# An Experience Report on Course Teaching in Information Systems

Carlos Oliveira

*Abstract*—This paper is a criticism of the traditional model of teaching and presents alternative teaching methods, different from the traditional lecture. These methods are accompanied by reports of experience of their application in a class. It was concluded that in the lecture, the student has a low learning rate and that other methods should be used to make the most engaging learning environment for the student, contributing (or facilitating) his learning process. However, the teacher should not use a single method, but rather a range of different methods to ensure the learning experience does not become repetitive and fatiguing for the student.

*Keywords*—Educational practices, experience report, IT in education, teaching methods.

## I. INTRODUCTION

THE approach of traditional education system assumes that intelligence is a capacity which allows man to store information. From this perspective, it is necessary to decompose the reality to be studied in order to simplify the knowledge to be transmitted to the student, who should only store the results of the process [1]. Thus, it is understood that in the traditional school, the student must simply accumulate content through transmission by a professor [2]. In this school, the teacher takes the initiative to expose the lessons to the students and apply exercises that students must perform [3]. If the student does not do the exercise correctly, the teacher gives the student new exercises until that knowledge is assimilated. It is believed in the traditional school that if the student was able to reproduce the contents taught, even automatically, then they had learned it. The traditional school is therefore structured in expository method, with emphasis on the transmission of knowledge. It is observed from this that the traditional school remains similar to what it was in its beginning, even long after its inception.

In the constructivist school, knowledge is not given as something finished. It is the interaction of the individual with the physical and social environment [4]. On the constructivist school, it is understood that the man is a being endowed with reason that he has a cognitive potential to think the world [5]. Therefore, in the constructivist view, learning is a construction of the student, which is the center in the process, not the teacher. In this way, on the constructivist school, the student is led to think, not memorize.

For Piaget, which is one of the main representatives of the constructivist thought, the student overcomes a lower stage to

reach the next stage by successive "imbalances" and "rebalances" [6]. Thus, education should promote the achievement of challenging activities that cause cognitive conflicts, or "imbalances" and subsequent "rebalance" to promote the discovery and construction of knowledge. So for Piaget, knowledge is not simply discovered by the student, not mechanically transmitted by the teacher, but is the result of interaction in which the student is always active.

This paper is a report of experience in the Teaching course in Information Systems, offered to doctoral students at the Federal University of the State of Rio de Janeiro. The goal of the course is to enable teachers to critically analyze their own teaching practice (research and training method), based on: didactics, epistemology, psychology (cognition, learning theories), philosophy, history, among other things. It is understood that the teacher must rethink and modify his own practices over the years according to each context.

At the beginning of the course, each student must present a dilemma about teaching as a teacher or student. As part of the evaluation, each student discipline should teach a class. The subject of the class could be chosen by the student (based on their dilemma), but the important thing is that should not be given a lecture but an interactive class. As can be seen in Fig. 1, in the lecture the student has a learning rate of only 5%. Hence, the traditional class or school is criticized.
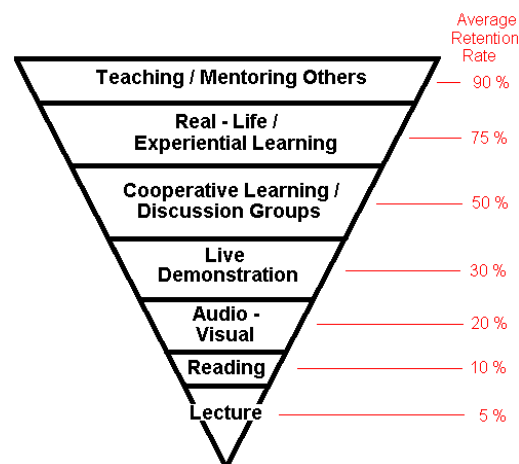


Fig. 1 Learning rate in different activities

In the Teaching course in Information Systems, the student should also submit your lesson plan on the first day of the course. The lesson plan of the author is presented in Section II. In the first classes, after delivery of the lesson plan, different teaching methods were presented. In their classes, students

Carlos Oliveira is with the Federal Institute of Education, Science and Technology of Rio de Janeiro, Rio de Janeiro, Brazil (e-mail: carlos.roberto@ifrj.edu.br).

might also present other methods. Some of these methods are outlined in Section III. The goal was to show that a class does not need to be expository, and also that the class can be interactive and fun for the student. In this way the student feels more motivated to participate in class and overcome learning difficulties.

## II. LESSON PLAN

The lesson plan was presented based on the following question. How school and the teacher can help the different students in a class in order to improve the learning of each student? This question arose from concern that each student has a learning style. Some learn best through seeing, others through hearing, others are kinesthetic [7]. So how can the teacher teach a class that meets in the best way, all these different styles? Therefore the lesson objectives were (1) know the different learning styles, and (2) identify the learning style of the student and understand how to take advantage of this knowledge. These objectives would be achieved with the display of a video of 20 minutes on the subject, with the application of an online test, lasting five minutes, so that each student could find out their learning style and 20 minutes of discussion with the class.

Understanding the cognitive styles provides educational implications, especially with regard to the improvement of teaching methods, the qualifications of the teacher's actions, the intensification of student learning strategies, the expansion in the form of conceiving goals and educational outcomes, the improvement of demands related to the styles of educational media [8]. However, if the teacher makes use of an approach that favors a particular learning style, students who did not develop the same ability will tend to lose interest and feel a sense of difficulty in learning. If the teacher favors the student learning style, the student will not develop other skills, hampering his future academic and professional performance [9]. The ideal seems to be proposing to the student activities that meet their individual preferences and also activities that challenge them to experience some discomfort, helping them to develop new learning strategies [10]. In this sense, one of the applications of learning styles can be understood as assistance to teachers in the planning of the balanced education. Therefore, it is not necessary for the teacher to identify the learning style of students - the important thing is that the students choose one of the learning style models available in the literature, and consider the features of all their categories when planning their lessons because a class probably consists of students representing all styles. Identify the learning styles prevalent in the class through a style assessment tool, however, provides additional information that contribute to an effective instructional planning [11].

Another important application of learning styles is directed to the learning process. It is important that the student know what his learning style is, understand its characteristics and identify his strengths and limitations in order to develop new learning strategies and improve his academic performance. The teacher should talk to the student about the characteristics of his learning style; and explain that the styles are not good or bad, they are just different. The teacher must also evince to students that their learning preferences are not related to the ability to solve problems or not, but the way they are resolved; and finally show them that the limitations of their style may be confronted with the development of new learning strategies.

## III. TEACHING METHODS

Are presented in this section the methods that have already been experimented by the author of this work or that can be put into practice in various areas of education, such as gamification.

### A. Flipped Classroom

The flipped classroom [12] was one of the methods presented at the beginning of the course. The main objective of this approach, in general, is that the student has prior access to the course material, print or online, and can discuss the content with the teacher and other colleagues [13]. In this perspective, the classroom is transformed into a dynamic and interactive space, allowing the performance of group activities, stimulating debates and discussions, and enriching the student learning from various points of view [13]. So for better fixation of the information and concepts presented in the course it is necessary that students take the time to study the contents before class time. The flipped classroom is, therefore, a reversal of the traditional classroom. Perhaps the most important benefit of this method is the possibility of promoting more advanced discussions in class, once the content has been previously studied by the student, providing a higher level of discussion and a broader knowledge to the students. On the other hand, one of the challenges is that there are no lectures, which students are accustomed to in traditional teaching. Thus, some students may feel lost, unmotivated, or even find that the teacher is not fulfilling his role [13]. Therefore, the search for the change of mind about what to expect from a class is one of the main challenges to be faced in the process of innovation in education. From the teacher's point of view, one can find barriers, especially with regard to the loss of part of his authority in the classroom, to the extent that he is no longer the one to dictate the rhythm of the interactions and hold the power of knowledge [13]. Thus, when using the flipped classroom, the teacher must reflect on their behavior if students do not perform the necessary preparation study and find it difficult to monitor the interaction in class, which can lead to demotivation and disinterest in the content, and have a negative effect on learning. Another challenging point is that students need to manage their time well and divide their study hours between the different subjects they are studying.

The flipped classroom was used in the class about learning styles, which had its lesson plan presented in Section II of this paper. It was decided to use this method when it was realized that the time available for class, 45 minutes, would not be appropriate for the presentation of a 20 minute video, completion of the online test in another five minutes and hold a discussion among students. In this way, 25 minutes were released for discussion among the students.

Despite the initial motivation for the adoption of the flipped classroom was the issue of time, it was observed that the discussion was more productive, since the students had studied the matter beforehand. There was a high degree of student engagement in carrying out the activities at home. However, a presentation was prepared with three slides, summarizing the subject for those students who could not carry out the activities before class.

It is possible that the reason most students have done their homework can be attributed to the fact that it was a class with doctoral students, who are more experienced people and more compromised for time. And also the fact that it was a single class. Different results would be expected in at various educational levels and when applying this method often. However, it should be noted that it was no scientific evidence was found in this regard.

### B. Gamification

The lack of motivation in those students who find classes boring and tedious, is something that is of concern for teachers. On the other hand, digital games have conquered an increasingly larger space in the lives of children, adolescents and adults. These players spend long hours playing enticed by the stories, graphics, challenges and the possibility of being part of the history of the game, while being in control of a character. This time could be used in other activities such as study, for example. This generates complaints from parents and teachers, because they would like their children and students devote the same level of attention and commitment to studies [14].

According to Savi and Ulbricht [15], diverting the attention of students away from games to educational activities is not a simple task. This scenario has increased the number of research efforts to try to find ways to combine education and fun with the development of educational games. By providing attractive and innovative educational practices, where the student has the chance to learn in a more active, dynamic and motivating way, educational games can become an important auxiliary of the teaching and learning process.

Another possibility is the teacher using gamification [16] in the classroom. Gamification is the use of techniques and dynamic of games to engage people, solve problems and improve learning, motivating actions and behaviors in environments outside the context of games. Thus, when because of lack of a technological structure the teacher cannot use computer games with their students, they can use this knowledge to engage their students by taking advantage of the techniques of gamification such as (1) score, used to increase participation; (2) Insignia for visual representation of the achievements and goals achieved; (3) skills or reputation, showing the preferences and characteristics for possible alliances; (4) Scores, as a means of comparison among the involved; (5) Progress levels, to encourage participation and completion of the tasks; (6) Challenges, as an incentive to solving tasks; and, (7) Rewards for student motivation [17].

Among the techniques most used to promote engagement is the reward, which can be monetary or psychological (satisfaction) [17]. In [17], the authors propose the use of gamification to engage, retain and promote changes in people's behavior. The authors explain that to "gamificate" a process or activity refers to its restructuring and turning it into an experience similar to that of a game for the participant [17]. The idea is to insert the dynamism of games in tasks regarded as uninteresting or boring, to make them more fun and so to encourage frequent participation and collaboration.

In one of the classes taught in Teaching course in Information Systems, gamification was used to present the operation of some equipment in a computer network. Some adhesive tape strips were placed on the ground, representing paths through which data could pass on a computer network. Students were asked to remain standing around these paths. The teacher sought to show the operation of different network devices. For this, he said, "now let us try to understand how equipment A transmits the data". Each student represented a piece of data to be transmitted on the network. According to the equipment that was being represented, the teacher advised how the students should move around this path. In this way, the students could understand the advantages and disadvantages of data transmission in each device. The major advantage of this class was the presentation of content in a more interesting and engaging way to the student. Thus, there is no need for the student to memorize the content. Learning becomes easier because the student associates the content with an experience they lived.

### C. Coding Dojo

One of the challenges in the teaching process is to maintain the attention and motivation of students. This challenge can become even greater when the course has a greater complexity, such as computer programming. In these disciplines there is the need for the student to practice what was taught. So it is important to offer lessons in the lab because the lab classes allow students to put into practice the theory learned and exercise their creativity. For these classes, an interesting method is the Coding Dojo, which are meetings of developers aimed at learning, practice and experience sharing [18]. Dojos promote the exchange of experience and personal development of each participant.

In Dojo, a given problem is divided into small problems, or small goals. Dojo was not created with the teacher's role, but as a way to exchange experiences and carry out the work in a cooperative way, however, it can be adapted to the classroom. Dojo was applied to the Algorithms discipline, taught in a technical course in informatics. One of the problems encountered was the need of the student practice what was taught, which is abstract content. When the teacher presents the code of a computer program, the beginner cannot understand how the computer program represented by that code will work if he does not run it on the computer.

In the technical course in informatics mentioned, less than half of the students are interested in attending higher education or have a career in the IT area. So these students have less motivation to learn the technical disciplines in the field of informatics and end up not being interested by the practical

part of the course. For this reason, they end up producing poor exam results. To overcome these learning difficulties, Dojo was used with these students. One problem was presented by the teacher, who divided this problem into smaller problems. Only one computer was used in the lab. Each time a student assumed the role of "pilot" and typing in the computer the code to solve one of these little problems. Another student took the role of "co-pilot" and watch the pilot's work. The other students are the audience and should help the pilot by telling him what he should do. After a few minutes, the teacher asks students to exchange the roles. The pilot should return to the audience, the co-pilot takes the computer and another student from the audience assumes the role of co-pilot. The time that each student spends as a pilot depends on the number of students present in the class.

Students reported that they found Dojo positive because it allowed for mutual support. Those who had greater knowledge helped students with less knowledge, and who also assumed the pilot role. Students' grades improved after the adoption of Dojos. As a negative point, the students said that when the class is large, many people in the audience talking at the same time can disrupt the pilot. But over time, the audience improves in this regard, and pilot's job is facilitated.

Dojo could also be adapted for other laboratory disciplines such as chemistry and physics. The teacher can ask the class to perform an activity together making each student feel part of the completion of the task and learn from colleagues.

## IV. Discussion

During the course it was observed that the teacher should not use only one method. There are several ways to make classes more appealing and engaging for students, increasing the chances of developing a better learning process. However even engaging methods can become annoying if repeated too often. The teacher should use a variety of the methods. In this way, each student at times will be in his comfort zone and at other times will feel challenged and will understand that he can overcome challenges.

Importantly, it is not desirable that all classes are expository. But at times, it may be necessary for the teacher to give a lecture.

## V. Conclusion and Future Works

The Teaching course in Information Systems showed the difficulty of the traditional school to make classes appealing and engaging to students. Part of this difficulty is because in the traditional school, most of the classes are expository. It was also observed that in the lectures the student experience less learning, compared to other methods. Several teaching methods were presented in the course, some of which are also presented in this paper. During the course, it was concluded that the ideal is to combine different methods, making the student feel stimulated and challenged. It is further understood that the student should not be a hearer; he should be taken to participate in the knowledge creation process.

A future issue to address is how to make the most engaging class for the student? One should also think of ways to allow the student to propose a more interesting class that favors the learning process.

## References

[1] D. M. M. Leão. Paradigmas contemporâneos de educação: escola tradicional e escola construtivista. Cadernos de pesquisa, 107, p. 187–206. 1999. (in Portuguese).
[2] M. G. N. Mizukami. Ensino: as abordagens do processo. EPU. 1986. (in Portuguese).
[3] D. Saviani. Escola e democracia. 25a ed. 1991. (in Portuguese).
[4] F. Becker. O que é construtivismo. Revista de educação AEC, Brasília, 21(83): p. 7 - 15. 1992. (in Portuguese).
[5] B. Freitag. Aspectos filosóficos e sócio-antropológicos do construtivismo pós-piagetiano–i. GROSSI, EP, BORDIM, J. Construtivismo pós-piagetiano: um novo paradigma de aprendizagem. Petrópolis: Vozes, p. 26–34. 1993. (in Portuguese).
[6] J. Piaget and B. Inhelder. "psychologie de l'enfant (La)." (1975).
[7] W. B. Barbe, M. N. Milone, R. H. Swassing. Teaching through modality strengths: Concepts and practices. Zaner-Bloser. 1988.
[8] S. Messick. The nature of cognitive styles: Problems and promise in educational practice. Educational psychologist, 19(2):59–74. 1984.
[9] R. M. Felder, B. A. Soloman. Index of learning styles. 1991.
[10] V. Lindemann. Estilos de aprendizagem: buscando a sinergia. 2008. (in Portuguese).
[11] R. M. Felder, R. Brent. Understanding student differences. Journal of engi-neering education, 94(1), p. 57–72. 2005.
[12] B. Tucker. The flipped classroom. Education next, 12(1). 2012.
[13] F. G. Vargas. Sala de aula invertida. EI! Ensino Inovativo, Volume Especial. 2015. (in Portuguese).
[14] J. Kirriemuir, A. McFarlane. Literature review in games and learning. bristol: Futurelab. 2004.
[15] R. Savi, V. R. Ulbricht. Jogos digitais educacionais: benefícios e desafios. RENOTE, 6(1). 2008. (in Portuguese).
[16] S. Deterding, D. Dixon, R. Khaled, L. Nacke. From game design ele-ments to gamefulness: defining gamification. Em Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments, p. 9 - 15. ACM. 2011.
[17] T. Classe, R. Araujo. Gamificação para participação social em processos públicos: Mapeamento sistemático. Simpósio Brasileiro de Sistemas Colaborativos (SBSC), p. 130–137. 2015. (in Portuguese).
[18] D. T. Sato, H. Corbucci, M. V. Bravo. Coding dojo: An environment for learning and sharing agile practices. In Agile, 2008. AGILE'08. Conference, pages 459–464. IEEE. 2008.