Agile Accelerator Program: From Industry-Academia Collaboration to Effective Agile Training

Caio Steglich[1], Anielle Lisboa[1], Rafael Prikladnicki[1], Sabrina Marczak[1], Michael da Costa Móra[1],
Alejandro Olchik[2], Nelice Heck[3], Yasser Rachid[3], Guilherme Ghidorsi[3]

[1]MunDDos Research Group - PUCRS
[2]Ionatec
[3]Thoughtworks Brazil
Porto Alegre - Brazil

(caio.borges,anielle.lisboa)@edu.pucrs.br,(rafael.prikladnicki,sabrina.marczak,michael.mora)@pucrs.br,
aolchik@ionatec.com.br,(nheck,yrachid,ghidorsi)@thoughtworks.com

ABSTRACT

The agile accelerator program takes place in a Brazilian technology park, as a collaboration between a university and a world-renowned technology company, specialized in agile development and consulting. This partnership has 8-year long with the main goal of preparing undergraduate students to work in high-performance agile teams. This partnership created a culturally rich environment for student learning while influencing other companies to follow the same initiative within this technology park. We conducted a Case Study aiming to characterize this partnership (explaining how it works) and the resulting program, understanding the benefits to the program students. Our results point out the importance of the kind of partnership that provides an immersive learning environment to students, where students can learn empirically, with real projects and real stakeholders and how important it was for the program's former students to enter the job market. This successful enhanced students' training program on agile software development through the blending of culture between institutions can be of inspiration to those interested in aiming to bridge the gap between academia and industry.

CCS CONCEPTS

• **Social and professional topics** → *Software engineering education*;

KEYWORDS

Agile Education, Agile Training, Agile Development Teams

ACM Reference Format:
Caio Steglich[1], Anielle Lisboa[1], Rafael Prikladnicki[1], Sabrina Marczak[1], Michael da Costa Móra[1], Alejandro Olchik[2], Nelice Heck[3], Yasser Rachid[3], Guilherme Ghidorsi[3]. 2020. Agile Accelerator Program: From Industry-Academia Collaboration to Effective Agile Training. In *34th Brazilian Symposium on Software Engineering (SBES '20), October 21–23, 2020, Natal, Brazil.* ACM, New York, NY, USA, 10 pages. https://doi.org/10.1145/3422392.3422485

1 INTRODUCTION

Traditional Software Engineering undergraduate classroom teaching is often limited with regards to the realism it can offer to students [7]. Such limitation is commonly faced given the short course schedules, large classrooms, and the amount of theory-based courses that comprise an IT-based Program. While theory offers the foundation of any learning process, practice is a supplementary pedagogical resource of great importance to Software Engineering.

On the other hand, industry practitioners are more than often unsatisfied with the lack of knowledge on some 'essential skills' like the ability to work in teams, to communicate, and to coordinate activities that recent graduates bring to the market despite the efforts of college instructors to help students to develop them [5]. Therefore, industry-based training is usually offered as part of company on-boarding processes or as a means to supplement undergraduate education.

A large number of reports on Software Engineering conferences and specific Education tracks suggest that academia has also realized and recognized the importance of offering students industrial experience during formal college education to reduce alumni difficulties after graduation [6].

Brazil is a country where it is common for students to have a job at the same time they are taking their undergraduate degrees. The Agile Accelerator program integrates academia and industry efforts to jointly bring students closer to the job market. In this program, undergraduate students are prepared to work with agile development teams in a real project embedded in a work environment that mirrors industry settings from the stakeholders' engagement to the software development processes, technology use and performance. This training program is not an undergraduate discipline but an internship alike program, teachers working together with industry professionals in a technological park partnership program to teach students how the industry works. A description of the original version of this 16-week long Program in its initial format is presented by Estácio et al. [8].

The industry-side is the project sponsor, providing the financial support for the program operation and the professionals to teach the most recent technologies to students. The purpose of this Program to put the students 30 hours by week (for 15 weeks) into an intense

industry-alike environment, where they will learn in practice the agile methods, techniques and how to work in a high-performance agile development team. Stakeholders, who bring the problem-at-hand, do expect a functional prototype but the program leadership and management makes sure to help the student develop social and human-based skills.

Therefore, the main goal of this study is to characterize the partnership between academia and industry, the program and its results, regarding the students' learning and career development. We conducted a Case Study [15] that considers historical data from the 16 editions of the Program along the 8 years since its foundation. With this historical data, we characterized this partnership with industry, the practices and methods used in the support of the developed projects in the Agile Accelerator program, the roles, the environments required for its operation, and the impact the Program fostered into the professional life of its alumni.

Our main findings include:

- The partnership between academia and industry is based on a balance of interests, where neither party should overlap the other (all problems are discussed and both sides seek to align expectations);
- The students develop real projects and experience several distinct roles in an Agile team, using well-known industrial practices such Scrum, XP, Kanban, Pair programming, among others;
- It is much important that students has a immersive environment, such as in this program, that support them into learn agile practices and to use their creativity to create new solutions to stakeholder;
- The Program has influenced its alumni, causing many to be currently employed in the industry today, mainly as developers in agile projects.

The remainder of this paper is organized as follows. Section 2 presents background information. Section 3 presents the Agile Accelerator Method. Section 4 describes our research methodology. Section 5 reports our case study results while Section 6 discusses them. The lessons learned observing this program are presented in Section 7. Section 8 indicates the study limitations and Section 9 concludes the paper.

2 BACKGROUND

2.1 Software Engineering Education

Software Engineering is a discipline concerned with theory, knowledge, and applied practice to support the development of software that satisfy the requirements of users [11].

Shaw [17] describes that over the past decades, software developers have been educated in traditional ways: undergraduate and graduate programs in colleges and universities, vocational courses and in-house training, and personal initiative in learning new techniques. The most common methodologies for teaching software engineering include lectures, laboratory classes, among others. However, Literature shows that Software Engineering education counts with several strategies for an effective learning process, such as [14]: The replacement of lectures by the discussion of practical cases; Group dynamics and game application; A group effort to run a project from start and finish with students.

Matturro [12] characterized the development of effective software, when the effectiveness of teaching software engineering occurs, as it is a highly technical activity and requires software engineers with skills, knowledge, experience in several methodologies, tools, and techniques. This highlights the importance of a well-designed Software Engineering training. Mainly since companies look for software engineers with strong technical knowledge, well developed social skills, and potential to growth [12].

2.2 Software Engineering Education Programs

Bastarrica et al. [2] explains what a student may expect from a Software Engineering capstone course, being one of the few studies that present the teamwork perspective in the evaluation process of this course by students. There are several studies on teaching undergraduate students about agile methodologies. For instance, Paasivaara et al. [13] share their experience in a course based on Scrum, where they invited industry stakeholders to a capstone project. Their study identified that such participation improved students' attitudes and communication skills, and reduced their difficulties in learning new technologies. More importantly, the students realized that software engineering goes beyond coding, including more skills than development.

Anslow and Maurer [1] describe a course aimed at teaching Agile (Scrum and XP), in which for 13 weeks students developed a web application for a real customer. Project teams, composed of undergraduate and graduate students, interacted with non-industry customers, which limited the students experiences in learning Information Technology (IT) trends as argued by the authors [1].

Green and Chao [9] present results from a 10-years experience with the Agile Software Factory program, in which students are encouraged to learn agile. This Program [9] is a startup that was funded by the Agile Alliance, and although industry support is desired, the startup has no commercial purpose.

We present in this paper a partnership with industry in which students learn by being immersed for a 16 weeks-long program in an industry-alike environment where practice is promoted, mentored, and supported by both industry professionals and academic instructors guided by theory. Theory is organically revisited each time a new activity is introduced as a means to reinforce theoretical foundations and their place in real-life work.

3 THE AGILE ACCELERATOR PROGRAM

An initial version of the Agile Accelerator Program was described by Estácio et al. [8]. The program aims to train students to work in high-performance agile development teams, social and technical skills, and how to conduct a real software development project. In a 16-weeks long program, the development process itself aims to develop the students' skills in several dimensions such as business, governance, technical, and behavioral [8].

The program was inspired by Sutherland et al.'s Shock Therapy proposal [19], which proposed an immersive environment to teach Scrum for software development. The authors [8] applied it to teach Scrum combined with Kanban and XP into small teams through agile coaching and peer mentoring sessions. Also, they proposed to use real-life projects, with the participation of stakeholders and the

expectation of proof of concept or high-level software prototypes hand-ins to them.

Estácio et al. [8] described the Agile Accelerator in 4 phases, namely:

- **Phase 1 - Pre-Evaluation:** Lasting about 3 weeks, this phase refers to recruitment process of the team, in which students with complementary backgrounds and profiles are sought;
- **Phase 2 - Iteration -1:** Lasting approximately two weeks, this phase refers to the preparation or training, in which the work environment is set up and students learn the main concepts of working in an agile team. Their developed knowledge is assessed through Dojo sessions [3];
- **Phase 3 - Iteration Zero:** Lasting 1 week, refers to the project selection and definition of the vision and scope. Students also have specific sessions for learning and practicing agile ceremonies and as a means to define the technical framework (e.g., IDE, programming language, architecture model, etc);
- **Phase 4 - Iteration 1 to 5:** Consisting of 5 iterations of two weeks, it refers to the project development phase itself, in which at the end of each iteration a retrospective is held for the identification of improvement opportunities.

The project is presented to the stakeholder every week, in a meeting where the stakeholder may choose the requirements are more important to be developed for next week and to evaluate the developed features of the project.

Also, Estácio et al. [8] defined that the program demands 5 basic roles to work, as listed below:

- **Students:** Responsible for developing the project, including requirements, ui Interface, architecture, coding, and quality assurance activities), and for communicating with the Product Owner;
- **Coach:** Responsible for the pre-evaluation of the students, as well as conducting the planning, review, and retrospective of each iteration. This role also supports the Teaching Assistants and conducts the project final evaluation;
- **Teaching Assistant:** Responsible for helping the students to prepare the development environment, solving impediments, helping the team in technical questions and collaborating in the coaching activity;
- **Mentor:** Responsible for supporting the team throughout the project and teaching and introducing new development practices to peer instruction;
- **Product owner:** Responsible for defining the requirements list, prioritizing them and assessing the requirements delivered at the end of each iteration.

Initially, Estácio et al. [8] proposed to evaluate the students' daily activities by work practice (e.g., pair programming, continuous integration) but soon realized the workload and lack of added value to such detailed assessments. The authors use the retrospectives today to evaluate the project ongoing and students needs.

The Agile Accelerator process is as presented in Figure 1, being the first step the call for students and the last the development of the software. All original phases' activities are kept at their core. However, the activities had been rearranged as a means to reflect lessons leaned and to promote a better work flow. For instance, currently, there is an open call for projects to the internal (e.g., university departments and sponsoring company units) and the external (i.e., overall public such as government agencies, private companies, non-profit organizations, education district schools, etc) community. The project to be developed in later on selected by the students upon a previous study of each project and opportunities to learn. Thus, phases 1 to 3 refer to the program preparation (light green color in Figure 1), phases 4 and 5 to the project preparation (pink), and phases 6 to 8 to the project development (blue).

Therefore, it is important that the partner company do not have interest in hire the students, but to collaborate with the local ecosystem and to prepare these students from different backgrounds and social diversities (e.g., women, LGBTQI+) to get a job opportunity. Heck et al. [10] present the partnership in details from a historical point of view. This book reports on the experience lived by both partners altogether. However, the book does not explore on the impact and implications of the Program, specially it does not quantify this impact. Thus, our case study reported in this paper.

4 RESEARCH METHOD

To achieve our goal of characterizing the partnership and the program as well as the impact that the program brings to the former students, we posed the research questions and the data collection methods as presented in Table 1.

To answer the posed research questions, we conducted a Case Study as defined by Runeson and Höst [15]. First, we defined that the purpose of this case study was to characterize and to identify how is the Program operationalized in practice and how the learning affects alumni career development. The case under investigation is the Agile Accelerator Program.

RQ1. How does the partnership between academia and industry work in this Agile Accelerator Program?

Both the Project Coordinator, the University Professor who founded the Program, and the Coach who is an Agile Consulting Professional, have joined the Program since its first year. Thus, we conduct an unstructured interview with each one of them with the following theme: the partnership and its perceived difficulties and benefits. The interview with the Program Coordinator took place in his University office and lasted about 1 hour. The one with the Coach was conducted over the phone and lasted about 45 minutes. Both interviews were voice recorded with the participants' consent and later transcribed. We also took notes during the interviews to support the recording of interview highlights.

RQ2. How is the Program operationalized?

We observed the two 2019 classes of students. An average of 50 hours of observation were conducted with the consent of the participants for each one of the classes, including the attendance of agile ceremonies (e.g., User Stories Prioritization, Dojo Programming Sessions, Showcase Meeting with Stakeholders, Retrospectives), training sessions with Mentors, and day-to-day activities with the Teaching Assistant mentorship. In addition, we also interviewed Students of both classes throughout the Program development in order to identify how they perceive their roles and responsibilities(A total of 21 students–12 of the 2019 class and 9 of the second one in their workplace and we interviewed them on their workspace).
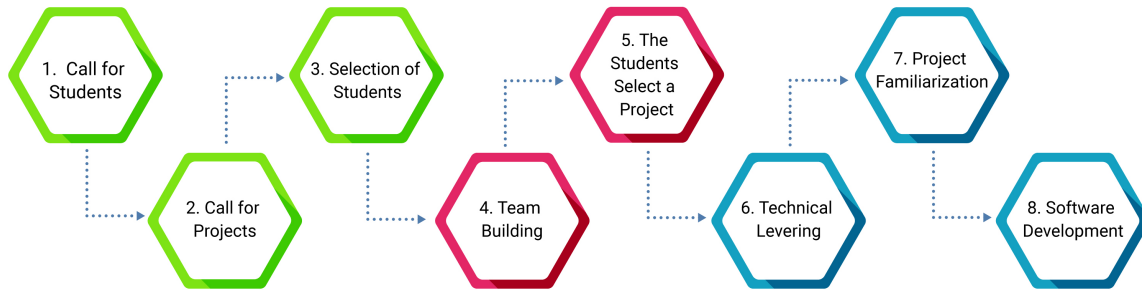
Figure 1: The Agile Accelerator Process
Table 1: Research Questions and Data Collection Methods

Research Question	Data Collection Methods
RQ1. How does the partnership between academia and industry work in this Agile Accelerator Program?	Interview with the Program Coordinator Interview with the coach
RQ2. How is the Program operationalized?	Observation of the work environment Interview with current students, mentors and teaching assistants
RQ3. What is the impact of the Program on students' career development?	Inspection of the Program historical records Questionnaire-based survey with the Program alumni

The semi-structured interview asked (i) What is the role you are performing now?, (ii) What are your responsibilities, and (iii) What agile practices have you used so far and why? Moreover, we interviewed 5 Mentors and the 2 Teaching Assistants in order to identify their role in the Program and what agile practices and technologies they train the students on. All interviews were voice recorded with the participants' consent and transcribed.

RQ3. What is the impact of the Program on students' career development?

We inspected the Program historical records (e.g., students' enrollment list and students self-assessment records) from all the 16 editions. We also invited former students to answer a questionnaire-based survey which remained opened for about 2 months, which asked: i) How well did the Program meet your expectations?, ii) Are you currently employed? If so, what is your current job position?, and iii) In your opinion, how has your participation in the Program helped you to get this job? Invitations were sent out to the 130 alumni by e-mail, out of which we received 42 responses. Email addresses were collected from enrollment records.

Textual interview data (RQ1, RQ2), observation notes (RQ2), and questionnaire open questions (RQ3) were analyzed using the Card Sorting technique [18]. The Card Sorting procedure consists of identifying codes that are later categorized by the iterative process of clustering codes by similarities, e.g., those codes indicating students' positive perceptions about participating in the Program are grouped together. Similar to other textual analysis, Card Sorting adopts a rigorous but a lightweight approach to data analysis. The adopted Card Sorting process is as follows: 1) Write the data in digital cards, 2) Group these data by similarity, and 3) Create codes based on these groups. Numeral data (RQ3) was analyzed using descriptive statistics.

5 RESULTS

5.1 The Program and the Partnership (RQ1)

Academy and industry often have their own cultures, and these are quite distinct. The academia has as one of its primary functions preparing its students for the challenges they will face in the industry, but who better than the industry to bring this knowledge requirements to the academia?

The mix between the academy and industry cultures makes for a healthy learning program in which the student learns the skills the market demands without losing the pedagogical quality provided by academia. Thus, partnership programs between academia and industry have the potential to reduce a gap in student education, which is the application of concepts learned in theory.

The Agile Accelerator is not an academic course (the students develops a real solution to a real stakeholder in an industrial-alike environment, and the program staff aims to support these students develop social and human-based skills). At this Program, members of the academy and industry participate in all phases of a project, according to the roles described in Section 3. The Academia-based members, the Teaching Assistants, are graduate students. One of them is a PhD student and the other, a Master student. These teaching assistants are responsible for the dissemination of theoretical knowledge, monitoring student progress and supporting students to become protagonists in this process, promoting students not only perform their duties but also lead team activities.

The industry-based members of this Program are employees of the large company that are a reference in development methodologies and sponsors the Program. These industry mentors are responsible for bringing students closer to their reality by demonstrating the practices and technologies used in the current context, assisting with technical issues and allowing students to know the routine in an industry-based project.

By the joint collaboration between academia and industry to run the Program, a new culture is born, different from the one present in its individual parts, but which adds the strengths of both making it a welcoming result to the students and mentors.

However, there were some difficulties and challenges arising from this partnership (as reported by the Program Coordinator), one of the most challenging difficulties is the change of mentors present in the Program. Technical mentors are employees of the company who are linked to industrial projects and voluntarely a few hours of their week to share knowledge. At times, the company may allocate more hours to other projects so that they have to leave the Agile Accelerator Program for a certain edition or two. Teaching assistants are graduate students at the university and when they complete their graduate program they need to leave the project, opening the opportunity for another colleague. Therefore, despite the reason, these professionals need to be replaced (either temporarily or permanently) and this can bring the challenge of a new team formation, the establishment of a new working culture, the adoption to new good practices, and similar aspects related to any kind of team member turnover. The team needs to adjust and this can cause a slowdown or even disrupture in schedule and deadlines. For instance, "when the former PhD student and only Teaching Assistant at the time left the Program two-years ago, despite all his notes, the Program had to re-establish all the good day-to-day ground rules with the students, such as arriving on time, communicating and requesting days off, among others. It took us a class or two to get back to speed with these small things that are necessary for establishing a good work environment" (Program Coordinator).

Also, as a partnership project, both sides need to be balanced so that the demands of one do not overlap with the other. It means, academia and industry have different objectives (and cultures), but the common is to improve the local ecosystem and prepare better professionals for the industry.

The Program Coach pointed out that there are several advantages of this type of partnership, for example, Program students do not need to be linked to the university or company responsible for the Program but can be from any university, it improves the diversity of student backgrounds, creating a team with complementary knowledge. Also, the Program Coach explain that the partner company has a strong social policy that influences the Program, creating a comfortable environment for inclusion of people with diversity (e.g., women, black people or LGBTQI+s are encouraged to participate in the Program). Many students pursue the Program not only because they seek to learn agile development but because of the social values upheld by the partner company, whose culture blends with that of the academia creating a teaching environment that respects diversity.

5.2 Agile Accelerator Operation (RQ2)

The Agile Accelerator has two working environments located at the University campus, namely: 1) the development and practice room, which has two-screen computers for pair programming (Figure 2), and, also in the same room, a a large-screen computer corner for Dojo programming (Figure 3). There are also Frames and Flip-charts, so that students can organize their ideas, using post-its and 2) A dynamic room with movable tables, stands, tables, large monitor, projectors and comfortable benches to the students conduct their agile dynamics and practices that demand different environments (Figure 4). The flexibility of the environment is a fundamental factor of the Program since students as protagonists must use their creativity and techniques to propose solutions to the problems brought by the stakeholder. The whole environment set up aims to promote such creativity and teamwork.

Nowadays, the execution of the process described in Section 3 has been carried out as follows:

Phase 1 - Pre-evaluation: This phase is the recruitment of the students, to build a team with complementary skills. Nowadays the selection of Agile Accelerator has six steps, being them:

(1) The instructors (mentors and teaching assistants) team select and invite 2-3 students from the last edition to stay in the next one, to share their knowledge with the newcomers;
(2) The instructors' team ask for university departments to spread the Program, asking for the curriculum of the interested students. All academics on any course of computation can apply for a vacancy. These curricula are evaluated by a minimum of three mentors, and this student must be associated with one university;
(3) For students who have had their curriculum accepted, the technical mentors' team send 2-3 basic algorithm exercises, but not expecting a perfect solution, only the candidate demonstrates their commitment to the solution attempt. These exercises are corrected by the technical mentors, who write down their observations about the codes, trying to understand the difficulties the candidate may have;
(4) The instructors' team conduct a Dojo [3], with 8 candidates together per session (these candidates do not need to be from the same university in this partnership, just need to study in one), divided into 2 teams. The goal is not a competition between the two teams, but rather to look at the candidates individually, trying to identify which ones have appropriate behaviors to work on teams and which demonstrate behaviors that could harm the team in the future;
(5) The instructors' team interview those approved in the previous step (one technical and one operational mentor per student), trying to find out their previous experiences and looking in which candidates this Program could best support if selected (Sometimes knowing the student's skills helps mentors to help them develop their potential);
(6) The mentoring team meets to select 9-10 candidates to compose the new class edition (this class may have a maximum of 12 students) based on their performance in the previous steps (in all steps the candidates are qualitatively evaluated by instructors).

In addition to technical criteria, such as soft and hard skills, the instructors also assess student social vulnerability, and how beneficial the opportunity for contact with technology and development teams can be to become a professional. In the last three classes, that are 4 months each (the Program has approximately 21 students per year), at least half of the class were women, at least one-third of the class were black people. In all these years, the Program also had
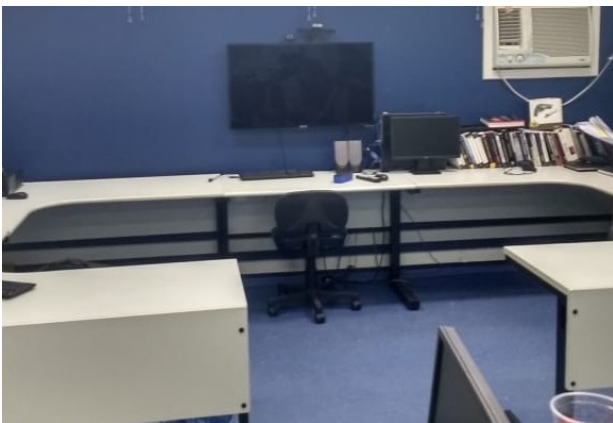
Figure 2: The Pair Programming Environment

Figure 3: The Dojo Environment

Figure 4: The Dynamic Activities Environment

older students, people with disabilities, although they are outnumbered (because only a few people apply for selection).

The selected students dedicate 30 hours per week to the Accelerator and earn a scholarship to fund their costs (similar to an internship in Brazil). After selection, the training process starts bringing complementary skills about how to work in multi-functional teams.

Projects are selected some days after the student selection process, according to the following process:

(1) Once the university announces that the Program is selecting students, it also announces that the Program has open submissions for projects. Anyone can submit projects for development on the agile accelerator, however, in the last 16 editions, most projects were social (also, after this 15 weeks, the class deliver a minimum viable product to a Product Owner, it means, to a stakeholder that proposed the project);

(2) The instructors' team pre-selects submitted projects, seeking to identify the technical, ethical and in some cases legal feasibility of the project. It is necessary to explain to the project owners that each edition happens in about 16 weeks and that the runtime will probably not deliver the full product, but a minimal version that adds value to the project owner;

(3) The projects that pass the pre-selection are presented to the selected students (Inception process as presented by Caroli [4]) so that the team students select the project they will develop. This presentation is prepared by the product owner, supported by an operational mentoring and consultant mentor who organize dynamics for product vision alignment;

(4) Mentors facilitate a session in which only students vote and discuss which project to select. After this, students sometimes unanimously select which project they want to develop.

Phase 2 - Iteration -1: After the students and project selection, is technical leveling, where students on the team take classes on various technologies (Figure 5) that they will use to develop the project, such as Java, pair programming, facilitation, principles of agile methods, continuous delivery, among others and practice this knowledge in Dojo [3], with the support of the mentors. Sometimes, the students organize such sessions, with the aid of a technical mentor (Figure 6).

The technologies that are taught today are Java, SpringBoot, CSS, HTML, Postgres, JavaScript, Linux, GitHub, and Circle CI. Practices taught are Pair Programming, Feedback, Kanban, Scrum, User Stories, Continuous Integration, Client Negotiations, Facilitations, Meetings (Daily, Retrospectives, Huddles, Showcases [16]), Sprints, Badges, Debts technical, object-oriented programming, clean code, relational database, application prototyping, and Lean Inception. To solve any questions students may have, mentors have a channel with students on Slack[1], which serves not only for students to ask questions but others to follow up on their peers, learning even more with them.

Phase 3 - Iteration Zero: This iteration is about the familiarization with the project and agile practices, where students perform tests on the product that will be developed, focusing on its improvement and may ask questions about points they still do not understand. At this stage they begin to align their vision on the

---

[1]https://slack.com/ - Accessed on Oct, 21/2019 at 03:17 PM

Figure 5: A Example of a Technology Session

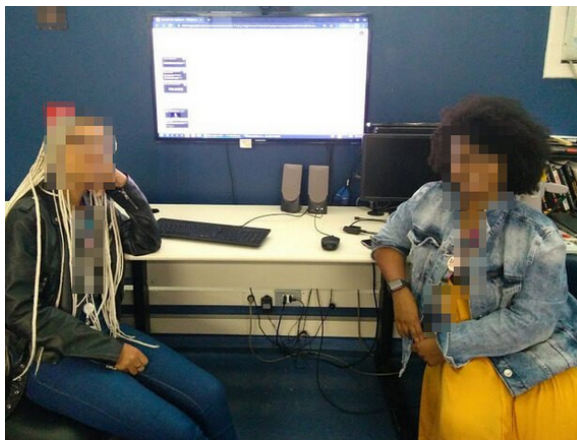Figure 7: A Example of a Retrospective Session

Figure 6: A Technology Session Organized by a Student

Figure 8: Students Working on Their Tasks

product to be developed, understanding customer needs and thinking about deliverable versions (MVP). At this Phase, instructors seek to explain to students that the focus of the Program is not on developing a perfect software but on learning, but it is recurring that students worry about delivery while forgetting this purpose. **Phase 4 - Iteration 1 to 5:** It is the longest, taking around 10 weeks and every 2 weeks the mentors conduct a retrospective session (Figure 7) with the class to resolve any technical impediments or conflicts [16]. In this phase, students produce the application requested by the customer (Figure 8). With the help of the instructors, the students have the kanban with all the stories and tasks set and every day when they arrive, they do a daily [16] to decide whom they will work with and what story they will develop, based on the customer needs. During this phase, the main development practice used is pair programming, however, when the stories to be developed are very complex the students perform a Dojo involving the whole class (Students may use the Slack channel to make questions). Also, at times students get tired of programming in pairs, causing them to rarely take on other forms of organization such as programming in threesomes or dojos.

5.3 The Impact of the Program in the Students' Professionals Career (RQ3)

We run a questionnaire-based survey with Program alumni to identify how they are doing in their career and the impact that the Agile Accelerator Program has had on their professions. We received 42 responses out of the 130 invitations, which is approximately 35% of the former students.

Generally, the main reasons students pursue this Program, according to the alumni, are learning or improving the way they work in agile teams. The first question asked was how well the Program met the students expectations, about 52% of respondents stated that the Program fully met their expectations, approximately 36% explained that it met most of their expectations and 12% revealed that the Program partially met their expectations.

Introduction to new technologies and Methodologies
> *"In addition to the curriculum experience that the Agile Accelerator gives, it also introduces one to various technologies and methodologies used and valued by companies in the job market. It had a large weight in*

having me getting employed." (R5, 12th edition, undergraduate Student in Software Engineering, currently a developer in a large-size company)

Empirical and practical approach

"The Accelerator exceeded expectations. In the beginning I thought it would be more theoretical (such as my undergraduate degree), but the Program has a highly practical focus. The used concepts and techniques used are easily applicable to projects outside the course." (R18, 11th edition, Bachelor in Information Systems, currently an Software Developer)

When asked if they were employed, 88.1% of the respondents said they were employed in the IT area, 4.7% of respondents said they were currently working but that they had left IT, and they left IT and 7.1% said they were not in with any job appointment.

We asked alumni who are working in IT about what impact the Agile Accelerator had on getting them their current job. About 86.5% said the Program had a big impact on getting this job. The remaining 13.5% reported that the Program partially influenced them, but learned much more after the Agile Accelerator, becoming even better professionals. Also, some of them explain:

Introducing students to job market

"The Accelerator has drastically changed my career path. I learned a lot of things that gave me a chance to return to the market and evolve a lot as a professional." (R6, 6th edition, an undergraduate student in Analysis and Systems Development, currently a developer in a large-size company)

In-depth knowledge in 16 weeks

"The Program immersion provides an in-depth knowledge in a short time. Vocabulary, networking and the main thing: learning to learn helps a lot to follow in the market." (R20, 10th edition, an undergraduate student in Information Systems, currently a UX designer in a large-size company)

Program recognition in local industry

"The experience in the Agile Accelerator was extremely important for me to get where I am now, I learned practically everything I know today, and my curriculum is very well regarded." (R28, 13th edition, an undergraduate student in Information Systems currently a Product Owner in a large-size company).

These former students also informed us of their current positions, most of them became developers (59.4%), the others are respectively technical leaders (13.5%), System Analysts (13.5%), Development Interns (5.5%), IT Support (2.7%), User Experience Designer (2.7%), and Project Owner (2.7%).

In addition, we asked the former students to write their opinions about the Agile Accelerator Program.

Skills developed by the Program

"The Accelerator is a starter pack that every developer needs, as the Program promotes the creation of, develops and improves people's capabilities that will make a

different in the job market." (R33, 12th edition, an undergraduate student in Computer Science, currently a developer in a small-size company)

Learn with professional from industry

"The Accelerator is a great opportunity to enter the IT market, as the Program allows you to actively participate in all stages of software development and it is best that students can count on the help of more experienced colleagues and technical mentors. The Accelerator contributed a lot to my career, and learning has had a great weight on my curriculum, to this day I receive LinkedIn messages from recruiters who come to me for my participation in the Program. In a nutshell: The Accelerator was the best opportunity I had in my professional life." (R30, 10th edition, Bachelor in Information System, currently a developer in a small-size company)

Learn with real projects

"The Accelerator is an incredible opportunity for those looking to learn how to develop software using agile methodologies and for applying techniques that are used in the market in a real project. It offers the autonomy and freedom to create and explore whatever it takes, yet deliver the product at the end of the project." (R27, 7th edition, Bachelor in Information System, currently a developer in a medium-size company)

Supporting students to begin in IT area

"The accelerator appeared in my life when I was changing my profession, it certainly supported me very professionally to evolve both the technical and mainly the behavioral, learning to work in a team and applying the agile methodology. The professional immersion that the accelerator undergoes opens many doors after the accelerator in the job market" (R22, 7th edition, Bachelor in Analysis and systems development, currently a developer in a large-size company)

These students are Brazilian and have been working since before completing their undergraduate courses (as is common Latin countries such as Brazil), but most of them had their first experiences in this Program, improving in agile practices (such as XP), which are extremely used both in the Program and in the local industry.

The Program brings student to industry

"The Accelerator was instrumental in my professional placement as a programmer. I was studying Mathematics at the time, but my main interest was in the computational part and the Accelerator was the gateway to the professional world of this area. My learning was substantial to my development as a person" (R15, 9th edition, Undergraduate student in Mathematics, currently a developer in a medium-size company)

6 DISCUSSION

In this section, we discuss the identified results (Section 5).

6.1 Partnership Importance to Improve the Local Ecosystem

The partnership between academia and industry is always a challenge towards aligning the individual interests. On one hand, Software Engineering academia understands the benefits of bringing students closer to market experiences. On the other hand, industry is aware of how well prepared students need to be to become future industry professionals. Yet, the student needs to know the market in which they will be present after the graduation. The Agile Accelerator Program was considered groundbreaking when first proposed about 10 years ago. It was a landmark alongside the arrival of a large multinational company specialized in agile development on the campus' technological park, and of the first agile-based conference in Brazil. The University had also just recently updated its Computer Science and Information Systems programs at the time in order to offer undergraduate courses to discuss agile development such as Topics in Agile Project Management and Agile Development.

This Program has influenced the local ecosystem not only by preparing students to work on high-performance agile development teams but also by influencing other large companies to do the same. Currently, the local ecosystem has 5 partnerships between academia and industry, and this Program was the first having agile development as a theme. All other partnerships follow a variation of this model offering the proximity with industry. For instance, Company A keeps a program with the University in which students participate on a 16 weeks long hands-on training program that develops an application which is both for in-house support and also for government-based access. Upon completion, students can apply to internship positions at the company.

6.2 The Program Operation and Replicability

The study presented by Estácio et al. [8] generically explained the flow of operation of the Program, to characterize the environment in which the authors studied the adoption of agile practices by student teams, such as pair programming or dojo. In the current study, we decided to present the Program's processes in detail, describing how each step is conducted from the call by students to the development of a real product to a stakeholder.

The description of the process as a whole helps in the replicability of the Program in other contexts. Companies and universities can join forces to produce similar programs, based on a simple process that can be adapted according to the available environment, resources and background of the professionals who will be able to teach the students of the project.

In addition, within the same technology park, other companies have proposed programs similar to this one for University A, some of which have been approved and currently in practice. These other programs have different formats, with a focus on teaching other technologies, such as mobile development, database development and management, among others. In some cases, some of these companies are interested in hiring the best students after the end of the proposed learning cycle.

6.3 The Importance of the Program for Students' Fostering Carrer Development

We believe that one of the best metrics to evaluate the quality of a program like this is the conversion of students into professionals in the technology market. In this study, we collected extremely positive data from the students, and of these interviewees, most of them are employed in the technology area, the majority being software developers.

The Program, in most cases, is the first experience that these students receive to work in an environment close to the industry, where students experience different roles in an agile development team. At the end of the process, these students usually have no great difficulties in inserting themselves into the local ecosystem, in some of the several companies present in the technological park surrounding the university. In addition, some mentors currently in the Program are alumni of previous editions of a few years ago, now part of the Program's partner company.

The interviewed alumni claim that the Program had a major impact on their careers, in many cases having been essential in achieving the position they are currently in. Former students from older classes are in several companies from any sizes (i.e., since smalls companies until big companies), and in some cases in leadership positions after other experiences after the program.

7 LESSONS LEARNED

In this section, we will share some lessons learned based on our observations over this program and its operation.

Academia and Industry Integration

One of the academy's biggest goals is to prepare professionals who will participate in the industry as workers. An effective strategy to reduce the risk of graduating students who are not ready for industry is to bring this student closer to professionals in this industry. Industry professionals can bring new ideas to the teacher and together they can conduct activities that will be essential to develop skills that students will need in their professional journey after graduation.

This study presents evidence that former students enjoyed having training close to people in the industry, and that this program was decisive in their to be hired in this new current position. The integration of the academy with the industry provides a differentiated learning environment, where the student can learn from their successes and mistakes in real scenarios, similar to those they will find outside the classroom.

Students Perceptions from Agile Accelerator

The Program lasts 16 weeks-long, which is a quick experience for students, who at the end realize that they have learned a little about all the roles in an agile development team, knowing how to interact with other industrial challenges that may appear to the student during his journey in the industry.

The effectiveness of the Program often occurs because students do not realize that they are learning, because they are outside a formal teaching environment, and feel useful to develop the software with their colleagues, in addition to some being delighted to perform some role in an agile team, which represents a promising career start for these students.

Replicability of this program

An important criterion of this program is its replicability, i.e., it is possible to develop an Agile Accelerator at another university, with the support of other companies in the IT industry. Initially, we realized that other companies had programs in partnership with University A. These programs, in the words of their organizers, are inspired by the Agile Accelerator, however, these companies have a greater interest in converting these students into future professionals of these companies, thus capturing new talents.

Each company has a specific objective of having a teaching program in partnership with the university, such as Agile Accelerator are most focused on improve the local ecosystem and capturing new talents and filling vacancies, enriching the experience of the students who participate in these programs.

8 LIMITATIONS

This paper reports on a Case Study with the purpose to understand the impact of this program to students and to the local industrial ecosystem. Some validity threats could be found, such as the data analysis method (Card Sorting), that can be confused in large quantities of data, but it be suitable to the data collected in this study. Also, the students that answer the questionnaire could be the most succeeded from the former students, but in a worst scenario, 37 from almost 140 previous students working in IT area is a good result to Agile Accelerator Program.

The focus of the study is to present the results of the Program. Data collection was performed through observation and interviews to understand the process that the Agile Accelerator has been going through for the past 8 years. Despite this, we believe that the program is perfectly applicable for other partnership contexts between academia and leading technology company, as it is applicable for over 8 years in this Program.

Also, the Agile Accelerator program can not be scaled up for more than 12 students [4], because it would exceed the limit of participants of an agile team, but it can be applied in more than one class, respecting a limit of members by the team. The agile accelerator is a complementary training program that uses the theoretical bases that its students learn in undergraduate courses.

9 CONCLUSION

The Agile Accelerator takes place empirically, enabling students to have the real experience of developing a product on a development team, having responsibilities and discovering the roles of agile development teams.

On conducting this research we found that the program may be applied to other contexts, provided it meets specific needs, such as an environment designed to meet this proposal, a serious selection and follow-up process and a continuous reflection on how to improve for the next class edition. The Program is in constant improvement and the work team uses the lessons learned from every edition to it, based on the students feedback.

A future work is to investigate the Social Accelerator Program, a spin-off derivative from Agile Accelerator Program that aims to support students with social issues to come to IT market. This new Accelerator is a diversity-driven program that wants, through teaching, supporting women, LGBTQI+s, ethnics, being sensitive

to students' social contexts as the first step towards becoming professionals with large employment opportunities.

ACKNOWLEDGEMENTS

REFERENCES

[1] Craig Anslow and Frank Maurer. 2015. An Experience Report at Teaching a Group-based Agile Software Development Project Course. In *ACM Technical Symposium on Computer Science Education.* ACM, Kansas City, USA, 500–505.

[2] María Cecilia Bastarrica, Daniel Perovich, and Maíra Marques Samary. 2017. What can students get from a software engineering capstone course?. In *Proceedings of the International Conference on Software Engineering: Software Engineering Education and Training Track.* IEEE, Buenos Aires, Argentina, 137–145.

[3] Mariana Bravo and Alfredo Goldman. 2010. Reinforcing the Learning of Agile Practices Using Coding Dojos. In *International Conference on Agile Software Development.* Springer, Trondheim, Norway, 379–380.

[4] Paulo Caroli. 2018. *How to Align People and Build the Right Product.* Caroli Press, São Paulo, Brazil.

[5] Aldo Dagnino. 2014. Increasing the Effectiveness of Teaching Software Engineering: A University and Industry Partnership. In *Conference on Software Engineering Education and Training.* IEEE, Munich, Germany, 49–54.

[6] Deepak Dahiya. 2010. Teaching Software Engineering: A Practical Approach. *ACM SIGSOFT Software Engineering Notes* 35, 2 (2010), 1–5.

[7] Deshinta Arrova Dewi and Mohana Muniandy. 2014. The Agility of Agile Methodology for Teaching and Learning Activities. In *Malaysian Software Engineering Conference.* IEEE, Langkawi, Malaysia, 255–259.

[8] Bernardo Estácio, Rafael Prikladnicki, Michael Morá, Gabriel Notari, Paulo Caroli, and Alejandro Olchik. 2014. Software Kaizen: Using Agile to Form High-Perfomance Software Development Teams. In *Agile Conference.* IEEE, Kissimmee, USA, 1–10.

[9] Robert C Green and Joseph T Chao. 2017. Ten Years of the Agile Software Factory for Software Engineering Education and Training. In *Conference on Software Engineering Education and Training.* IEEE, Savannah, USA, 182–186.

[10] Nelice Heck, Patricia Knebel, and Rafael Prikladnicki. 2019. *Aceleradora Ágil e Inclusiva: Unindo Conhecimento, Projetos e Pessoas para Construir um Futuro Tecnológico Justo.* Fatos & Ideias, Porto Alegre, Brazil.

[11] Richard J LeBlanc, Ann Sobel, Jorge L Diaz-Herrera, Thomas B Hilburn, et al. 2006. *Software Engineering 2004: Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering.* IEEE, Tokio, Japan.

[12] Gerardo Matturro. 2013. Soft skills in software engineering: A study of its demand by software companies in Uruguay. In *Proceedings of the International Workshop on Cooperative and Human Aspects of Software Engineering.* IEEE, San Francisco, USA, 133–136.

[13] Maria Paasivaara, Dragoş Vodă, Ville T Heikkilä, Jari Vanhanen, and Casper Lassenius. 2018. How Does Participating in a Capstone Project with Industrial Customers Affect Student Attitudes?. In *International Conference on Software Engineering: Software Engineering Education and Training Track.* ACM, Gothenburg, Sweden, 49–57.

[14] Rafael Prikladnicki, Adriano Bessa Albuquerque, Christiane G von Wangenheim, and Reinaldo Cabral. 2009. Ensino de engenharia de software: desafios, estratégias de ensino e lições aprendidas. In *FEES-Fórum de Educação em Engenharia de Software.* ACM, Ceara, Brazil, 1–8.

[15] Per Runeson and Martin Höst. 2009. Guidelines for Conducting and Reporting Case Study Research in Software Engineering. *Empirical Software Engineering* 14, 2 (2009), 131.

[16] Ken Schwaber and Mike Beedle. 2002. *Agile Software Development with Scrum.* Prentice Hall, New Jersey, EUA.

[17] Mary Shaw. 2000. Software engineering education: a roadmap. In *Proceedings of the conference on The future of Software Engineering.* ACM, Limerick, Ireland, 371–380.

[18] Donna Spencer. 2009. *Card Sorting: Designing Usable Categories.* Rosenfeld Media, New York, USA.

[19] Jeff Sutherland, Scott Downey, and Björn Granvik. 2009. Shock Therapy: A Bootstrap for Hyper-Productive Scrum. In *Agile Conference.* IEEE, Chicago, USA, 69–73.