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The development of an Integration Methodology for project management in an adapted online environment

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Abstract

Since the closure of the dumpsite in Brasília, the waste pickers who worked there had to adapt to the new reality of receiving only at the end of the month. These changes impacted especially in the family financial management. Therefore, the Mobile Education project was created to develop a solution to assist waste pickers acquire knowledge about financial education through digital solutions. The project was planned to occur with the cooperation of four Problem Based Learning (PBL) disciplines of the Industrial Engineering course from University of Brasilia. However, the Covid-19 pandemic imposed serious changes in people's lives and also in the way the disciplines were conducted in the course. The goal of this article is to present the integration methodology developed for the Mobile Education project that occurred in an adapted online environment. This research is exploratory and has a qualitative approach. As a result, a methodology of project integration was developed to define the communication channels, the schedule management and the control of the main deliveries. This article focuses on how the management team promoted the integration among all other teams, helping them to achieve their final objective. The article's main contribution consists of discussing a way to properly manage and integrate projects in the context of social distancing.

Keywords: Problem Based Learning, Project Management, Methodology of Project Integration.

1 Introduction

In 2020, the COVID-19 Pandemic affected the entire structure of society because of the need for social distancing and suspension of presential activities, including the university ones. At University of Brasilia (UnB), the classes were also suspended and some of the projects were adapted and modelled to be occurring online. One of those projects was the Mobile Education for waste pickers, which was created by the SDG Challenge, a student-centred initiative that connects students from different universities and countries in the development of solutions and products that can be strategic to the achievement of the 2030 Agenda for Sustainable Development, set by the United Nations (UN).

The Estrutural's Dumpsite, located at Brazil's capital, was the second biggest waste deposit in the world and the biggest one in Latin America. It was closed in 2018 to minimize environmental, social and health problems. Its closure affected the income of approximately two thousand waste pickers that worked there, reducing and changing the frequency of the income received, because they were reallocated to waste cooperatives, forcing them to adapt their financial life.

Vieira, Bataglia and Sereia (2011) define financial education as measures that aim to create and transmit financial information to individuals, providing them the ability to distinguish advantages and risks of their choices. Moraes (2019) explains that the main objective of financial education is to instruct people on how to manage their monetary resources, helping them to make conscious decisions that enables to save and invest, ensuring that they live well financially, whether in the present or in the future. According to Vieira, Moreira Junior and Potrich (2019), Brazil's financial education is being highlighted due to the *Estrategia Nacional de Educação Financeira (ENEF)*, a national strategy that promotes financial education and social security, contributing to the strengthening of citizenship and conscious decision-making by costumers (BRASIL, 2010), developed by the Central Bank of Brazil.

At this article, it is shown how project management was used to integrate all the work fronts at the Mobile Financial Education for Waste Pickers project, in this context of COVID-19 Pandemic, remote solutions and SDG of United Nations. There were several teams working at different sides of the project courses: Production Systems Project 2, 3, 5 and 8 (PSP2, PSP3, PSP5 and PSP8). The project was divided in four main fronts: interface prototyping (PSP2), financial education content (PSP3), quality control (PSP5) and project management (PSP8). The focus of this paper is at the PSP8 team's objective: how it promoted the integration among all other teams, helping them to achieve their objectives to assist waste pickers to acquire knowledge about financial education through digital solutions.

This paper is divided into 5 sections: the first one contextualizes the theme and the research's objective; the second section shows the literature review that supports the research and provides a better understanding of it; section three reports the research methodology, explaining how the integration methodology was developed and implemented; the fourth one provides the results of the integration methodology; and the fifth section shows how the methodology can be used at future projects.

2 Literature Review

This section presents theoretical concepts that supports the research.

2.1 Project Integration

Cooper et al. (2020) defines portfolio management as a dynamic investment decision process and its final objective is to maximize the value of the portfolio list of active new projects. The new projects are evaluated, selected, and prioritized; existing projects may be accelerated, killed or de-prioritized; and resources are allocated and re-allocated. The monitoring of all these changes directly impacts the perception of final value on each activity.

According to Pollack (2016), organizational change is the most inevitable consequence of any project, and the better this change is managed, the more likely the project is to succeed, project management is also identified as an important tool that increases the chance that organizational changes be successful. The 2015 CHAOS Report has shown that lots of projects fail to achieve the expected outcome. Agile based projects resulted in more successful results and less outright failures. The report also lists factors which work together to make projects more successful. Anderson (2010) presents that the lack of clearly designated project leader, the lack of clear expectations and goals and communication challenges may lead to a project failure as well.

According to Eisner et al. (1993), integration management is the major element of systems engineering. This concept is proposed by the authors as a list of requirements, interfaces, interoperability, impacts, testing, software verification and validation, and architecture development as the main elements. Moreover, they refer to integration management, where they define the main elements as scheduling, budgeting and costing, configuration management, and documentation.

Demirkesen et al. (2017) investigates the relationship between integration management and project management performance and conclude are that several components can be used to guarantee better performance in the project. These individual components of integration management are presented as: development of project charter, knowledge integration, process integration, staff Integration, supply chain integration and the integration of changes. Understanding project management and integration were extremely important since it would provide a way to allow the project teams to achieve jointly their goal of providing financial education to people in a vulnerable reality aligned with the 2030 Agenda and its SDGs, shown in the next section.

2.2 Sustainable Development Goals - SDGs

According to the UN, the SDGs are the main focus of the 2030 Agenda, guiding the countries and their actions towards the three dimensions of sustainable development – environmental, social and economic. Their goals lead to the actions that need to be made and the measures that need to be considered to fulfil the objectives.

Their main purpose is to guarantee human development and the basic needs of the citizen of the whole world through an economic, political and social process that respects the environment and sustainability in the present and future.

The closure of the dumpsite and built of the mobile application for waste picker's financial education is related to some of the UN's SDGs, as the target 6 of goal 11 – Sustainable Cities and Communities - which says "By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management" and target 2 of SDG 10 – Reduced Inequalities - "By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status". To promote empowerment and social and economic inclusion, it is necessary to teach waste pickers on how to manage their money correctly, this topic is presented in the next section.

2.3 Financial management for low income

According to Naxin (2013), financial management is the ability to manage money and use it properly, it is also a life skill that teaches people how to survive. As presented by Wagner (2015), financial education has a positive relationship with a person's financial literacy score. The findings suggest that there are benefits to financial education, but the extent of the benefits may depend on the time horizon for changing financial behaviours. These findings will aid financial education programs. According to Anderson (2004), lower-income people tend to be less financially educated than those with higher income levels. As presented, low-income people are more likely to have limited education and are less likely to benefit from financial management training programs, that issue is due to the lack of content that low-income people can relate to during the training. The method chosen by the Mobile Education for waste pickers Project to teach financial education was through mobile learning, by the design of a gamified app prototype.

2.4 Mobile Learning

Maciel (2013) addresses the user experience of a mobile application for adult literacy in Brazil, as the author states, the era of mobility, in which we live today, allows the development of applications for education. Mobile Learning is the combination of mobile technology and education, it that allows people to learn anytime, anywhere. Maciel (2013) also states that, in Brazil, the Mobile Learning applications area is still small and has a lot of room to grow.

3 Research Methodology

The section 3 presents the method and structuring of the research.

3.1 Research Method

This research is exploratory, because, as stated in Silveira and Córdova (2009), it views to provide greater familiarity with the problem, in order to build a justificative. Also, it has a qualitative approach because, according to Gerhardt & Silveira (2009), it doesn't quantify the value and the data analysed is non-metric. The study object of the research is based on how the integration of the Mobile Education teams occurred in order to assure the success of the project in an adapted online environment. The inputs needed for the integration methodology development, described in section 3.2.1, were collected by informal alignment meetings with the four main stakeholders: representatives of PSP2, PSP3, PSP5, PSP8 and the Mobile Education project general coordinator. After understanding the demands, the integration team did a brainstorming session in order to discuss how to build the monitoring framework, what were the best tools to use, and how to provide communication between teams.

3.2 Structuring of the Research

The study is structured in 4 phases: (1) Contextualization of the project, (2) Development of the integration methodology, (3) Monitoring the implementation of the methodology and (4) Project results.

3.2.1 Phase 1: Contextualization of the project

Since the project was composed of different teams, it was necessary to properly understand the demands and deliverables of each one. To do that, the first step was to identify all the actors involved and getting in contact with them. After that, the alignment meetings with the project teams and the main stakeholders were arranged. The meetings allowed the alignment of the expectations of the stakeholders and the identification of the deliverables for each team, giving the integration team a better understating of the project as a whole. Then, to formalize what was decided, the integration of the project teams was mapped. The tool used for the mapping process was Miro, an online collaborative whiteboarding platform that enables the drawing of different flowcharts.

3.2.2 Phase 2: Development of the integration methodology

After the contextualization of the project was completed, it started the development of the integration methodology to ensure that each project team was going to receive everything needed and provide the input for the other teams. First, was analysed what was necessary for the integration to be effective. Some of the questions answered in this step were: How often do the teams need to communicate? How much a team needs to be aware of the other team's deliveries? What is the best way for this communication to happen?

After that, it was analysed the available technologies to choose with one would provide a better space for this integration to occur. To make this choice, it was important to consider that the project was inserted in a university environment and was done in a remote structure, due to COVID-19 restrictions. When the technology was chosen, it was done a brainstorming section - between the integration team - to decide how to build the monitoring framework. This framework was important because it would be the best way to assure that each team was going to stick with the schedule and also it was a way to provide a holistic view of the development of the project teams.

The project schedule was defined through the alignment of the delivery dates of each project team. The project leaders shared their specific schedules and decided together when they would need to deliver their contribution. All the schedule was transferred to the platform Microsoft Planner and it was managed using the same tool by the integration team. When everything was defined it was important to formalize what was decided and how exactly the integration methodology would work. To make the methodology more visual for the project team members was done a presentation using Microsoft PowerPoint as a tool.

3.2.3 Phase 3: Monitoring the implementation of the methodology

Once the integration methodology was elaborated, the next step was to ensure that all team members were aware of it. To do that, it was arranged an alignment meeting with the team members and some of the stakeholders to present the methodology created. The meeting was done on an online platform and recorded so that the ones who couldn't make it could have access to it. Also, during the development of the project, the integration team supported the teams that had any kind of problem when using the methodology proposed.

3.2.4 Phase 4: Project results

After the end of the semester, the results of the project were analysed and, especially, how the integration methodology contributed to it. To understand how the team members felt about the use of the integration methodology, there were made informal meetings with some of the team leaders. Their impressions and suggestions for improvement in the methodology are made in section 4.4.

The section 4 shows the result of the research.

4   Results

Section 4 presents the results obtained from the methodology of project integration. As presented in Section 2, a literature search was made in order to understand what tools and frameworks were already used on similar projects, however, no results presented solutions to the project needs.

4.1 Contextualization of the project

The goal of the Mobile Education project was to design and develop a platform that would teach waste pickers financial education. Since there were many work fronts in the project, the first step was to identify the actors and stakeholders involved to identify the deliverables for each team. As a result of these interviews, the main integrations were mapped and are displayed in Figure 1.
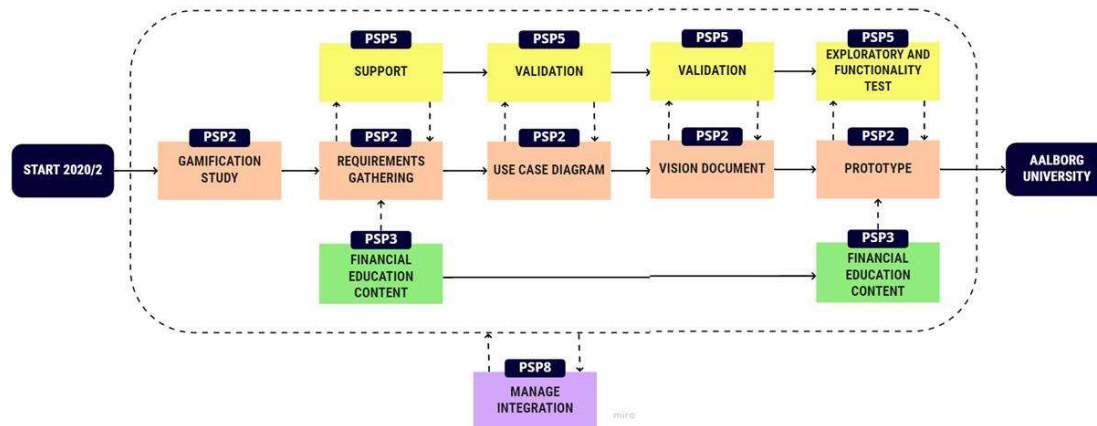

Figure 1. Overview of Project Integrations

The project had around 35 participants, including Brazilian and Danish students. At UnB, the students were divided into project teams that were responsible for different parts of the development of the prototype. Those project teams were: PSP2, PSP3, PSP5, and PSP8 responsible, respectively, for the interface prototyping, financial education content, quality control and integration of the teams. Also, there was a computing team of students from the University of Aalborg (AAU), Denmark, responsible for the back-end coding of the solution, which would be done after the Brazilian teams finished the prototype. Each area had a professor responsible and there were also stakeholders representing the SDG Challenge initiative and the Central Bank of Brazil.

4.2 Development of the Methodology of Project Integration

Since it was not possible to organize presential meetings to promote the integration, the choice of the channel of communication turned out to be one of the most important steps in whole the process. The key factor in this choice was to look for tools that are financially accessible for the stakeholders and the ones that the usability allows the design of a framework compatible with the project management methodology selected. As the educational activities in UnB were adapted to these atypical circumstances, a partnership with Microsoft made Microsoft 365 available to all the students. Since the students had free access to Microsoft Teams and Microsoft Planner, those tools were presented to be the most compatible with the integration development.

In addition to Teams and Planner, it was important to create another channel to promote easier and more agile information exchange. Again, availability played a key role in the choice, and WhatsApp was defined as one of the communication channels since it is a common messaging app in Brazil. The team leaders were united in one group in the app to share important warnings and to exchange information. To keep track of all the interactions between teams, an Excel sheet was built inside the Microsoft Teams channel. The sheet was used to schedule the meetings needed and to register the meeting progress. Every team had its sheet to register important data like date, main subjects, participants, discussed topics, and pendencies.

As the tools and the limitations were considered, the integration team agreed to adapt the methodologies proposed by Beck, Kent, et al. (2001) and Sutherland, Jeff, and J. J. Sutherland. (2014) to build the online framework. Once the tools and the framework were set, it was important to understand how the integration methodology was held together. In Figure 2, an overview of the methodology of project integration is provided.
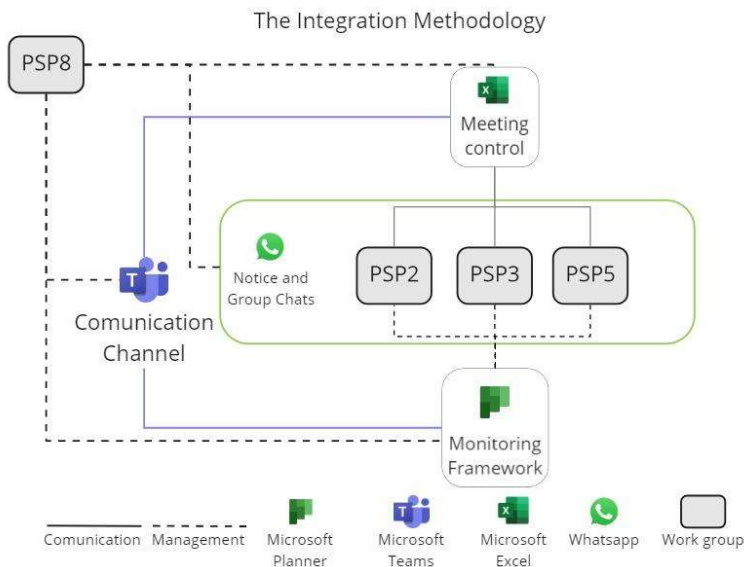
Figure 2. The Integration Methodology to The Mobile Education Projects

Figure 2 helps understanding how the tools connect and built the system to make sure all the information is easily accessed and displayed in a way that each member of any team can understand the current situation of the progress of all teams individually and collectively.

4.3 Monitoring the implementation of the methodology

When it comes to the development of an agile methodology, it is important to revaluate what can the team change on management routine in order to become more effective, adjusting the behaviour regularly as said Beck, Kent, et al. (2001). Having it said, it was important to be prepared to adapt to any circumstances that could appear during the project development. The whole integration methodology was sustained in the progress shared in the framework designed, and the chart itself was built on a backlog basis. During the first iteration of the framework, the integration team noticed that some teams were having trouble adapting their internal task management to the sprint planning required in the framework, once they were using the PMBOK management methodology instead of the agile system proposed based on widely used, and written by many authors, SCRUM board, which classify the tasks as "to do, doing and done". This issue was easily solved once they translated some tasks of their analytics project structure into backlog tasks. This translation was successfully achieved by understanding which products of their analytics project structure would be used as inputs to another team's backlog task, translating them into their backlog tasks. As shown in the latest version of the framework displayed in Figure 3.
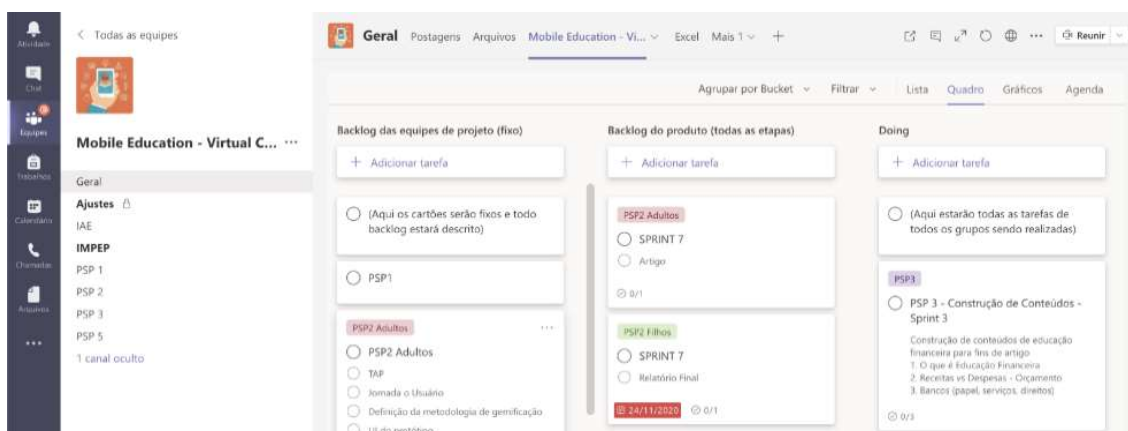

Figure 3. Integration Management Framework

The framework was organized into four buckets. The first one was fixed and used as a guide for the fastest visualization of the whole backlog of every team. Each task stood for a team and each subtask stood for a

backlog task. The other three buckets stood for backlog – tasks to be done, doing, and done. Every subtask listed on the first bucket was copied to the second one and then moved to the following as it was completed. To make sure it was easy to find your tasks, there were filters to help to find the tasks of specific teams.

Once listed as a benefit of the WhatsApp group tool, the facility of information exchange on the WhatsApp group ended up overshadowing other tools that also had an impact on the project's success. This issue impacted by making some developers use the app to share documents and make meetings appointments, losing track of the information required by the Excel sheets, and failing to share their progress properly on the chart. This problem was solved by talking individually to the team leaders to make them set the integration methodology orientation as their team routine.

4.4 Project results

As predicted at the beginning of the integration design, the social distancing had a huge impact on the communication between the developers, especially when it comes to a framework based on the agile methodology. The impossibility of making SCRUM daily meetings proposed by Sutherland, Jeff, and J. J. Sutherland. (2014) challenged the integration management team. It was also difficult to teach every team how to use the framework proposed without a presential meeting to present them the methodology.

Despite these setbacks, the integration management team was able to overcome these difficulties, guiding a large number of developers into achieving impressive results with the integration methodology presented. The Mobile Education for Waste Pickers Project also managed to propose a product that can generate huge impacts on the waste pickers' life while dealing with the challenges presented by the pandemic. The main result of the Project was to design a gamified app prototype that aims to improve the financial literacy of these waste pickers and their families. The app also helps to achieve the SDG goals by providing financial citizenship to a vulnerable class. Figure 4 presents the first version of the prototype, jointly developed by the project teams in a PBL environment.
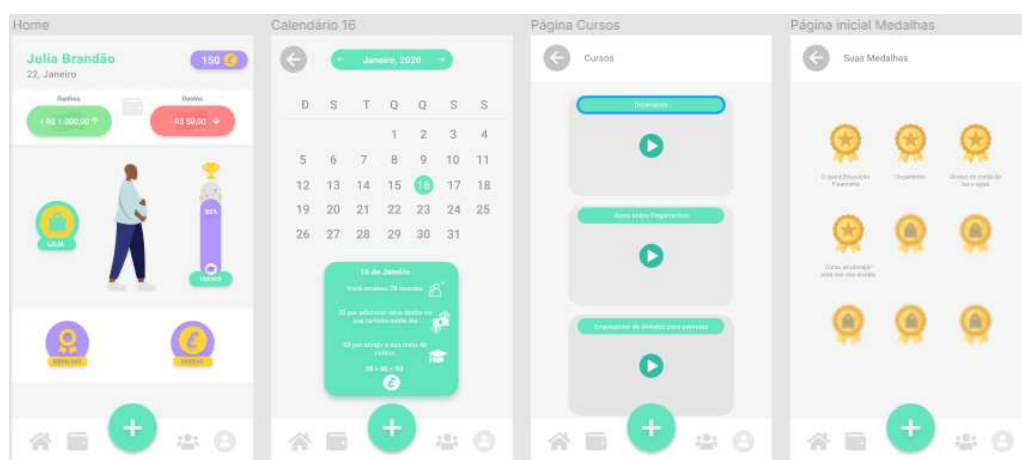

Figure 4. The Mobile Education app prototype.

Regarding the methodology of project integration, every tool selected plays an important part in the integration system. Table 1 specify how every integration need solution was designed and which challenge comes along in the adjustment of the tool to the management framework.

The framework proposed with the selected tools allowed multiple teams to work together despite the challenging situation imposed by the pandemic without missing any task listed in the backlog. Once the project came to an end, the team in charge of the integration management was invited to present their results in a quality webinar event at the UnB.

The framework proposed with the selected tools allowed multiple teams to work together despite the challenging situation imposed by the pandemic without missing any task listed in the backlog. The integration methodology was adjusted during the semester and validated by the students and the professors involved by revaluating, adapting and talking regularly with all the developers involved in the project, as suggested by

Beck, Kent, et al. (2001) and Sutherland, Jeff, and J. J. Sutherland. (2014). Once the project came to an end, the team in charge of the integration management was invited to present their results in a quality webinar event at the UnB.

Table 1. Benefits and challenges of the proposed methodology of project integration.

Integration need	Tool	Benefits	Challenges
Monitoring framework	Microsoft Planner	- Keeps the progress visible to every member; easily accessed.	- How to neatly display the teams backlogs separately; - Exemplify the usage of the tool's features.
Communication channel	Microsoft Teams	- Gather information in one place; - Easy access to video meetings; - Everything is registered in the platform.	- Include all the project members in the tool.
Meeting control	Microsoft Excel	- Easily display the main topics discussed.	- Engage the groups to fill in the tool after the meetings.
Notice and chat groups	WhatsApp	- Frequently accessed by the users; - Fast and fluid communication.	- Include all the project members in the tool.

5   Conclusion

The Covid-19 Pandemic has imposed serious changes in people's lives and institution's functioning. Industrial Engineering's Mobile Education for Waste Pickers project needed to be adapted, so as the teams working at it. For that reason, it was important to have a team responsible for managing the integration among the various fronts of the project.

Because of that, a methodology was developed on how to build the monitoring framework and what it needed. After its creation, alignment meetings over the integration methodology were made with the project members to teach them how to register and keep the other teams informed of their progress. By using the methodology, it was possible to develop a first version of the app interface for waste pickers' financial education, gathering the products of all the teams. This solution achieved provides help to achieve the target 2 of SDG 10 – Reduced Inequalities - "By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status".

In this multifaced project, where there were various groups, tasks, and deliveries involved, some teams' deliveries were needed to the progress of the other parts. In this case of interrelated activities, the schedule management was noticeable and necessary to assure that each team was going to stick with the schedule, providing a whole view of the project to all involved in order not to generate delays. Due to the end of the semester, it was not possible to collect feedback from the managed teams and students about the effectiveness of the methodology of project integration implemented.

In future works of online integration among teams, it is recommended that all the parts of the project know the importance of the integration and management to ensure that all information and progress is registered and known by all the parts working, guarantying the best communication and deliveries among the teams, because existing communication channels, as WhatsApp, may overshadow the methodology of project integration created. Also, it is important to absorb the feedback from the affected by the project management about its efficiency and performance, to improve later works.

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