The Contribution of CITs in the Development of New Pedagogical Practices

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Abstract:
The active learning methodologies correspond to a new teaching model built and based on the interaction and participation. In this context, we have the Blended Learning, a methodology that combines online ways of learning, by means of Distance Education and traditional. This study aims to present the contribution of the Communication and Information Technologies (CITs) on the application of active learning methodologies. Therefore, it was carried out a Bibliographic and Documental Research in two Virtual Learning Environment (VLE). The first, from a Higher Education Institute, in Brazil, that uses the Blended Learning, in the Flex modality, in which, some subjects are developed on-site and other, online, by means of a Virtual Learning Environment. On it, it is provided, for the students, the content of the subject online, video classes and exercises. Another Virtual Learning Environment presented is the one from University of Harvard, called Interactive Learning Toolkit (ILT) – created by Professor Eric Mazur and his team, for the development of the Teaching Methodology, called Peer Instruction, containing reading activities and exercises to be done before the lesson by the students. We verified that, in the Higher Education Institutes studied that the CITs have contributed for the knowledge transmission, being a support for the development of active learning methodologies, as in the Peer Instruction case, that uses the data obtained from the online activities to teach, in class, the knowledge in a collaborative way.

Keywords: Communication and information technologies CITs, active learning methodologies, blended learning, peer instruction

1. Introduction

The communication and information technologies, inserted into the society at the end of the 20th century, altered, significantly the way people relate to each other, changing cultures which were long settled. Education, in this context, seeks to reconstruct itself. Traditional classes, in which the teacher has the role of a transmitter of received information in a passive way by the students, were and are being reconfigured, aiming interactivity. In this scenario, active learning methodologies present themselves, in which the student has a relevant role in the process of learning how to learn. In this study, we try to present the contribution of communication and information Technologies in the application of active learning methodologies. For this purpose, it is discussed, initially, these new technologies.

2. Convergence of the Communication and Information Technologies on Education

Castells (2016, p. 1), in conducting an analysis of the impact of the society structured in net on the education, reports the it enables the transformation of information in knowledge and skills. In this context, the teachers are the leaders of this process. According to Moran (2012), the technologies enable an expansion on the concept of lessons, of space and time, of audio-visual communication, as well as they establish new bridges between the live and virtual.

Gruzd; Haythornthwaite; Paulin; Gilbert &Valle (2016) points out three possible reasons for the use of social medias in teaching, which are: the possibility to expose the students to the practices; expand the learning environment in terms of contacts, contexts and resources and the promotion of learning with social interaction and collaboration.

In this context are presented the Virtual Learning Environment (VLE) as technological tools, in which a great variety of practices and pedagogical and communicational attitudes are used, with practices that can be either instructive or interactive and cooperative (Santos, 2011)

The virtual learning environment are Learning Management Systems (LMS). They are "software designed to act as virtual classrooms and is characterized by the management of members, access and activities reports, promotion of the interaction among participants,

publishing of content". In its use for education, the VLEs provide the same resources as the Internet does, which are: mail, forum, chat, conference, resource bank. They differ from other environment on the web, for having its own dynamic, which attempts to meet the pedagogical aspect. To do so, on them goals are established to be met by the students, as well as providing feedback (Barros & Carvalho, 2011, p. 214).

Pretto (2013, p. 138), when analysing the form of use of technological resources on education, indicates the existence of the utilization as instrumentality, that "empties out these resources from their fundamental characteristics, transforming them into a sole animator of the old education", and the utilization as fundamental, which has in this perspective the role of transforming the school, becoming a centre that irradiates knowledge and leading the teacher to the modification of their posture, becoming a communicator, an articulator of these several sources of information.

3. Active Methodologies

The active methodologies appear with the purpose of making learning more significant, in the higher education institutions, by means of didactic innovations. In this sense, it is sought, in the didactic area, the development of actions which take the students to having a more independent and participative posture, promoting "the synthesis, analysis and evaluation of studied contents (Koehler; Sellmann; Silva; Bueno & Pinto, 2012, p. 76).".

According to Berbel (2011, p. 30), the active methodologies have as basis ways of developing the learning process, by means of real or simulated experiences, looking for the solution of challenges resulting from social activities. The attitude of the student, in relation to the new learning, must be one of engagement, seeking "expand their possibilities of exercising the freedom and autonomy in decision taking in different moments of the process that is lived, preparing themselves to the future professional practice."

In the active methodologies, what is expected from the students is that they learn how to learn, by means of the self-managing of the learning process, being co-responsible for their own process of formation. (Koehler; Sellmann; Silva; Bueno & Pinto, 2012)

Silva (2014) states some innovative options in education. Among them we have: 1) Design/Project/Problem Based Learning (PBL), learning based on the problem and project. Methodology used at Olin College, in Boston, and in Brazil, in the course of production engineering, of the Engineering College of Lorena of University of São Paulo; 2) Technology Enable Active Learning (TEAL). A TEAL Room was built by the Massachusetts Institute of Technology (MIT). 3) the Peer Instruction, created and developed in Harvard. Subsequently, it is present the pedagogical and strategic aspects of the active methodology of teaching, denominated Blended Learning.

3.1. Blended Learning

The Blended Learning is a modality of hybrid Distance Education, in which it is used, together, the online and live methodology, being that, in Brazil this approach is set out in Article 1 of the Ordinance 2.253 of 18th of October, 2001 (Brasil, 2001), that allows the Higher Education Institutions to "insert in the pedagogical and curricular organization of their recognized higher courses, the offer of subjects that, in their totality or in part, use a distance method", since it does not surpass the limit of 20% (twenty percent) of the course workload.

Initially, the term blended learning was associated with the traditional classroom, in which online activities were done, generally, with asynchronous work, that is, accessed by the students outside the class period, according to their time availability. The term, thus, has evolved, to embrace a set of learning strategies. Nowadays, a programme of Blended Learning can combine one or more dimensions, as outlined in Table 1 (Campos & Silva, 2016)

Learning Dimensions	Characteristics
Traditional and distance learning	In the simplest level, the blended learning combines ways of online learning, via Internet and the traditional, in a classroom.
Individual and Collaborative Learning	Individual learning is lonely and it is done in a controlled rhythm, whereas the collaborative implies the in a more dynamic communication among the students, sharing knowledge.
Structured and Non-Structured Learning	Learning with or without a structured programme, organized content, with specific sequence.
Personalized content and ready content	The ready content can, nowadays, be personalized, with a mixture of live experiences.
Practical learning and support to performance	Support to performance, upon tools that facilitates the execution of the adequate tasks.

Table 1: Blended Learning: combination of learning dimensions
Source: Adapted from Singh (2003 apud Campos & Silva, 2016)

Among the modalities of blended learning drawn by Staker and Horn (apud Campos; Silva, 2016) stands out the Flex Model, in which the teaching-learning is supported by content and instructions available, to the student, in an online platform, being the flexible part, the type of support received by the student in a live situation and the Rotation Model, which provides for the student the possibility of transiting through different types of learning. One example of the Rotation model is the Flipped Classroom. In it the content and the instructions are given in an online way, to the student, as an activity that precedes the lesson, being the lesson in the classroom intended for practical activities, such as, resolution of problems, elaboration of projects, discussions in groups.

The following is a study, performed by Campos (2012), related to the blended learning adopted by a private Higher Education Institution, located in Brazil.

It was verified that, the implantation of the methodology Distance Education (EAD in Portuguese), in the Institution, happen strategically, being adopted, firstly for the subjects that students failed and needed to redo, combining online learning with on-site classes. After a certain time, the classes, in this regime that students needed to redo the subject, have become entirely online. The same happening, afterwards, with a few regular subjects. Regarding the online subjects, the learning is structured, and, its content, made available on a Virtual Learning Environment (Campos, 2012).

The following is the architecture of the lessons, on the online screen, in the perspective of the teacher, responsible for the evaluation of the subject, taught in the Distance (EAD) modality, according to Campos (2012).

The teacher accesses the Virtual Learning Environment, via WEB, and is invited to select, among the subjects that have been given to them, which they will utilize at that moment.

After choosing the subject, the teacher has on the left side of the screen, three big topics: Content, Exercises and Student.

By accessing the link content, the teacher is invited to select the title to be taught. When accessing, for instance, the title Unit I, they will have the content organized, in its specific sequence: Text book, Slides of the lesson, Video lesson Part 1, Part 2 and Part 3. The booklet of the course is in the text book.

The slides are copies of the one used by the teacher in the video lesson. Yet, the video lessons are elaborated with an average duration of fifteen minutes, having as access way the Player Silverlight or the Player Flash.

The topic exercises, when accessed, open links to a series of exercises related to the content studied. These exercises are presented, in a multiple-choice format, in which the students have the possibility of making several attempts, being informed when they get the right answer.

One managing instrumental is presented to the teacher, in the topic Student, in which the teacher can consult the situation of the student throughout the semester. To do so, the teacher must inform the register number of the student, in the Education Institution. Besides that, the teacher, in this window, has access to all the students registered in the subject.

The communication of the student with the teacher/tutor is possible on the Virtual Learning Environment via email.

Comparing the architecture of the lessons in this Higher Education Institution, with: combination of learning dimensions of the Methodology Blended Learning, it was verified that:

- The Institution combines forms of online learning, via the Internet and the traditional, in a classroom.
- The learning, of the subjects taught with the Distance Education modality, is individual.
- The learning is structured, with an organised content, with specific sequence.
- The content is not personalized.
- The support to performance of the students occur, via email facilitating the adequate execution of the tasks.

The following is a teaching methodology, in the lines of the Flipped Classroom model, of the Blended Learning, which is the Peer Instruction.

3.2. Peer Instruction

Peer Instruction is an interactive teaching methodology that promotes an interaction in the classroom, engaging the students and approaching difficult aspects of the subjects studied (Watkins & Mazur, 2013).

The improvements seen with the Peer Instruction goes through the reading, the student, a text book, as well as a lecture elaborated by the teacher, about the difficulties found in the Reading, which makes the student deepen the comprehension and to build confidence, in addition to enabling the inclusion of further examples (Mazur,1997).

Per Vieira (2014, p. 23), the activities that precede the lesson consist of the solution of preparatory problems and of interactive expository lessons. The author cites the categorization elaborated by Novak and Middendort, of the activities of the teachers, who use the Peer Instruction, via web: "Preparation activities for the lessons; provision of texts about the practice and daily applications, with links to several websites, for a posterior reading by the students; Provision of simulations and lists of exercises, to completion [...] extra-class".

Crouch; Watkins; Fagen &Mazur (2007) states that the reading the student does before the lesson, in addition to preparing them better to use the material, in the resolution of the Concept Test proposed by the teacher, results in less time required, by the teacher in introducing definitions and basic concepts exposed in in way accessible, in the books. The authors highlight the fact that after the college graduation, it will be by means of reading that the student continues their learning process.

Per Araujo & Mazur (2013), in the Peer Instruction the teacher divides the lessons in little oral presentations, of approximately 15 minutes, directed to the main concepts. After that, with the purpose of evaluating learning, they present a question related to the more relevant concepts that have been introduced, normally, in a multiple-choice way, to be answered by the student in approximately 2 minutes.

After the question is answered, the voting is performed, which might be done by means of answer cards or transmission devices, such as the clickers, which are, generally, small portable units, with the approximate size of a mobile phone, used to send the answers via a keyboard, to the receiver of the teacher. This collects the answers and send them to the computer that processes the data in real time, allowing that the instructor knows how the questions have been answered. These can be multiple-choice answers, or even short answers, depending on the type of system used (Keough, 2012). These devices are considered as facilitators in the learning process, for enabling the participation of the students (Campbell; Monk, 2015), Duarte (2015).

Mapped the individual answers, in case there has been more than 70% of right answers by the students, the teacher simply explains the question and restart a new dialogued exposition of a new topic. Thus, in case there has been less than 70% of right answers, the teacher gathers the students together in groups of 2 to 5 people, using as a choosing criterion the position of people who have chosen different answers and requests that each student tries to convince their classmate of their choice. Normally, each group takes from three to five minutes, in this stage. Afterwards, the teacher re-opens the voting process and explains the question. In case the number of right answers, in the second voting, is lower than 30%, it is advisable that the teacher presents a new question about the same topic (Araujo & Mazur, 2013).

The ConceptTest makes it possible to occur the self-evaluation of knowledge by the students and an evaluation of the group by the teacher, as well as the discussion of the content in pairs, making the students learn with one another, articulating, in an oral way, their ideas and by that practicing the communication (Barros; Remold; Silva & Tagliati, 2004).

According to Crouch; Watkins; Fagen &Mazur (2007), there are several resources available for the implementation of the Peer Instruction in the courses, focused on education. Among them, there is the online interactive learning, denominated Interactive Learning Toolkit (ILT) and the Learning Catalytics. Both were developed by Mazur and his team, with the intention of facilitating the development of the Peer Instruction.

The ILT, available on the Harvard University website is a system of learning management, with register of copyrights in 2002 and 2006, as ILT-BQ Consortium, which is part of the ILT-BQ software package. It can be used for the course management, by means of tools that help organize and design courses, links, lectures, attributions, question and answer, reading boards and participation in class, in addition to providing a database containing several ConceptTests. It was created to encourage the enhancement of the communication between the teacher and the students, as well as aid the students in the comprehension of the course concepts (Interactive Learning Toolkit, 2016).

The following is a brief description of some functions provided by the ILT:

- Lectures
  Per Crouch; Watkins; Fagen &Mazur (2007), the lectures can be used to project each class meeting and are linked by dates. With the database, the instructor can prepare their lesson, choosing which ConceptTest can better probe the student comprehension of the reading. It can also generate a set of slides with all the ConceptTests.
- Reading module
  The Reading module provides resources to help create and post material for reading before the class and attributions. These attributions are anchored to the dates and times of the lectures. The students can see tasks and their deadlines. The instructors can see again all the students' responses to a given question quickly, getting to know the common deficits of the class. In this way, the ConceptTests can be chosen beforehand to reach the content areas that the students proved to have more difficulties. The ILT allows, also, that the instructors respond to questions and doubts expressed by the students, via a web interface, raising, the individual interaction of the student with the instructor (Crouch; Watkins; Fagen &Mazur, 2007)
- Standard Tests
  Fagen; Crouch; Mazur (2002), in a survey carried out, with instructors, who use the Peer Instruction determined that most of them use the methodology to teach physics, and that they indicate as challenges for its implementation, the development of ConceptTests. The fact that there is an online database which provides several ConceptTests, minimizes this problem.
  Crouch; Watkins; Fagen &Mazur (2007) report the ILT enables that the students respond to the ConceptTests from several wireless-enabled devices, such as cell phones, laptop computers or PDAs.

When the Peer Instruction is complemented with other strategies, such as the ones provided by the ILT, which increase the student's involvement, each element of the course end up actively involving the students (Crouch; Watkins; Fagen &Mazur, 2007).

4. Conclusion

The incorporation of Communication and Information Technologies in education has enabled the emergence of new teaching methodologies, which sought to overcome the practice of knowledge transmission, present on traditional methodology, introducing teaching models, in which the construction of knowledge occurs in a collaborative way.

Despite the advances in the pedagogical practices induced, by the incorporation of digital media, as well as the creation of Virtual Learning Environments (VLE), not all the developed systems reflect a change, to an active methodological format of teaching. Many of the advantages enabled by the Internet, such as the creation of communication nets, are not yet duly explored.

The Blended Learning approach is present in the Distance Education context. It is used concomitantly on-site and distance education, enabling the creation of hybrid courses. In this approach, it is possible to find several models, such as the Flex, in which the teaching-learning is structured and available to the students by mean of an online platform, and the rotation model, of which the Flipped classroom is part of. An example of a class that uses the Flipped Classroom is the Peer Instruction methodology.

This study aimed to present the contribution of the communication and information technology in the application on active learning methodologies. Therefore, it was presented, in the context of the Blended Learning approach, two learning management platforms. The first one, employed in a Higher Education Institute, in Brazil, that uses Blended Learning in the Flex format. For the format as the platform is structured, we can verify that the Institution presents its courses/subjects in the traditional teaching way, in which the contents are available in video classes, such as lectures, and it is the responsibility of the students only to access the contents and solve the exercises.

The second platform, of Harvard (EUA), is used on the application of the Peer Instruction teaching methodology. In the historical context of its creation, we verified that, initially, some communication and information technologies were used, such as the laptop computers and the clicker. However, they restricted the application format of the ConceptTests, once only multiple-choice questions were possible.

For the improvement of the methodology, professor Mazur sought, on the new communication and information technologies (CITs), tool that could enable a greater management of the process, as well as the flexibility of the application form of the questions (ConceptTests), resulting in the creation of the Interactive Learning Toolkit (ILT) and the Learning Catalytics.

We conclude that, in the Institution that uses the Flex model, of the Blended Learning, despite all the process happening in an online way, the learning process follow the traditional teaching methodology, in which it is not observed a preoccupation with the knowledge construction in a collaborative way. However, in the Institution that uses the Peer Instruction methodology, the Communication and Information Technologies are used together with live activities and apart from enabling the interaction of the participants, they contribute for the generation of interactivity, by means of their attribution modules and forum.

5. Acknowledgements

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