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Abstract. Design techniques focused in user are desirable for undergraduates, but there are few initiatives that address the insertion of these techniques into the curricula of Higher Education Brazilian's colleges. This article sought to develop hypotheses that would help to construct a model for insertion of learning in design-based techniques for Brazilian's academies through the use of Design Sprint adjusted for educational purposes applied as a case study at the Federal Institute of Goás. To that end, exploratory research methodology was used. In the survey applied, 91% of students considered Design Sprint productive in learning context and 100% of students agreed that Design Sprint can creatively solve problems. They also expressed a desire to participate in new applications of it for educational purposes. After the case study was planned, applied and validated, it is inferred that possibility of Design Sprint's insertion in curricula exists and that, in fact, such techniques add value to teaching when applied in some classes, making it dynamic and intuitive in addition to solve real problems which students are experiencing.

Keywords: Design Sprint· Design Thinking · User Experience · Educational Learning

1 Introduction

For that companies can differentiate your products and offer services that really add more value for costumers there is a growing need of incorporate two basic components in its development process: agility and innovation. Just have good ideas is not enough. According to Knapp, Zeratsky and Kowitz[11], good ideas are hard to find and even the best of them endure an uncertain rise up to the top in real life. In accordance with Ries[14], the most of new innovative companies, it called startups, fails and great part of their products dont get expected success when issued in market. In this context, the search for agility proposed by Agile Manifesto[4] and the encouragement to innovation become targets of companies

and scientific community efforts. Therefore, methodologies like Design Thinking and Design Sprint have arisen [11,1].

Design Thinking (DT) can be understood as a set of tools and techniques used by a multi-disciplined team that, applied to design stage aims to promote innovation of companies[6]. After DT, other methodological tools that not only identify ideas, but also develop solutions to be tested with final users appeared. Was the case of Lean Startup[14] and with same purpose in mind, but doing a similar process in a five day time box, Design Sprint was developed in Google Ventures Labs[11].

Innovative skills in User Experience (UX) used in mentioned methodologies above are desirable to undergraduates in computing areas. In work presented by Hardy, Trina and Sankupellay, authors perceived this need and construct a method of DT inserting in an Australian University [10]. Based in same premise, DT is already being integrated into higher education curriculums, due to this same need of have undergraduates thinking like entrepreneurs [2]. However, the local reality of Federal Institute of Education, Science and Technology of Goás Formosa Campus remains somewhat far. Students have little knowledge about Design Thinking, Lean Startup, Design Sprint and all these new innovative techniques of UX.

Encouraged by issues above, we made a exploratory study so that from data get in research be possible suggests UX learning practices in Brazilian universities. In this experiment, we chose Design Sprint, that according Knapp is a greatest hits of business strategy, innovation, behavioral science, design, and more packaged into a step-by-step process that any team can use [11]. We made adaptations in technique so that it could have a minimalist approach to be applied in a weekly meeting with Software Engineering students from Technology in System Analysis and Development (TADS) course in Federal Institute of Education, Science and Technology of Goás Formosa Campus. The choice for this group is due to affinity of subject in this curriculum with Design Sprint approach.

In the following report, we use some terms that we would agree to better understanding. With the word course, we want to refer to the course in Technology in Analysis and Systems Development of the Federal Institute of Education, Science and Technology of Goás - Campus Formosa, to which we also refer simply as TADS. When referring to the set of two weekly classes of the discipline of Requirements Engineering, for which Design Sprint has been adapted, we use the term weekly meeting. To the Coordination of School Integration - Company responsible for the internship processes we call COSIE-E and the Federal Institute of Education, Science and Technology of Goás - Formosa Campus we call IFG and, sometimes, we also refer to the term Sprint as being the Design Sprint.

The remainder of this paper is organized as follows. Section 2 presents theoretical basis necessary to understand the study. Section 3 reports the preparation of case study. Section 4 provides a report of applying minimalist Design Sprint and discussions. Finally, Section 5 presents main conclusions, limitations and expectations for future studies.

2 Background

2.1 Design Thinking

According to Brown [5], we can understand Design Thinking as a user experience methodology applied to the design step, which aims to provide an easy, fast and assertive way to solve problems and innovate in business. Although the concept is not new, the term became popular when a technique using its concepts was adapted to the field of administration by David M. Kelley, founder of the American company IDEO [12], [7] [15]. Theres no consensus to naming stages of Design Thinking. Stickdorn et al. [16] suggest these:

1. **Exploration**: The purpose of the exploration stage is the search for the characterization of organization culture and the problems universe based on costumer point of view. This stage can be performed through surveys, interviews with experts and stakeholders, or through any other techniques that help in understanding the problem.
2. **Creation**: The creation stage seeks to consolidate the information collected in the initial phase through ideas testing, not avoiding mistakes, but exploring as many as possible mistakes.
3. **Reflection**: The purpose of the reflection stage is to generate prototypes to be tested with costumers or experts to gain feedback to improve them. This is a iterative cycle that goes on until prototype match needs of costumers.
4. **Implementation**: This phase addresses the changes needed to implement a new service where they are tracked and handled quickly and creatively.

2.2 Design Sprint

One of the problems of the workshops and other techniques of group discussion, according to Knapp et. al [11] is that normally the ideas that would be successful were not those generated during a noisy brainstorming session, but at moments of introspection of individuals. Knapp et al. concluded that the best ideas came after the excitement of the workshops ended, usually when people continued to think of them while they were in their offices, waiting for a coffee or even while showering. The challenge, in this case, was to bring to the business environment a tool that would allow individuals to get those best ideas [11], [3].

In his work on projects of Gmail's priority inbox and a video conference that would later become Google Hangouts, he noted that focusing on individual work, taking time to prototype and working with a strict deadline brought much better results than his traditional workshops previously used. In this way of working, he gave the name of Design Sprint [11]. In short, Design Sprint can be understood as a well-crafted process, consisting of steps and tools to get creative solutions and test them with end users. The first stage for its execution is to prepare the environment. Before starting a Sprint, it is necessary to make sure that the correct challenge has been discovered, that the right team is involved, and that the time and space for conducting the project are adequate. The bigger

the challenge, the better Sprint. Once the environment is prepared, we follow the Sprint steps that take up full days for a week.

Monday - Map/Understand: The purpose of Monday is to understand and map Sprint's goal and its obstacles from start to finish. For this, conversations are held with business experts so that all participants have a better understanding of the overall problem. A short representation of the process is made. This should include all key players on the left and the end goal on the right, while in the middle a streamlined flow of five to fifteen steps is developed. From this map an overview of the path to be covered for the final goal will be found and where the team will identify points of improvement in the process using the How Might We technique. How Might We is a tool where each member of the team identifies problems in the flow and silently notes questions on cards beginning with the initials HMW, which means "How could we", for which they will bring solutions at a later time . Once the cards have been filled by the team, they are pasted into a frame or wall, organized by groups of ideas so that the most relevant ones receive votes. Once the votes have been distributed, the next step is to pass the most voted cards to the map.

Tuesday - Create/Sketch: Tuesday is when solutions will be proposed to the problems identified and prioritized on Monday. As a source of inspiration for the team, the day must start with a review of what other companies or service providers have done about a given problem. This review, called Lightning Demos by author, should be informal and each example must be presented in a few minutes. As examples are presented, good ideas are captured and written down in a large picture where everyone can see and follow. Once the review stage is over, the team initiate solution proposals by creating sketches. Knapp [11] suggests a technique divided into four stages, in which each participant must individually execute each of them, which are: first, all the solutions proposed in previous day are posted on a wall or board. Then, each team member must silently analyze such solutions and use adhesive dots to identify the parts they judge most promising. Once this individual analysis is done, the team must discuss together each sketch to take notes of the most relevant ideas. At the end, each team member will be able to vote on parts that they consider more important. In this way, the sketches that will be part of the final solution will be identified and a storyboard will be designed to plan the next days prototype.

Thursday: Prototype: The prototype created that day should not be very realistic, but it should look like reality. A principle used in this construction says that it must be good enough that it produces the learning of whoever comes to test it and nothing more.

Friday: Test: Also called validation, this is the last stage. In it the prototype is taken to real customers who will be interviewed by members team. The content of the questions focuses on the prototype use. It is recommended that the interview be conducted in a room with discrete cameras that record it during use and transmit in real time to others members of the team. When notes have been taken and necessary adaptations have been verified, new Sprints can be planned

with prototype refining intention until it matches customer needs, even if the new Sprint iterations do not last five days again.

3 Preparing the Case Study

We had one goal in mind: to get data that would help to hypothesize how we could build a learning model based on UX techniques. The formatting of techniques within Design Sprint was a good starting point, from which we could adapt a minimal session that was executed in a weekly meeting. We chose, therefore, the exploratory research modality with a bibliographic study and a case study, which when applied, would provide data to be used in construction practical teaching of Design Thinking in the superior courses of Brazilian universities.

Based on time constraints, the challenge was to make Design Sprint five days fit into a weekly meeting, so that its main goals were still met. In this context, the problem-mapping, solution-sketching, decision-making, prototyping, and testing stages had to be reduced from hours to minutes. Not to disfigure them required that the main UX techniques in each of them be identified, selected and adapted. After a debate between us and a intense refinement of the document that we decide to call "schedule", we have the following structure:

- **9h00 - Understand**
  - 10 min - Contextualization
  - Lightning lectures on challenges and problems
    - 5 min - Specialist Lightning talk
    - 5 min - Student Lightning talk
  - 10 min - Process mapping
  - How Might We (HMW)
    - 5 min - Explanation
    - 5 min - Dot voting
    - 5 min - HMW ordering
- **9h55 - Find Solutions/Draw**
  - Crazy 8's
    - 5 min - Explanation
    - 10 min - Wireframes drawing
    - 10 min - Solution's sketch
- **10h20 - Interval**
- **10h35 - Decide**
  - Voting
    - 5 min - Explanation
    - 30 min - Decision making process
- **11h10 - Prototype**
- **11h40 - Validate**
- **12h10 - Closing**
  - 20 min - Application of questionnaire

It is worth mentioning that the nomenclature of some items was kept reliable to was defined in the book Sprint [11], except for the term *lightning talk* that represents a few minutes lecture [13]. Prior to Sprint Day, we asked students to list various problems they experienced in the course they wanted try to solve. They mentioned many and from a voting system, they chose the non-mandatory internship problem for TADS, for which we defined as Sprint's goal: *"More TADS students on internship"*. In the original Design Sprint model, this step is inside Sprint and must be done by team, however, we made this decision to save time. At another time, even before Sprint Day, also motivated by time savings, we collected information about the current flow of the internship process on the Formosa campus [8]. With this known flow, we abstracted it until it became a stream in the pattern of Monday's map, with five steps from the main stakeholders to the final goal.

As we knew of the risk of a small involvement of the students with Sprint, one of us, who is the teacher of the discipline, decided to treat Sprint as an evaluation activity, for which he would evaluate their engagement. This strategy proved to be useful, since the engagement worked in part and even there was extrapolation of the time of the weekly meeting with reasonable commitment of students. The materials used in the Sprint application were two self-adhesive note packs containing 100 units each, 100 dot stickers, 50 large dot stickers, 100 sheets a4, 15 black sphero-graphic pens, one room with one table, chalk, eraser, a large table, chairs, one data-show, one notebook, salty and soda for the range.

4 Application, Results and Discussion

Fiften people participated in Sprint. Dealing with this amount of people was a challenge, since the traditional Design Sprint model suggested that a maximum of seven people with different views to participate [11]. However, for the purposes of this research, it was necessary to have more participants. The lack of heterogeneity of a class of students that comprised a limited vision of the problem of the stage was solved with the presence of a COSIE-E employee who spoke at one of the lightning talk and the facilitator, who was the teacher of discipline. However, we understand that the ratio of students, expert and teacher was a threat to the validity of the Sprint solution outcome, as we have seen in the validation phase. For future iterations of this research, we suggest that greater power be given to the votes of those involved who are in minority, making one of them a Decision Maker. Due to the delay of some students and the COSIE-E technician, Sprint began at 9:17 am and not at 9:00 am as planned.

Lightning Talk: In the opening minutes, we gave the lectures. The expert did not use five minutes reserved for him and there were relevant details not mentioned during his speech. We believe that this influenced the students' ideology, since one of the points not mentioned was the documentation bureaucracy which, not by chance, did not receive enough votes on the HMW cards to advance to proposed solution stages in the prototype. However, the documentation bureaucracy was identified as missing by one of the users during validation stage. These

were the expert's considerations: 1. The internship is not mandatory, so the company must pay the trainee;2. There is a lack of contact with the Company-School Integration Institute (CIEE, in Brazilian Portuguese) and the Euvaldo Lodi Institute (IEL, in Brazilian Portuguese) by the IFG and students.

We heard that the specialist had trouble speaking in public. We believe that a specialist who does not have inhibitions of this nature can bring better results for Sprint. The students' lightning talk was initially designed to be made by only one of them, but they requested that anyone who wanted to speak could have the floor, which was granted by the facilitator. The talk took place as a small 5-minute brainstorming where everyone could talk, exposing different parts of the problem. They did not speak one in the speech of the other and the time was respected. In the end, the strategy worked well and the problem was very well characterized in their view.

The major problem may have been the lack of proportionality between this view and the specialist's view, as has been discussed earlier in this article. These were the students' considerations:1. Trainees are hired to do work that is not directly related to the course; 2. Employers require advanced knowledge that trainees have not yet obtained in the course; 3. The companies do not know the specificities of the course and thinks that informatics course prepares students to work solely with infrastructure;4. Development companies are missing in Formosa; 5. There is a lack of structure in existing companies, which are small and lacks demand for development of greater softwares;6. There is no connection of IFG with the National Job Site (SINE, in Brazilian Portuguese); 7. Companies are unaware of the existence of the TADS course in town; 8. IFG does not know companies that can offer internship.

From all the notes in this step, we see the following issues to address at Sprint: **Is it possible to resolve the speech of interest of the companies by the trainees of the TADS, even if they have to pay it? Is it possible to improve communication between the IFG and the companies?**
Technique How Might We: We got 53 cards with How Might We questions, of which 39 received no votes, 7 received one vote, 4 received two votes, one received three votes, one received five votes and one received six votes. Cards that did not receive votes or received only one vote were disregarded for the following stages. The justification is that since each participant could vote on their own card, they probably received votes from the owners themselves or were so irrelevant to the others that at this point they should be put aside and can be recovered in subsequent iterations, if necessary. Table 4 presents the contents of the cards considered for the construction of the solution. Sometimes during the voting, the facilitator was required to ask the students to be silent so there would be no bias from Sprint's classmates. By the way, the anxiety to speak when they should be silent was a recurring problem.

Crazy 8's Technique: For students, the 5-minute time spent on Sprint was not enough. Some claimed to have understood the operation of the technique only when the timer had already been triggered. However, even those who said they understood before the timing was started, they could not do the eight

How Might We	Card Content
2 votes cards	How might we create communication between companies and interested students in traineeship through a system where a company look for trainees and trainees (students) look for companies? How might we arouse companies' interest in requesting trainees? How might we make COSIE-E know of the companies that provide internship for the course? How might we solve the problem of vacancies available?
3 votes cards	How might we attract more companies to the IFG to know how the courses work and which the focus area?
5 votes cards	How might we integrate the IFG and the companies for more communication?
6 votes cards	How might we solve the problem of students' lack of experience?

Table 1. How Might We cards

sketches. After the sketches were made, we noticed that some students understood that the drawings of Crazy 8's should be done in flow, each drawing being a precedent of the next one. Greater clarity in the explanation addressing all these details is a point to consider in a future adaptation of Sprint for educational purposes. The decision process started after the break. Because of the intervals recommendations in sections of Sprint [11], we have decided to adapt a rest period with snack sponsored by us participants. The intention was for them to get together, for talks about Sprint to happen and for them to return to the room without being late. A conversation about Sprint even happened between two students and the facilitator, but the attempt to get them back in time to the room failed and Sprint restarted with a delay of 15 minutes.

Crazy 8's produced 4 sketches without a single vote, 4 sketches with only 1 single vote, 1 sketch with 2 simple votes and 2 sketches with 3 simple votes that were disregarded for the later stages, because the decision process was made in two stages with application of votes and supervotes, in which only those who received supervotes proceeded to the refinement. It should be mentioned that of the sketches that received only 1 simple vote, there was one that made a representation of the real world, although the initial scope of Sprint focused on building a mobile application that attacked the stage problem. However, this sketch was one of the chosen ones to be commented on in the step that in each student selected a sketch that was not of its authorship to talk about him. His interpretation led him to understand the design as an appeal to the ease of use that the application should have, which eventually influenced the prototypes in relation to this nonfunctional aspect of the application.

This event made us think that opening the scope during the application of Crazy 8's can encourage the creativity of participants, even if the idea is limited, as in the case of our application, where the goal was only to build an application. The sketches that served as the basis for the prototype were all those who received supervotes and another that, because of the large number of

simple votes and by decision of the Sprint team, was also considered for later stages. The numbers of these were: 1 sketch with 8 simple votes, 4 sketches with 1 supervote, 3 of them with a simple vote and 1 of them with two simple votes, 2 sketches with two supervotes, one of them with 2 votes and one with 10 votes simple, and 1 sketch with 5 supervotes that received only 1 simple vote (Figure: 1). The ideas born of Sprint culminated in a prototype of 14 screens that, if traversed led the user through 5 different flows.

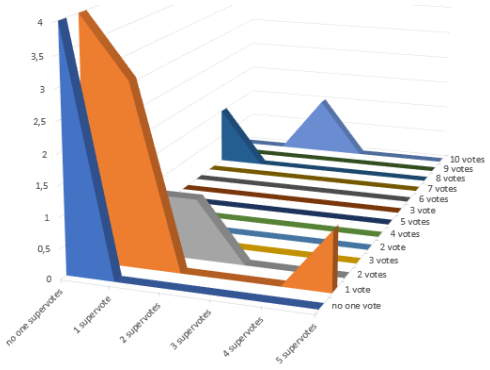

Fig. 1. Simple Votes and Supervotes from Sketches.

4.1 Validation

Because of problems with Sprint delays, the validation step can only be made the next day. It was carried out with a time limit of 36 minutes. For her, the students took their prototype to be tested by a computer science teacher, a TADS student, and an administrative technician working at COSIE-E who was not the same Sprint specialist. Sprint students who were validating the prototype were shy in the first interview. They were tempted to influence the interviewee, explaining too much or trying to justify why they had decided on certain features or buttons in the prototype. This was promptly corrected by the researcher after the first interview and improved on the other two. We recommend establishing an interview template for them to use, as recommended in Sprint [11]. It is worth mentioning that the student chosen to validate was a wheelchair. Such a choice was quite interesting, given his productive considerations about usability in the application.

In the test with the teacher, the notes made mention of a poor choice of the **Request Trainee** name for the button where the company creates vacancies and sees the list of trainees available. He also mentioned a lack of information on the **Request Visit** screen, unintuitive buttons in the corporate interface, badly placed **Create** button, a need to better separate study materials and a consideration of the **EJA** on the student's home screen, which, as previously

mentioned, was the result of an escape from the original Sprint proposal. The learning of this stage was very significant. After the students had done the three interviews, a small talk between us and them revealed new needs and starting from them, very new and innovative ideas have emerged. If the research continued, they could be added to the prototype in future Sprint iterations and then validated. Some of these ideas were:

1. Open the possibility of the intermediation of services freelancer of the students by the application, in order to meet the needs of the companies of the region, since there are very few of them whose end-activity is software development, besides guaranteeing a remuneration to the student;
2. As one of the problems reported in the validation was the fact that firms that would potentially be interested in student services did not know the purpose of the systems analysis and development course at the IFG or even know that there is a supply of labor from developers and system analysts, the application could generate automatic postings on social networks with the provision of services so that there was a greater dissemination of trainees and their skills.
3. Knowing that a large part of the companies want course trainees for infrastructure, support, help desk and maintenance work, which are not specifically belonging to the area of knowledge treated in the course and that this happens because of a lack of knowledge of the names and technical jargons of the area, the application could provide videos explaining what each specialty is provided as a student's skill, after all, often the company does not even imagine that their need can be solved with some specific tool or technique learned in the classroom .

The application would allow you to add tags with information on student skills (e.g.: Java Programming, Interface Design, Database Deployment, Project Management, etc.) and companies could register their needs (e.g.: Develop a website , mapping processes, maintaining a legacy system, etc.). In this, the application could link the students' skills to the corresponding needs.

4.2 Questionnaire

The questionnaire the students answered was released on the same day of validation and was online for 24 hours [9]. The 13 participating students answered. According to what was obtained, we learned that 61.5 % of students who participated in Sprint entered the IFG in the semester 2016-1, 23.1% entered the IFG in the semester 2015-1 and 15% entered the IFG in the semester 2016-2. Their age ranges from 18 to 26 years, with 53.8% of them belonging to the age group between 18 and 20 years. It was a heterogeneous class with little variation.

The students' preferences among the areas of computer science showed to be very mixed, the largest being the Programming area with 38.5% of declared preferences. In the opinion of 7 of them Design Sprint was extremely productive in terms of learning, with 6 of them giving a grade 9, 4 of them giving a grade

8 and 2 of them giving a grade 10 to the grade. learn about Design Sprint. Regarding their colleagues, 7 of them gave a note 9 to the apparent learning of their colleagues. Most students were divided between grades 7 and 9 to ask how they assessed the participants' commitment during Sprint.

Regarding the space where Sprint was applied, the vast majority stated that space and materials were well organized. 5 of them said they did not agree or disagree on the suitability of the room to Sprint while 8 agreed. Most of the notes about the limitations of the room were due to the physical space and size of the room, which in fact was small for the number of participants. Opinions were divided as to whether Sprint's time was a limiting factor. 5 of them agree with the statement, 4 of them disagree and the other 4 do not agree or disagree. 7 of them think that 3 days is the ideal time to apply this Sprint adaptation. The Crazy 8's technique was considered the most confusing element with 5 of the votes and students unanimously agreed that Design Sprint can creatively solve problems, but also expressed a unanimous interest in participating in new Sprint applications for educational purposes .

5 Conclusions

This work presented an account of the experience of applying a Sprint Design adapted for educational purposes. The artifacts generated during the research are available in digital repository. It was noted that the Sprint Design learning and innovation factor are very strong characteristics and bring very interesting results to even real problems. Unconventional solutions such as the idea of inter-company chat, COSIE-E and students to deal with the problem of communication failure, the possibility of creating events to establish business contact with students' work, online support with video lessons and books digital to address the problem of students' inexperience with certain advanced aspects required in the stage and the idea of inserting the possibility of freelance work handled by the application as a way to minimize difficulties with the modality of non-compulsory training are evidence of the potential of this method.

Because it is an extremely dynamic and multidisciplinary technique, the possibility of success in applications in the context of academic classes is great. However, some care is required with the techniques, the commitment of those involved and especially the time. Three hours may be enough time for the first four phases of Sprint using the techniques outlined in the calendar set up for this survey, however, using that time to include validation leaves Sprint unproductive. Divide it into two shifts, leaving the second shift to interview planning and validation seems to be the most appropriate. A second iteration in a third shift, perhaps on another day, is suggested to make the prototype even more functional.

As already mentioned, the adapted Sprint technique is still in its early stages and needs refining. It did not address future required iterations after validation with end users, did not provide all students contact with all steps and extrapolated the initial deadlines. However, we believe that if refined, it can help in the

creation of an academic culture that goes through the teaching of user-oriented design strategies. And these, if deeply rooted, can change students' way of thinking and make them surrender more of themselves, transforming them into future graduates capable of solving problems in more dynamic and innovative ways. We hope that future studies that bring adjustments to this initial adaptation can be made, so that transforming it into a framework suited to its insertion in Brazilian higher education courses, especially those with a semester model.

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