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LEARNING ECOSYSTEM FOR HIGHER EDUCATION DISRUPTION: A NEW APPROACH PROPOSAL BASED ON BLENDED ACTIVE LEARNING TECHNIQUES

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Abstract

The paradigm in higher education is changing due to the pressure imposed on the one hand by the new technologies and on the other by the characteristics (habits and skills) presented by the students who arrive at the universities. These characteristics are not compatible with the teaching methodologies used up until the present, the traditional model (lectures) consolidated in the nineteenth century. Thus, teachers using active learning have attracted much attention because they stimulate motivation and autonomy to achieve more competencies on the part of the students and are aligned with the guidelines, for example the European Standards and Guidelines for Quality in Higher Education. In order to respond to these new challenges, an innovative pilot project was developed, from the pedagogical point of view, implemented in a 1st Cycle course (Management and Information Systems) and using various active methodologies. In this context, a model composed of three Active Learning techniques (Group Project, Peer Review and Peer Teaching) was developed and implemented within the framework of the “New Tendencies in ITs” course, 1st semester, 2nd year, called ECLECTIC approach. The results obtained are very promising, because they have allowed students to engage in and out of the classroom and have resulted in an approval rate of more than 80%.

Keywords: Disruption, Learning ecosystems, Active learning techniques, Higher education.

1 INTRODUCTION

Information technologies are the essence of up-to-date organizations in general, and higher education institutions (HEI) in particular. Changes in this field are occurring at an uncontrollable pace, interrupting traditional models and forcing organizations to implement new models. According to Holzinger et al. [1], the organization of learning is changing with the introduction of technology in educational institutions, for example in learning activities. The same literature also points out that the correct use of most technologies stimulates the learning environments and promotes student motivation, being these important factors, determinants for learning. This is because attracting and motivating NetGen people constitutes challenges for educators around the world [2]. The integration of technological innovations with the new practices can enable significant advantage. On the other hand, the present students, named generation Z, who reach HEI, force a disruption in teaching process. In this context, it is justified the need to introduce new paradigms in the teaching-learning process (TLP).

This expectation of change is directly related to the fact that the expository experiences centered on the performance of teachers in the classroom still present a predominant style [3]. Therefore, the need to reinvent education is latent, since this instructional model, consolidated in the nineteenth century, *“has now also to meet the demands and needs of a democratic and inclusive society, permeated by differences and guided by the inter, multi and transdisciplinary knowledge, with which we live in this early 21st century”* [4]. This change is necessary because as stated by Chickering and Gamson *“Learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing prepackaged assignments, and spitting out answers. They must talk about what*

they are learning, write about it, relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves" [5].

In order to meet this need, in the last decade, according to Freeman et al. [6], classes that resort to active learning have attracted a great deal of attention, since they stimulate students' motivation to seek to build higher competences. According to [8] *"In the context of new pedagogical trends, the Active Methodology is one of the possible strategies, for which the student is the central protagonist, that is, responsible for his/her educational trajectory and the teacher is as a facilitator of the experiences related to the learning process"*. However, *"literature rarely identifies the key elements of pedagogical innovations or explains how to implement them in the classroom."* [7].

The active learning methodologies [9] [10] [11] [12] are, in turn, student-centered approaches in that they transfer to those the responsibility over the management of their learning experience. It is advised to place students often in a situation of collaboration with classmates. In an active learning situation, teachers assume the role of facilitators or mediators rather than information providers in a unidirectional way. The presentation of facts, often introduced through direct reading, is mitigated in favor of class discussion, problem solving, cooperative learning and writing exercises (classified and unclassified). Other examples of active learning techniques include role-playing, case studies, group projects, or role-reversal dynamics such as think-pair-share, peer teaching, debates, Just-in-Time Teaching, and small practical demonstrations followed by class discussion.

In this paper, a validated approach will be presented through a case study, in which an innovative learning approach developed to a curricular unit of a 1st cycle course was introduced. The proposed approach took into consideration, in addition to the motivational aspects, the fusion of several learning strategies for the development of new competences, framed in the current and future moment, in which the digital transformation predominates. The new approach was coined as **LEarning eCosystem bLEndEd aCTive teChniques** (ECLECTIC¹). The developed and validated approach (empirically) encompasses several learning techniques: Group projects, Peer review and Peer teaching. The operation process consists of six blocks: (i) Group compositions; (ii) a Mini-lecture in which the professor gives a ten to twenty-minute presentation on a particular topics; (iii) Group projects – research on the theme for the construction of a small theoretical project; (iv) Peer review – evaluation of projects, with this evaluation being part of the final assessment of each members group; (v) Peer teaching – the projects presentation and teaching of this topic to the remaining students; and (vi) process control. At the end of the semester the projects produced are shared by all students and are used as study basis material for the final exam. The results obtained, with this new approach, allowed to promote students' engagement inside and outside of the classroom and achieve an approval rate of over 80%.

The paper is organized as follows: in section 2 the background of active learning techniques is presented and discussed. The ECLECTIC approach is presented in section 3. In section 4 is presented the analysis and discussion of results. Finally, section 5 presents the final conclusions and some directions for future work.

2 BACKGROUND

2.1 Active learning

Active learning is currently considered an effective strategy to promote learning as it seeks to provide identification with students and their cultural and digital practices.

The first approaches to active learning have been recorded for more than 20 years [5]. Chickering [5] identified the use of these strategies as a fundamental part of good teaching practice. There are several authors in the literature who define the concept of active learning, namely Vos and Graaff [13], that identify the concept of active learning as an effective teaching methodology to stimulate students to become actively involved in their own learning, to achieve complex goals, to think critically and to solve problems. Gudwin [14] state that active learning is *"the technical term for a set of pedagogical practices that address the students' learning process under a different perspective from that of classical methodologies"*. Konopka, Adaime, and Mosele [15] defined active learning as *"the process of acquiring knowledge, skills, values and attitudes by any educational strategy that involves or*

¹ ECLECTIC – according to Cambridge dictionary is "Methods, beliefs, ideas, etc. that are eclectic combine whatever seem the best or most useful things from many different areas or systems"

engages students in the process by leading them to activities and debates, instead of just putting them in the position of passively listen to the information given by the teacher."

According to Freeman et al. [6] *"Active learning engages students in the process of learning through activities and / or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work."* By opposition, Bligh [16], states that traditional lecturing could be defined as *"...continuous exposition by the teacher."* Under this definition, student activity is considered as limited to taking notes and / or asking occasional and unprocessed questions by the instructor. To counteract this tendency, according to Duron, Limbach and Waugh [17] university should offer multiple opportunities for students to engage in the analysis, synthesis, and evaluation levels of Bloom's taxonomy, since active learning at these levels (analysis, synthesis, evaluation) helps students to think critically – one of the skills suggested as fundamental for the 21st century[18].

Activities that constitute active approaches seek to promote a higher level of learning by emphasizing students' abilities / skills to control their learning environments and to develop interdependent or cooperative relationships with their peers. According to [19], active learning promotes a higher level of learning through the process of metacognition. In this context, Kane [20] defined a set of characteristics that characterize Active learning: 1) active engagement of students in learning, 2) students taking responsibility for their own learning, and sometimes for the learning of others, 3) teachers providing activities that facilitate active learning, instead of simply transferring information.

2.2 Group projects

Group projects can be defined as a learning tool that encourages collaborative work [21]. Group projects have been used for a long time in face-to-face classes with the aim of contributing to the improvement of students' cognitive learning. In addition, group projects provide not only practical experience, but allow students to practice the concepts learned, to be creative and to understand group dynamics [22].

Group projects thus contribute to helping students develop skills that are increasingly required in the professional context [18], [23], [24]. According to [25], [26], [27] the use of group projects is an irrefutably positive practice that contributes to the learning, retention and success of teaching in the context of higher education.

According to Park et al. [28] group projects also contribute to living positive emotional experiences, since in the course of a project, as students' perception of group harmony and positive social goals increases, their engagements with the group design as well as their positive emotional experiences also augments.

2.3 Peer review

Peer review is defined in [29] as a teaching strategy that involves the active participation of one student in the formative assessment of another student's work. In this context, peer review allows students to experience the *"collaborative process of construction and refinement of knowledge, the subjective nature of evaluation and peer review, and the role of creativity in research"* [30]. The peer-reviewed base format allows students to evaluate written work by other students and make suggestions for improvement. Peer review can be done in class and / or outside of class.

Prins et al. [31] argue that peer assessment is an effective way to help students develop the ability to provide valuable feedback and suggestions for performance improvement to another person or group in any situation. Students develop core or key capabilities, such as abstraction, argument development, assessment, critique, analyzing, and proofreading. With these capabilities, students find engaging ideas, ponder important issues, and develop critical thinking skills.

According to [32], the peer review technique can be applied to a wide variety of activities, for example *"to review research papers, to research lecture material, to annotate lecture notes, to make up original problems, to review other students' designs, and to weekly reviews in independent-study courses."* Students contrast the formative process of peer evaluation with other assessment approaches used in higher education for purely summative purposes. Peer assessment helps students identify their strengths and weaknesses, develop and manage their learning processes and work to achieve the learning outcomes specified during the learning process itself [33].

Before being implemented, the peer review process should be explained to the students – who, what, when, how and why of the collaborative experience, as well as the evaluation criteria, so that the activity is effective [34].

2.4 Peer teaching

According to the literature, the peer teaching method [42] is a very relevant approach given the benefits recognized at different levels. For educational institutions, peer teaching can be used, even with limited faculty resources, without compromising the quality of teaching. Student-centered design in peer teaching activities, along with the active role of students in the learning process, helps to shift the focus from passive apprentice to active apprentice and increase student cohesion [43]. The main benefits of peer teaching, according to Briggs [44] include the following: *"Students receive more time for individualized learning; Direct interaction between students promotes active learning; Peer teachers reinforce their own learning by instructing others; Students feel more comfortable and open when interacting with a peer; Peers and students share a similar discourse, allowing for greater understanding; Peer teaching is a financially efficient alternative to hiring more staff members; Teachers receive more time to focus on the next lesson."*

Ramaswamy et al. [35] claim that peer teaching has been widely used in education to improve student learning. Secomb [36], for his part, points out that there is clear evidence that peer teaching methodology is effective on a wide range of objectives and content. The use of peer teaching benefits students by taking on the role of teachers, since preparation for teaching involves an in-depth study of materials through analysis and selection of key concepts that will be taught in their own words. This methodology describes a collaborative and cooperative teaching and learning strategy where students are active and equal partners, self-directed, participate with interventions and participate actively in the discussions [37], [38].

Currens [39] states that *"peer teaching and learning was first conceptualized by Bell in the eighteenth century"*. Topping [40], for its part, argues that peer teaching originates in the ancient Greeks. However, according to [41] the first documented use of this methodology occurred in New York City as a method called the "Lancastrian system".

3 LEARNING ECOSYSTEM BELT APPROACH

3.1 Rational

During the academic year 2017/2018, in the context of a pedagogical training on Active Learning, promoted by the Center for Excellence in Teaching of the Portuguese University (CET-UPT), in July 2017, the challenge was to develop an innovative pilot project. The innovative character would have to be from the pedagogical point of view, applied to the course "New Trends in ITs", of the 1st semester, 2nd year in the course of 1st Cycle in Management and Information Systems. In this context, and as a result of this training, a model, ECLECTIC approach, was developed and implemented, supported by three Active Learning techniques – Group Project, Peer Review and Peer Teaching. Within this curricular unit, the student is expected to be able to: (i) To know the emerging technologies and associated business models. (ii) To know the trends of adoption in the organizations, to analyze the strategies of their adoption and evaluated impacts. (iii) Acquiring the ability to analyze the challenges to business processes and the future of information systems in organizations. (iv) Acquiring research capacity, systematization and knowledge structuring.

3.2 Project description

The organization of the semester, which includes information on key aspects of the pilot project, consists of several phases. In a first phase, the Active Learning techniques to be used were selected taking into account the type of subjects taught and the number of students enrolled in the curricular unit. The number of students enrolled was positive, because only nine students attended the course, which made possible to carry out a pedagogical experience in a controlled manner given their reduced number. With regard to the topics taught / programmatic contents of the curricular unit are based on the expression "New trends in IT", which immediately indicates the need to not resort to traditional classes due, for example, to the absence of literature / reference manuals. Thus, the possibility of electing some of the trends in IT (Cloud Computing; Mobility; Industry 4.0; Big Data; BYOD; Augmented Reality; Virtual Reality; Gamification; Internet of Things; Telemedicine; 3D Printing;

Privacy / Security; Smartphones; Wearables; Digital Transformation) allowed the organization and operation of the curricular unit in a different way.

The selection of the Active Learning techniques took into account the presented factors, as essences, and in parallel the competences that the students will have to possess in the 21st century [18]. Thus, in order to respond in the best way to the factors listed, three techniques were selected: Group Project, Peer Review, and Peer Teaching. The three techniques were described in section 2, and in parallel the positive contributions that each offered in the overall context of the ECLECTIC approach were also presented. In the course design, two evaluation instruments were also defined: a grid for peer review evaluations, and a grid for oral evaluations during the use of the peer teaching technique. All documents were evaluated by the teacher of the course, with the final grade consisting of a set of components related to the various projects and the outcome of the final exam.

3.3 ECLECTIC approach components

As presented previously, three Active Learning techniques were selected to be used during the semester consisting of sixteen weeks. These techniques are used together in a predefined sequence (Group Project, Peer Review and Peer Teaching) for each of the group projects carried out. The accomplishment of each of the group projects is preceded by the creation of the working groups and by a short lecture where the topics assigned to the working groups are presented.

The semester is divided in blocks of four weeks, in which each block represents the application of ECLECTIC approach (Figure 1). In the first class of each block, the groups (3 elements in each group) are constituted by the teacher and the assignment of one of the topics listed in section 3.2 (1). In the next phase (2), a short-lecture on each of the subjects assigned is carried out by the teacher. In phase (3) the guidelines of the Group Project technique are explored, always with the supervision of the teacher when the students are present in class. At the end of this period, students submit their work through the LMS Moodle. After this moment, the second phase of the project is started using the Peer Review technique (4), by assigning the works submitted to different groups.

The groups review the papers (using the Peer Review techniques of a scientific paper) and complete the corresponding evaluation grid. At this stage, the teacher evaluates the work and evaluates the revisions presented by the students. The revisions are sent to the authors of the works and they have to make corrections / changes suggested by their peers, after the supervision of the teacher, who analyzes and verifies the proposed changes. The groups submit the final version in the LMS Moodle. In the penultimate phase (5), teaching sessions are held by the students to the other students on the topic they worked; at this stage the technique Peer Teaching is applied. This activity is assessed through an evaluation grid indicated above. During each block a Process Control (6) is performed in order to verify how each technique that constitutes the ECLECTIC approach is being applied and meets its purpose. At the end of this session, a new block begins with the redistribution of the elements of each group, to ensure that practically all the students worked with all. At the end of the four blocks, the final versions of all papers are grouped together and presented as conference proceedings. These proceedings are the study material that students have to prepare for a final exam.

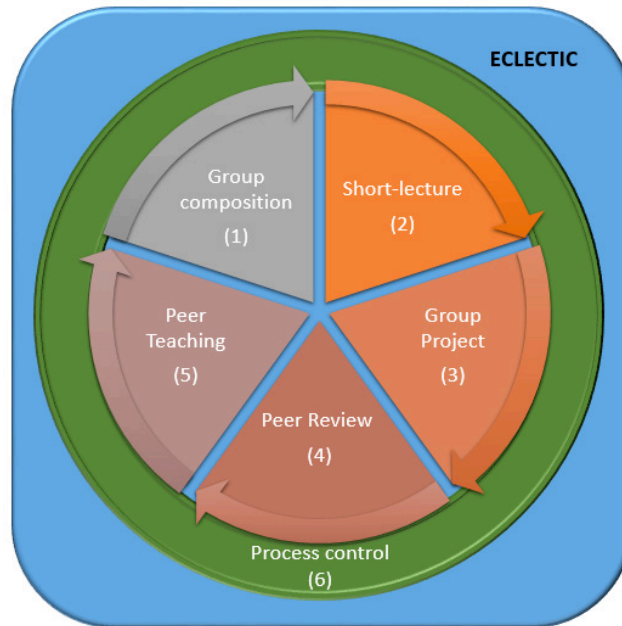


Figure 1. ECLECTIC approach.

3.4 Milestones and Assessment

The work is monitored on the basis of Milestones ($M\#^n_m$, with " n " representing the project number, and the " m " milestone for delivery or evaluation of project " n ") (figure 2). These moments are constituted by the presentation by the teacher ($M\#^1_n$), by the submission of the report ($M\#^2_n$) in the LMS Moodle, by the peer review of the works ($M\#^3_n$), and by the use of the peer teaching technique ($M\#^4_n$) by the groups. In addition to this objective, they aim to provide students with moments of feedback allowing a dialogue between teachers and students and among students.

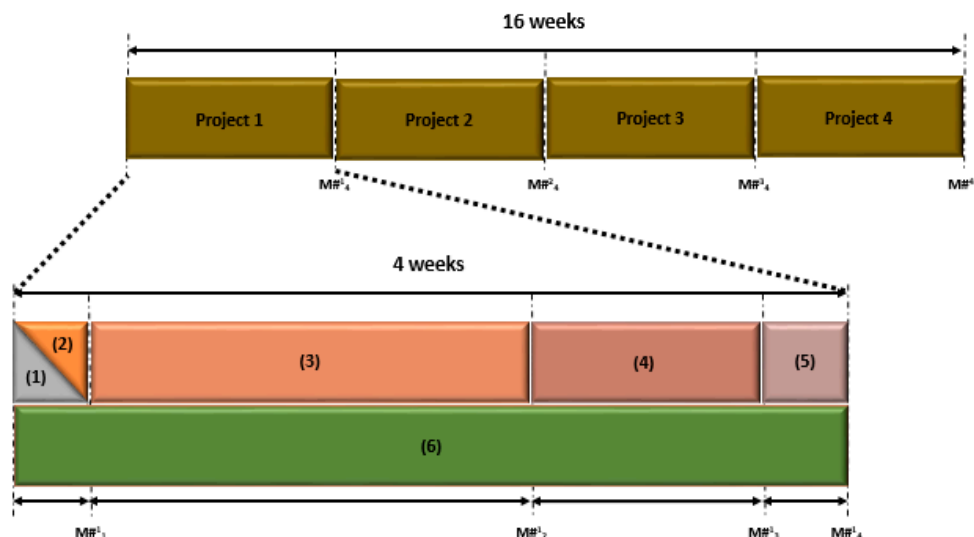


Figure 2. Milestones and Assessment.

The pedagogical strategies used in the classroom context are the combination of the expositive and active method. The lectures (called short-lectures) aim to present the themes attributed to each working group. All students are encouraged to do reading exploration activities, consult databases, namely the use of B-on (www.b-on.pt), and feedback from the teacher, in the light of the work to be done, in the context classroom work, and / or work done outside the classroom. The active method is achieved through the use of the three active learning techniques already mentioned.

As regards the evaluation elements, these are distributed at different times and designated by milestone M_n (with "n" representing project number), throughout the semester and by a final exam. The final grade of the student results from the classifications of the four projects (60%, with a weight of 15% each project) and a final exam (40%), allowing different final classifications for each of the students. The evaluation elements of each project are as follows: Report_#1 (50%), Revision_of_Other_Report_group_#2 (30%), Presentation/Teaching_#3 (20%). The final exam dealt with the themes of the projects compiled and made available to students.

4 ANALYSIS AND DISCUSSION OF RESULTS

The results of the operation of the curricular unit had two moments, at the beginning of the ECLECTIC approach, and at the end. In the first phase, students' expectations regarding the application of active learning techniques were evaluated. In the end, an evaluation was made regarding students' perceptions.

The data were collected through the use of two questionnaires (adapted from [45]), the first with five open questions and the second with 32 closed questions (in these questions we use five-point Likert scale ranging from "Strongly Disagree "(1) to" Strongly Agree "(5)) and three open questions. The study sample consists of nine students where the most respondent's gender were male (88.8%) whereby, the majority of students were aged between 18 to 21 years old.

4.1 Students expectations

Following a presentation on the ECLECTIC approach, explaining the objectives to be achieved with this pedagogical experience and the evaluation elements and their weightings, a survey was carried out, with five open questions, to gauge students' expectations. The questions included in the questionnaire were (adapted from [45]): (i) What motivated me the most in the project presented? (ii) What aspects do you consider to be the most positive in the development of learning activities supported by the ECLECTIC approach? (iii) What do I hope to learn from this pedagogical experience? (iv) What are the main difficulties I envisage? (v) Observations / Suggestions.

The obtained results were very interesting due to the innovative character of the experience for the students, since they were accustomed, in most cases, to attend curricular units where the programmatic contents are taught through the expository method.

From the results obtained, it is possible to highlight the motivation found in the majority of students regarding the possibility of exploring innovative topics in a teacher-led way, including the participation of each one of them in the process of reviewing the work of colleagues. Another of the results that motivated the interest in this ECLECTIC approach was the possibility of being able to teach the remaining elements of the class the contents that they studied and, finally, to be the ones to produce the program contents to be used in the final exam.

However, the students presented some apprehension about this pedagogical experience due to the absence of practice in the elaboration of written works in the form of essays, the revision of the works of the colleagues and, finally, to assume the role of teachers in the teaching of the studied subjects. Another of the issues pointed out, as a possible difficulty is teamwork and team change between each of the projects. The last question had no answers.

4.2 Final assessment

The evaluation of the application of the ECLECTIC approach, according to the students' perspective, was carried out through a questionnaire with 32 closed questions and 3 open questions. This questionnaire was answered in the last class of the semester after the presentation and discussion of the last project. Responses were obtained from all students (N = 9), who were involved in this pilot project. Due to the limited number of pages, only the questions "2 – *During the semester I played an active role in the groups*", "3 – *The presentations at the end of each project helped me to prepare for the final exam*", "5 – *The classification obtained in each project should be the same for all elements of the group*", "8 – *With the projects, I acquired and developed project management skills (research capacity, decision, organization, problem solving, time management)*", "19 – *The teacher's feedback on the presentations and the reports was useful*", "24 – *The ECLECTIC approach allowed me to better understand the contents of the course*" e "32 – *I believe that the ECLECTIC approach contributed to reduce failure in the curricular unit*".

The common characteristic defined in [18] and [46] is that the student plays an active and autonomous role in their learning, which was confirmed by the number of answers obtained in question (2), where 8 students pointed out option 4, and 1 student indicated option 5. This result confirms that this approach contributed to the development of students' autonomy.

Given the innovative character of the developed approach it was important to determine if the way the projects were organized would contribute to the development of study materials for the final exam as well as to the success of the curricular unit. Questions (3), (24) and (32) clearly indicate the contribution of this approach to the success of the curricular unit. Regarding the preparation for the final exam, 3 students marked option 4, and 4 marked option 5, that is 77% of students agree, or fully agree with affirmation. Questions (24) and (32) serve as a confirmation, since in question (24) 78% of students agree or fully agree with statement, and finally in question (32) 89% of students agree or fully agree with affirmation.

One of the issues involved in this issue is evaluation, and if students' autonomy in their learning was stimulated, students pointed out that the classifications should be different for each element in each project. Confirming this trend, 89% of students fully disagree when they answered the question (5).

Finally, the role of the teacher in active learning changes completely, passing from just a transmitter of knowledge to a mentor of learning. In this context, the results obtained in question (19) are very significant, since 56% of the students indicated Agree, and 44% of the students pointed out Strongly Agree. Thus, it is thus confirmed that the role of the teacher in providing feedback on the work done is an added value for progress in the quality of student learning.

5 CONCLUSIONS AND FUTURE WORK

In the current context of teaching, traditional lessons, consolidated in the nineteenth century, remain the predominant style (expository method). However, this approach is increasingly viewed as one of the problems of the current teaching system and is offering resistance in adaptation to the requirements of the 21st century. Thus, in order to meet the need for change, the lessons that use active learning have attracted a great deal of attention, since they stimulate the motivation to achieve more skills on the part of the students. However, this change requires a change in attitude on the part of teachers regarding the methodologies used in the teaching-learning process.

In order to respond to the needs listed above, an innovative pilot project was developed, from the pedagogical point of view, in the 1st Cycle course in Management and Information Systems. Thus, a model built by three Active Learning techniques (Group Project, Peer Review and Peer Teaching) was developed and implemented, in the course "New trends in ITs", of the 1st semester, 2nd year, designated by ECLECTIC approach.

Based on the results presented and discussed in the previous section (only 7 question of 32 questions were analyzed due to the limitation of the number of pages), it is verified that the issues related to autonomy, individual evaluation and success in the curricular unit were largely achieved by students. The change in the role of the teacher, adapting the profile of tutor, rather than transmitter, was very positive in the progress of student learning. Finally, the construction of study materials for the final exam of the course unit by students was one of the characteristics (among others) of this project that makes it more innovative, since the success rate of the curricular unit was higher to 80%. However, the results obtained show a limitation, which is the reduced number of students.

As a final conclusion, we can state that the results show that it is possible to take (controllable) risks and diversify the teaching methodologies by making use of several, creating new approaches in order to improve students' learning. In this context, the ECLECTIC approach will be applied in the academic year 2018-2019, with the improvement of aspects related to the peer review technique in order to ensure that the revisions are more independent due to the fact that the students know each other, and the number of students be reduced.

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