Active Learning Methods applied to an Environmental Awareness Course for CS majors

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ABSTRACT

The world has undergone major social changes in the last decades, leading us to a digital society. Although we have deeply changed the way we think, one subject has not changed in some countries such as Brazil: education. Brazilian students still sit in the classroom for hours while watching a professor speak. Even in undergraduate technology majors, such as Computer Science, the traditional learning methods remain and few innovations can be seen. This work shows a new curriculum for a discipline about environmental responsibility for undergraduate students in technology at a Brazilian university. The goal is to change the learning method using active learning, in which students are the protagonists of their own learning, while the professor acts only as a guide. Each class is 4 hours long and will be based on a different learning approach, therefore it must be self contained and well organized with a clear goal, so the professor can properly guide students to obtain the desired knowledge. This is a first step to change the way we see education to technological majors at our university, trying to bring innovation and new learning methods to a traditional environment.

CCS CONCEPTS

• **Social and professional topics** → **Computing education**; *Information technology education*; Student assessment;

KEYWORDS

Active Learning, Computing and the Environment, Computers and Society

1 INTRODUCTION

Education is constantly evolving. New methods and techniques of teaching and learning are still being developed and researchers seek ways to improve this process. The epistemology of Piaget [32]

states that knowledge is generated constructively, both from the subject her/himself and from her/his experiences. According to this theory, the construction of knowledge is active, i.e., the subject participates in her/his learning process.

Pedagogical strategies should facilitate students' learning process, while motivating and developing their critical vision. Therefore, the goal of each class should be well defined, focusing on the students, after all, as Paulo Freire once said "there is no teaching without discussion" [16]. Traditional learning is usually composed of expository lectures focusing on content rather than the student.

In this method, students remain as passive actors in the learning process, seen as mere information recipients. They memorize facts and use them in evaluation exams, discarding them later. This process is superficial and has a small contribution to the formation of critically and socially responsible citizen [26]. In some countries, such as Brazil, it is still common to find professors replicating the same traditional methods that they were submitted to in their own academic formation. These traditional lectures are still used because of their reduced time of implementation and focus on content [17, 36].

However, active learning methods agree with the cognitive theory of Piaget, in which the student is active in their own learning. Recent studies indicate better results in content retention and problem-solving in classes with active learning techniques [18]. In contract to expository lectures, these approaches encourage students to interact with each other and with the instructor, allowing them to experience different points of view, including their daily contexts.

Technology has facilitated some active learning techniques, nevertheless the influence of technology on society is not always positive. The broad use of computers increases energy consumption, e-waste with toxic or non-biodegradable materials, carbon emission, and other problems. For example, to compensate for the carbon emission of a typical desktop powered on 24 hours a day for a year one needs to plant over 500 trees [4].

It is crucial for computer science majors to acquire an environmental awareness and to attend to the impact of their future careers on the Earth, allowing them to act as critical and socio-environmentally responsible professionals. To this end, this work describes the experience of using several active learning techniques in the Computing and the Environment course at a Brazilian university, where otherwise only traditional learning methods are used. Therefore, the main contributions of this work are: (1) an experience report of using active learning in Brazil, where students and professors are used to a traditional method of learning; and (2) the experience of creating a course on sustainability focusing on CS major students.

2 RELATED WORK

At the present time, there are concerns with environmental issues such as carbon emission and energy consumption and these topics are receiving more attention even from companies, universities and research centers. *Going Green* represents an opportunity to the economy, research innovation and environmental education influencing several society sectors. This discussion is of extreme importance for the university engagement, spreading such practices in labs, researches and among students and teachers [38].

Although the need for knowledge about green computing and ways of reducing carbon emission and energy consumption is crucial, CS students and instructors show extremely low knowledge in this area [4]. This confirms the urgent need to include this topic in the curriculum for technological majors.

In 2017, Greenpeace released a report about the use of cell phones since 2007 [19]. It estimates that 7 billion phones were produced, i.e., if all of them still work there will be enough so that every person in the world could own one. Their manufacturing uses 60 different elements with a large impact on mining and processing these materials. Some of them are toxic and may also cause damage to the worker. Only in 2014, there were about 3 million metric tons of small e-waste discarded, with only 16% of them being recycled. The total amount of energy consumed in their fabrication since 2007 reaches the same quantity needed to supply the whole population of India for one year.

Moreover, alternative learning approaches that actively involve students in the learning process should be used to increase their engagement with sustainability and the Environment. Traditional teaching methods already show low performances in problem-solving classes and retention. Therefore, active learning methods [29, 30, 34] has been proposed and developed in the last two decades showing better results in retention of knowledge [31]. The implementation of this method in Computer Science courses confirms its positive impacts in learning and engaging students [18].

Students begin to use active learning methods in kindergarten and are familiar with this learning process. Also, active learning in Computer Science can aid students by encouraging them to interact with the topic, experiencing it in many forms and applying their learning to the real world [33].

Although active learning methods are becoming common in many contexts, traditional methods are still broadly used in Higher Education in Brazil [36]. Several projects aim to change the methodology of classrooms in universities all over Brazil [3, 22, 39], but the use of active learning strategies still suffers the resistance of instructors and the disbelieved from students and implementing it as a regular approach requires a lot of dedication.

In the scenario, it is indispensable for computing students to acquire an environmental awareness and to attend to the impact of their future careers on Earth, allowing them to act as critical and socio-environmentally responsible professionals. To this end, this work uses several Active Learning techniques to innovate the discipline Computing and the Environment by making it more dynamic and attractive to the students.

Thus, given the effectiveness of active learning and the increasing importance of learning about the Environment for technological majors, we added a new optional course to the curriculum. Our goal is to create socially responsible citizens and complete professionals prepared to deal with diverse social problems.

The Computing and the Environment course currently taught at our university has traditional lectures with some debates among students encouraged. Its syllabus consists of the following topics:

- Nature and Technology
- Socio-Environmental Responsibility of the IT Professional
- The role of Computer in the preservation of nature.
- The Electronic Waste: origin, destiny, discharge and recycling
- Digital Inclusion
- Sustainability

This course was mandatory for the Information System (IS) major between 2012 and 2016. It was never mandatory for the Computer Science (CS) major. Therefore, few Computer Science students enrolled in the course. Due to the lack of interest of professors and students, the course was not offered in the years in which it was optional. In 2018, we reformed the course using active learning. This drew attention from students from both majors, even though the course was not mandatory for either. It had the largest number of students enrolled so far. Figure 1 shows the number of students enrolled in this course during the last 6 years by major.
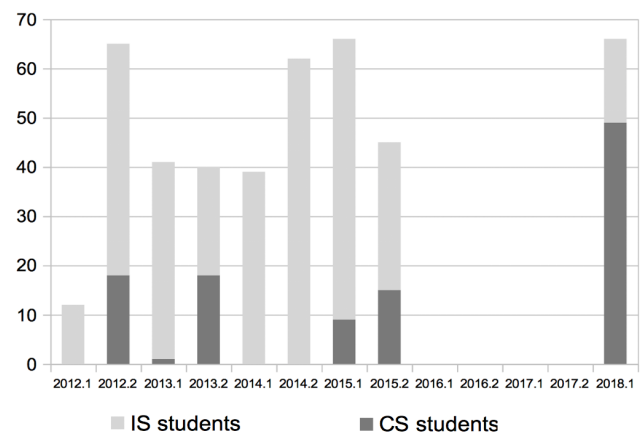

Figure 1: Number of students enrolled in the Computer and the Environment course by year at our university.

Our main goal is to modify and innovate such an essential course for future computing students. Therefore, we have studied active learning methods [29, 30, 34] to make classes more dynamic, trying to keep up with changes that higher education courses should have been suffering in recent years.

3 METHODOLOGY

Although several studies show the importance of active learning methods in Computer Science courses [15, 27, 37], it is a new approach at most universities in Brazil [36]. Most faculty members of our university did not approve of our use active learning. Beside the lack of support from colleagues, no official teaching assistant was hired for the course, leading the professor (and author) to search

for a volunteer student for this role unofficially. In spite of these issues, we developed the course and offered it twice.

3.1 Course Structure

Based on active learning approaches, we proposed a new curriculum for the Computer and the Environment course. It is composed of eight 4-hour instructor-planned activities, including initial and final presentations. It also consists of 4 days of activities planned by the students, which are included in their final evaluation. Therefore, it will take a total of 12 classes of 4 hours each, once per week, for a total of 3 months. It is important to note that in Brazil it is common to have 4 hour classes. The course syllabus, along with each activity's methodology, is described on Table 1.

We designed the classes in a self-contained way, therefore there is no tight connection between each class. Since the classes are 4 hour long, it is possible to use a new active learning in each one, creating a more dynamic study environment. Although diverse and more attractive to the students, this method can be more complex to manage. Also, each class must have a goal connected to the learning method chosen and its goal and steps must be presented in a clear way to the students at the beginning of class.

The first class consists of an introduction. We presented the syllabus and evaluation process,and most importantly, the methodology we used. It is important that students become familiar with the active learning methodology, since they are only used to traditional teaching in Brazilian university courses. Their initial reaction may be adverse or suspicious and a common reaction may include thinking that the professor does not want to do their job and they are delegating their work to the students. Therefore, trust and communication are essential during the whole course. After presenting the methodology and the content to the students, everyone introduces themselves, stating their relation with the environment (if any) and why they are taking this course. This will help not only the instructor to learn more about their students, but also start to show the nature of the class, where they are free to express themselves, which is fundamental for the conducting of the following activities.

The next class topic is the role of IT professionals in the environment. The instructor will propose questions rather than simply presenting facts, leading students to reflect on the impact they can have, either positive or negative, in the environment after their graduation. This class is based on *Inquiry-based Learning* [12, 13] that uses questions to guide and facilitate debate. We watched a movie that was chosen based on the students' age (20-25 years old). The idea was to gather their attention and to create a good learning environment. The movie chosen was Wall-E, a 2008 computer-animated science fiction film produced by Pixar [11]. This film features a robot, whose goal is to compress the garbage left on Earth, which was abandoned due to pollution. He finds EVE, a robot whose goal is to find any environmental life on Earth and together they embark on an adventure. On the day of the screening, students were asked to bring popcorn and soda, so an informal classroom style was built. After the screening, students participated in a debate, answering questions proposed by the teacher, such as which character do they relate to and why. The goal is to lead students to realize that they are the programmers of the company shown in the movie, and they will be the ones developing AI that runs everything. Each student

should reflect on their role in society and how their professional decisions can affect the community. Students (2 or 3) who make the most relevant and important comments will receive extra points.

The third class's goal is to show the importance of clean energy and the consequences of electronic waste on the Environment. Gamification or *Game-based Learning* [2, 20] is used to improve students' engagement and learning effectiveness. We played a game of questions and answers. Such a game is competitive and will evaluate knowledge not yet exposed for students who will have to think and analyze possibilities, and in some cases use luck, to get the correct answer. The goal is to stimulate their curiosity, so they are interested in the videos played after the game that will explain each question in more detail. The data used will be taken from Greenpeace [1] about the use of renewable energy and concern with e-waste by popular tech companies. The tool used for the game was Kahoot [9], an online tool which allows the creation of Q&A's that can be accessed by each student on their cell phone. The top teams can get extra points, but it is important that everyone wins something, regardless of their placement, rewarding their effort and attempt.

Next, we focus on responsibility for e-waste. In this class we use a method commonly used in law school, the *Mock-Trial* [24, 28]. In this activity, students simulate an appellate court hearing, taking the roles of lawyers and jury to decide who is to blame for the pollution generated by electronics. Students are divided in four groups and a small story about e-waste in a fictitious town is presented. From this story, students should argue which subject is the main responsible for the pollution: the local population, the government or the company that develops the electronics. Each group will have the same time for research and 20 minutes for presentation. In the end, the jury - also formed by students - can ask questions and has to decide who they think is guilty. Finally, students should evaluate themselves, naming among the members of their group who had the most valid participation. The intention is to dissolve the traditional role of the professor, the only one with the power to evaluate students. It is also important to note that in this class the groups are drawn, making students defend points of view that may differ from their own and forcing them to socialize with other students.

Project-based learning [6, 25] is a popular active learning approach, commonly deployed in CS as a Hackathon. In a Hackathon, students must create usable software or hardware building a functional product during a consecutive time period raging for some hours to a couple of days. In the classroom environment, this can be reduced to a prototype, due to time constraints. Therefore, the fifth class will ask students reflect on how they can help the environment by using their knowledge as future IT professionals. We organized a small Hackathon in which the students have to create a mobile application that aids the environment in some way, such as preservation, awareness or conservation. Students divide themselves into ten groups and each group creates an application within two hours. We expect that a goal for the application is well defined and some prototype screens are developed. In this activity

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[1]https://www.greenpeace.org/archive-international/en/campaigns/detox/electronics/Campaign-timeline/ReThink-IT/

Table 1: Basic syllabus with methodologies for the Computer and the Environment course

Week	Goal	Methodology
01	Give an introduction of the learning methodology	No special methodology used
02	Make students reflect on the role of computers in the Environment	Inquiry-based Learning
03	Give information about the Environment	Game-based Learning
04	Ask students to create a tool to help the environment	Project-based Learning
05	Guide students to think about their roles in e-waste	Mock-Trial
06	Use social networks to promote awareness of the Environmental situation	Design-based Learning
07	Help students to realize the social impact they can achieve	Service-Learning
08	Listen to students expectations and motivations	Round table
09-12	Evaluation of students' critical thinking, learning techniques and creativity	Assignment evaluation

students can choose any tool to create the prototypes, from programming, to image editing applications. Each group presents their idea and will be evaluated by a panel of invited students and faculty members. The projects are evaluated for originality, feasibility and environmental utility.

The activity for the sixth class is to promote environmental awareness. Students must use social networks to disclose awareness of environmental problems and the responsibility of technology professionals. They create so-called *memes* [8], which are funny images usually seen on the internet. In order to achieve this, we used *Design-based Learning* [35, 40]. This method brings design thinking into the classroom to engage students in an alternative activity, helping them to develop skills such as communication and collaboration. The final images will be posted on social networks so they can reach all students, not only those enrolled in the course. Students take pictures with their cell phones and edit each photo, leaving a message of environmental awareness. The final evaluation comes from the users of the social network itself, with their likes and comments on each picture. Students are asked not to interfere with the results and all posts will be anonymous.

Moreover, it is important that the course causes a social impact, so students can experience in practice the importance of their acts in society. To this end, in the last class students must organize a donation fair to gather old or broken electronics, applying *Service-Learning* [14, 23]. The support of a non-profit organization or the government itself is essential for this activity, so we can appropriately handle all the electronic waste gathered. It will be the students' role to collect all unused electronics asking friends, relatives and neighbors. They should also tour the university campus advertising the fair so the largest possible quantity of e-waste can be collected. Evaluation will be based on the engagement of each student. It is important not to promote competition based on the amount of material collected, as this involves other factors besides the student's effort.

Finally, dialogue is of key importance in the classroom environment. A teacher that desires to be listened to, must also listen. The relationship between an instructor and a student must be horizontal, generating mutual trust [16]. Therefore, the final activity consists of listening to the students. The class will take place outside the classroom, in a familiar environment to the students, such as a park, or other place they usually go in their free time. In this comfortable place they are asked to talk, not only about the course, but also

about their experiences with the major, the university and other aspects in their life. It is important that the professor listens and creates a bond with the students. In this activity, students should feel free to say what they think and should be respected by all involved. In this class it will be common to hear some complaints about the major, the courses or the university, which can create a bond between the students that suffer with the same issues. Although this class does not have a fixed subject in mind as a goal, it is extremely important for breaking the traditional educational paradigm of learning and for validating another learning category given by informal learning, based on the subject's experiences [7]. This class did not have any evaluation process.

3.2 Assessment and Grading Scheme

The main assessment for this course will be a presentation. Students are expected to give dynamic presentations on a subject related to computing and the environment. They must show knowledge not only about the content itself, but also about the form of communication used throughout the disciplines. They are free to use any presentation medium and also to choose any subject related to the course subject. At this point, new technologies, applications and technological resources that are still unknown to the instructor may be used, contributing to the learning of all involved. Groups will be evaluated by the following concepts: Self-Evaluation (the student will give a grade to themselves); Written Work (a small plan describing the theme and main idea chosen); Colleagues' Evaluation (each student in the group should give a grade to their colleagues anonymously); Creativity (presentations can be done in any way using at most one hour, all other students participate as audience members, traditional exposition of information is not recommended); and Content and Theme (relevance of the chosen subject and the quality of research made).

4 RESULTS AND LESSONS LEARNED

The first offering of the class had 63 students enrolled. Most students passed with the mean being 8.1, the median 9.1 and standard deviation of 2.8, on a grading scale from 0.0 to 10.0 (as used in all courses in Brazil). The highest grade was 10.5 (since students could earn extra points) and the lowest grade was 0.0 from two students that withdraw from the course. From the 61 students that actively

attended classes, only 6 failed to do the final assignment. This completion rate is a lot higher than usually seen in Brazil, where the withdraw rate is usually really high.

The students were really engaged and motivated during all classes. In the first class, we proposed the methodology and opened the discussion about the importance of the environment. Although many agreed on its importance, most students claimed to have only a bond with the environment through their pets, mostly dogs and cats. Few of them realized the impact of their daily lives on the environment. We also gave them a questionnaire in the first class about their experiences so far in the CS major and their expectations for this course.

4.1 Survey before Course

From the 63 students enrolled, 53 attended the first class and answered the initial survey. The goal was to determine the profile of the students in order to conduct classes properly. The first question asked the year each student was in. Most students (30%) had spent more than four years in the university, this is consistent with a known problem at our university: the difficulty of graduating on time in the CS major. Another 30% were in the third year and 10% were seniors. Only 12% were at the first year and 18% were in the second year. Therefore, most of the students already had a good knowledge of CS subjects, but overall it was a really diverse class.

The following questions used a Likert-type scale [10], asking for the student's motivation in taking a CS major, their motivation on enrolling in this course, their interest in computing and the environment and, finally, their daily concern with sustainability. Figure 2 shows the answers for these four questions. Most students are happy with their major choice with 76% being highly or very highly motivated in the CS major. Students also showed a great motivation for this course, with 78% having high or very high motivation and only 3% having low motivation with none having very low motivation. This was clearly a great way to start the course, since part of a successful course lies on motivated students.

Although 31% of the students showed very high interest in the Computer and the Environment course, only 24% showed interest in the subject with only 19% having some concern about it. This shows that students were more interested in the learning method to be used in the course, than in the content of the course. This was even clearer on the last question that was open for any comment. Thirteen students made comments about how they were excited and curious for a new and different learning method, since active learning is not used at our university at all. One student stated: "I hope to engage in a learning methodology that differs from the conventional and to regain the motivation to take classes and also to learn a little of the synergy between computing and the environment". While others were worried about how boring classes usually are: "I just wanted to take a class that is not boring". These comments show how students are losing their motivation due to the traditional and conventional learning methods. This could explain not only the high motivation for this course, but also the high number of students still in the university after more than four years.

Several students expressed doubts about the correlation between computing and the environment and some were concerned about
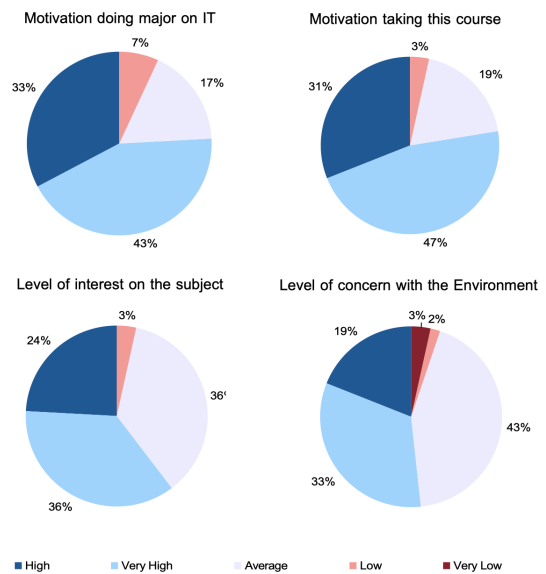

Figure 2: Students responses for the initial questionnaire.

how they could take responsible actions as IT professionals: "I hope to be more aware of my actions in relation to the environment and to be able to apply knowledge to computing in the future". Some even realize how they will affect society: "I hope to develop environmental knowledge and one day to use this knowledge in artificial intelligence". But most were curious and open to new knowledge: "To open my mind to technology-related environmental issues".

4.2 Survey after the Course

At the end of the course, we gave another survey. It was answered by 43 out of 63 students enrolled and asked for scores of several components of the course, in addition to some questions about the impacts of the class on each student using a Likert-type scale [10]. It also had an open space for comments. Almost all students (39 out of the 43) said that their expectations with the course were reached.

Figure 3 shows the responses for the Likert-type questions. Most students (56%) stated that their motivation to attend class was very high during the course, with two saying "it was the best course I've had so far" and "it was the only class I looked forward to attending this term". They also expressed an increase of interest in environmental issues, with 33% having a very high increase and another 49% a high increase. Only one student stated it was very low and another that it was low.

Most students also believe that the class improved their professional skills, with 77% stating the increase was high or very high. This shows that we were successful in connecting environment issues with computing and their own experiences. Finally, most students believe they improved their knowledge during the course, with only two stating that this increase was low or very low. This also proves that we were able to show students the values of active learning, since for most of them this was an unknown method.
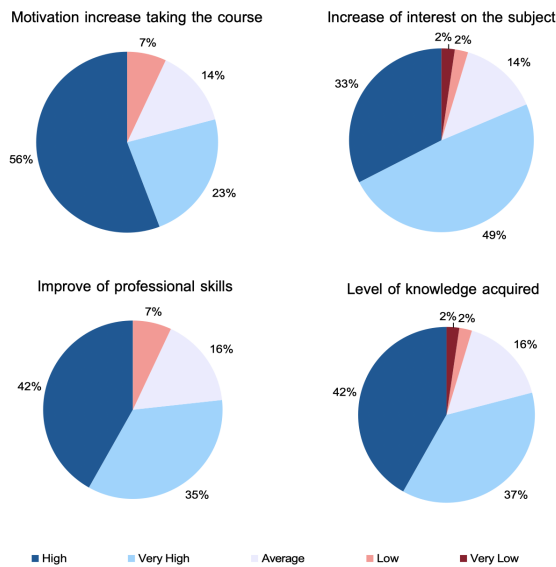
Figure 3: Students responses for the final questionnaire.

Students were also asked to give a score from 0 to 10 to some components of the course and each of the 5 activities (from classes 2 to 6[2]). Most students liked to create their own activities as the final assignment (average of 9.30), but complained of participating in other students' activities (average of 8.66). The conduct of the classes by the instructor (average of 9.59) and the overall evaluation of the course (average of 9.30) showed that the course was enjoyed by the students. Finally, each student had to choose the most favorite activity and the least favorite activity and explain their reasons.

The movie was chosen to be the first activity for being basic and simple. Our main goal was to start a discussion about the role of computing in society and to acclimate students to the new learning method. It was voted by 4 students as the most favorite and by 10 students as the least favorite one. On the positive side, students pointed out that they liked the movie, that the discussion afterwards was good without any heated arguments and that it was interesting to rewatch the movie with a more mature view. On the down side, students stated that the class was not really engaged (probably because they were shy since most students still did not know each other), it was too simple and it did not have much impact. Its average score was 8.78, leaving it as the second best scored activity.

The Gamification class was voted the most favorite by 13 students and the least favorite by only 3. It was cited as the most informative activity, showing students that they really did not know much about the subject and motivating the search for more information outside the classroom: "I could realize how my views on the impact of computing in the environment were distorted". Other good aspects were the healthy competition and the high engagement of the students (at one point they were all cheering and celebrating loudly

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[2]Class 7 based on Service-Learning had to be cancel due to lack of support of the university and government that did not allowed the collection of electronic waste on campus. Class 8 was not evaluated by the students because it did not focus on Computing and the Environment since it was an open discussion class.

and enthusiastically). As a down side, one student complained about not having the knowledge to answer correctly and another did not like the competition between their classmates. Its average score given by the students was 9.23, making it the activity with the best score.

The Mock-Trial activity was the most controversial one. Due to a communication issue, some groups misunderstood the rules, which generated a heated argument at the end. Also, students were extremely competitive in this activity, still arguing about it after the class was over. For most (23 students), it was the best experience since everybody was really engaged, making it the favorite one for most students. On the other hand, 11 students stated it was a bad experience due to the problems with communication and organization of the class. The activity proved to be a great idea, with most students enjoying the debate, but also proved to be the most challenging one for the instructor. Even students that voted it as the least favorite stated that the activity was great, the problem was in its execution. Students being forced to defend points of views that differ from their own and the groups being chosen randomly were also viewed as good by most of the students. The activity received a score of 8.27.

The activity based on Project-based Learning had mixed reviews, receiving 3 votes as the favorite one and 6 as the least favorite one, with an overall score of 8.41. Students praised working in groups, discovering new ideas from other groups and doing something practical. As a down side, all students complained about the lack of time, because they wanted to build something more concrete.

The final meme activity proved to be the least favorite among students. No student voted as their favorite and 12 voted it as their least favorite (making it the most voted least favorite activity). The main reason given was the lack of incentive from the university that did not aid in the disclosure of the final ideas. This made it difficult for others to access the memes created and led the students to believe that the activity did not have any relevant impact. It had the lowest score, with 7.43.

For the open comments section, most students praised the course, especially the active learning methods: "The course was amazing. I admit I was afraid of enrolling thinking it would be a boring class with uninteresting activities, but after the first class I could see that the dynamics were quite different from what I expected and that a computer and environment course can be really fun." The interaction between students was also cited as a good feature: "I made new friends, which other courses don't provide as much. The course represented well the university's role in motivating student's interest and interaction". As a down side, one student commented on the lack of traditional classes: "Classes could be more traditionally structured with just a few different dynamics spread out". And another complained that some classes were too superficial, but praised the method: "Subjects were not deeply discussed in some classes. The fact that each class was different was great because 4 hours is too much time for one lecture". Finally, one commented that classes should not be fun: "It was a fun course but I don't think that's the main point of a class", while other praised the interaction and inclusion of all students and points of view: "This type of course is ideal to raise interaction between students, especially those who do not feel included in the course. I felt that we could talk about

the subject without being in the constrained and limited classroom environment that we are used to have".

4.3 Reflections

As a professor, it was amazing to witness the success of active learning. I could watch students having fun while learning and interacting a lot with the content. I also know the discussions were usually continued after class and students were still reflecting and commenting on the topics in the university halls (probably impacting students not enrolled in the course as well). It was also important to see the interactions they had in class impacting their social lives; a lot of students made new friends, which I also think is a really important aspect of any course. Finally, it was interesting seeing the students and other faculty reaction during the term. At first, even the students did not take the course seriously; the traditional method of learning is so common in Brazil that any class that involves students having fun is not taken seriously. I could notice that students were trusting me but they were really suspicious. With time, they understood the goal of the course and they really enjoyed it.

Some professors were curious about that loud class where students were always talking and laughing. Most thought it was a waste of time, but some approached me afterwards to learn more and were interested in adapting some ideas on their own courses. They were surprised to know that this was a methodology and there were several papers published about it.

Overall, it was an amazing experience that I believe created a good impact not only on everyone involved in it, but outside the classroom environment as well. The main recommendation I would give for Brazilian instructors would be to spend the time talking to students and to other instructors, always referencing main papers, researchers and conferences. Project-Based Learning is also a good tool to start the conversation, since some instructors already do this without having any idea this is an educational methodology. It is important, not only to show the importance of active learning, but also how to properly implement and manage such courses.

5 CONCLUSION

This paper describes our experiences of modifying the Computing and the Environment course, which has the goal of developing students into active and responsible citizens and IT professionals. In order to achieve this, we used several active learning methods applying a different one each class, making it dynamic and creative, aiding students' motivation and interest for the class.

Even with the concerns other faculty members at our institute had with our active learning methods, we had an amazing response by the students, with more than 50 attendees and almost no withdrawals. The evaluations showed that classes were mostly successful in not only teaching the subject, but also in motivating students, bringing them closer and increasing their critical thinking and communication skills.

This course was offered another time in the following year. Since implementing Class 7 based on Service-Learning proved to be a greater challenge than anticipated, we replace that lecture with a Simulation-based learning activity. This type of lecture refers to the imitation of real-world activities and processes in a safe environment [1, 5]. In our case, we use a Role-Playing Game [21] to help students to connect and realize the impacts of CS in other countries and cultures. In an RPG game, each participant assumes the role of a character, that can interact within the game's imaginary world.

Students were divided into groups and were required to design a simple character (choosing only a name and distributing 12 points among their character attributes: strength, dexterity, intelligence, and luck). Using a dice, we can tell if their character managed to successfully do an action if the value they rolled in the dice is less than or equal to each character's attribute. The game is made up of small parts that include a decision between 4 options and a test of one of their attributes based on that decision. Different consequences can happen if a character succeeds or fails an action. The story, although initially fanciful about exploring a dungeon, leads to a real problem taking place in the Republic of Congo. At the end of the game, a short video showing the reality on which the game was based is shown, causing students to question what was fiction and what was reality. To help with the simulation, photos, maps and documents, and other props are used during class. The evaluation of this lecture comes from students that at the end collected more points, which indicates a little luck with the dice, but most likely smart decisions based on their character's attributes during the game.

Some other changes were made to some activities to maintain the course updated. It is essential to keep not only the data updated, but also to cover important topics, activities, and cultures that will attract the newer generation. We now want to extend this to other courses t our department by giving talks and tutoring faculty members to help them to update and improve their teaching skills, by adding active learning methods to their courses, hopefully changing the view of this method around our department.

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