:

1. Do you know how agile methodologies work in Project Management? 2. Do you know what are the areas of knowledge in Project Management according to the Pmbok, indicate them?

3. Do you know and have you used any of the following tools to support Project Management?

4. What do you consider to be the 3 essential elements of a project?"

5. Do you agree with the use of hybrid methodologies (traditional and agile) in the AP course?

6. Do you know what are the artifacts of the use of SCRUM, indicate them?

8. It is necessary to identify all the activities to be carried out in the project in order to deliver the required products and services, in addition to incorporating these into the weekly backlog to be used. How often did you use it in your project:

9. Indicate what was the main challenge in developing your group project? explain.

Case narrative
The following questions were applied:
1. What are the methodologies you use?
2. How do you collect requirements?
3. How and to whom are these requirements passed?
4. Who does the quality control of the process?
5. What happens if there are faults identified?
6. How is the delivery made to the client?
7. What is the documentation used throughout the entire process?
8. How is technical support provided to the end customer?
9. Approximate costs and customers in general.

4   Results

Firstly, the results of the questionnaire applied to the students of the most representative responses are shown:

2. Do you know how agile methodologies work in Project Management?

55% (Advanced)

45% (Intermediate)

6. Do you agree with the use of hybrid methodologies (traditional and agile) in the AP course?
55% agreement
22,2% Strongly agree
22,2% Neither agree nor disagree

Subsequently, the answers to the interview applied to the case study are shown.
The responses are listed below:
1. The company indicated that it uses agile methodologies such as scrum, Kanban and documents processes through different tools, we are ISO 9001-2015 and SOC2 type 2.
2. In the requirements approach, they begin with the mapping of the standard processes, applied for example in human resources for recruitment and selection, hiring processes, compensation, salaries and payments, payroll, vacations, Christmas bonus and liquidations. In the same way it is used for personnel development processes such as training, trajectory, documentation and performance evaluation. The requirements are made using tools such as interviews with the experts of the companies that want the software.
3. The functional consultant is in charge of gathering the requirements in addition to collecting the legal supports, and the approximate time is two weeks for this process. Subsequently, it translates the information indicated by the client through use cases and user stories, which will be transferred to functional tests; and transfers them to the technical area of the developers. This process can last 2 weeks.
4. The functional consultant does the quality control for what the programmer has done.

5. If it finds faults, it returns it to it, if there are no faults, it goes to training and delivery that lasts one month.

6. The training process goes hand in hand with data migration and then they start using it.

7. Finally, the Synopsis is delivered, which is all the final documentation that has been compiled throughout the entire process and implementation.

From the scope, the security issues of the application and the infrastructure where it will be used are defined. All processes have their defined metrics and control points.

8. If any inconsistency occurs, the quality manager will be alerted, who will provide traceability, follow-up, and establish the actions to be taken. Quality control procedures are carried out with the client through dissatisfaction reports and quality surveys.

9. They vary according to the type of client.

5   Discussion

First, the results of the graphs where the post-test is applied to the students of the course will be analyzed and they indicate in #2 that their knowledge of Agile Methodologies is 55% Advanced and 44% Intermediate; In addition, in the following graph #6, 77.8% indicate that they agree with the use of Hybrid Methodologies. And finally, in graph #11, it is consulted about the need to identify all the activities to be carried out in the project in order to deliver the required products and services, in addition to incorporating these into the weekly backlog to be used.

The frequency with which students have used it is 55% Very frequent and 44% Frequent, achieving a positive response. Subsequently, the case study is carried out at the Development company, which is chosen because it is one of the few companies in the capital of Costa Rica that have Software processes where they carry out the entire process with their own internal resource. It begins by focusing on question #2 in which they indicate that, in the requirements statement, they begin with the mapping of standard processes, applied for example in human resources for recruitment and selection, hiring processes, compensation, salaries and payments, payroll, vacations, Christmas bonus and settlements. In the same way it is used for personnel development processes such as training, trajectory, documentation and performance evaluation. The requirements are made using tools such as interviews with the experts of the companies that want the software. Then it is countered with question #3 where it indicates that they have a role of functional consultant who is in charge of taking requirements in addition to collecting legal supports, and the approximate time is two weeks for this process. Subsequently, it translates the information indicated by the client through use cases and user stories, which will be transferred to functional tests; and transfers them to the technical area of the developers. This process can take 2 weeks. Clearly, an agile process is evident with the appropriate structure and time and the combination of documentary elements as indicated in question #7 where the Synopsis is delivered, which is all the final documentation that has been compiled in the journey of the entire process and implementation. From the scope, the security issues of the application and the infrastructure where it will be used are defined.

All processes have their defined metrics and control points. This last paragraph shows us that the organization establishes controls for its entire process and ensures quality in each of them.

From the above, a model is proposed to work and promote teaching and learning processes combined with quality management from the classroom, resembling what was seen in the case study. This model is capable of guiding the practice in the classroom based on the accelerated changes that occur in the industry and how we can use the best of knowledge to work in Project Management from a more effective and concise approach.

The model consists of using Scrum in the iterations, which are normally 1 or 2 weeks, and the way to assign the activities and tasks is used in the Product Backlog and the Sprint Backlog. From Kanban, the way in which monitoring, and traceability is given through controls is used, and from XP, the way in which tasks are structured and reviewed for their execution.

From the traditional methodologies, documentation is used in all parts of the processes through the document called Project or Final Summary in which it has a synopsis of everything that happens in the project in all its phases. In addition, the continuous improvement cycle known as PDCA is applied when quality controls and reviews are used in all outputs of the project and its final products, that is, if these reviews present inconsistencies, they will be reviewed and corrected by the existing corrective and preventive processes in quality management.
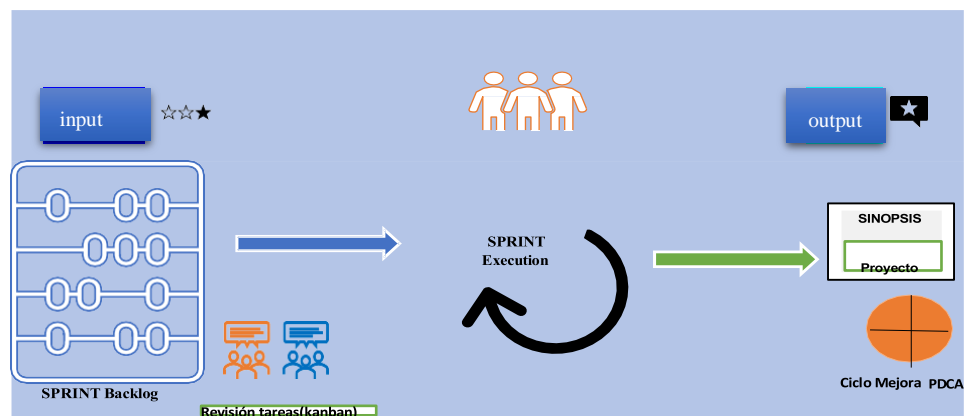

Fig. 1 Proposed Hybrid Model of Projects
Source: Own

6 Conclusions

Understanding our university work from the classroom is what transforms us and helps us reflect for improvement. Being able to investigate what we do through research, case studies, experimentation; it helps us to innovate in our teaching and to want to be better in the classroom. For this research, to understand how the industry works

through a case study, it offers us a different alternative to be able to show the students of the Project Management course. Knowing how projects work in companies today gives added value to the process of managing processes and projects.

Additionally, knowing the opinion of the students about what they learned in the classroom and what they could learn helps us to improve the formal work structure, supported by two different types of methodologies. They can also understand how software development companies work and even more so how projects are managed in an agile and efficient way without neglecting details, and all this seen in the classroom as a new and innovative perspective to create and improve knowledge. I lie. See the usefulness of cutting-edge methods, techniques and tools, best teaching practices where the learning results help the student to better understand their environment and the way in which it works and develops.

7   Limitations y Future Research

The case of the industry used illustrates very well the reality of companies in the Development of Software Projects. The combination of tools and artifacts depends on what is functional for each company and varies in each one.

In future research, it is expected to propose a change to the program of the career course where new methodologies of hybrid projects such as those proposed are incorporated, where the best of the traditional and agile scheme are used, in addition to knowing how the industry works first. hand through various case studies. Finally, through this innovation, we can expand knowledge to students, which is one of the basic topics to improve teaching practice and create critical reflection.

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