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Online course design: the crucial role of teachers in building online learning space

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ABSTRACT: *The e-learning courses are currently handy tools in education, reducing the distance between students and teachers, and providing better monitoring methods. The supported systems can play a particularly important role in programming courses, due to the need that students master new programming languages to code algorithms.*

Despite the relevance of technologies, teachers' role in this paradigm also stands out because they assume themselves as the link between the entire learning process. Rethinking the design of classroom courses for online courses brings new tasks for teachers who act as facilitators of both active and student-centred learning.

In this article, we intend to highlight the structural presence of teachers in the construction of online spaces for learning experiences, with an algorithm proposal (step-by-step) to carry out the bi-weekly cycle to promote interaction between peers. In higher education, student involvement occurs in a motivating manner by developing short iteration cycles of teaching + autonomous learning + formative assessment. The teachers adopt a coaching approach, verifying each of the students or groups' evolution and promoting greater motivation for active learning, more suited to the spirit of Bologna.

KEYWORDS: *Interaction, E-learning, online learning space, web programming teaching*

1 INTRODUCTION

The urgency of thinking about other teaching approaches that are not exclusively face-to-face, in the short and medium-term, the need to realign pedagogical methods and practices supported by information technologies correspond to new challenges in the organization and evaluation of higher education courses. Taking into account the structure of in-person courses, with a high face-to-face component based on cycles of theoretical and theoretical-practical classes (most of them), adapting to the online mode implies knowledge and application of some concepts for establishing a learning community with students and teachers: teaching presence, cognitive presence and social present [1].

Throughout this article, we present the developed approach in the Web and Multimedia II (WMII) curricular unit of the Degree in Multimedia Engineering (LEM) at ISTEC-Porto, a discipline

taught in the second semester of the 1st year of the course. The rethinking of the current teaching process is necessary to promote the teaching process's emancipation to other spaces of interaction between the learning community's authors. Furthermore, the role of the teacher remains central to keeping students at the center of learning.

This article is structured in five sections, starting with this introduction. Section 2 focuses on state of the art, both at the level of the foundations of computational thinking and web programming, and fit with active learning to leverage a transition to other modes (online or b-learning) in this course. Section 3 describes one face-to-face course design, and section 4 proposes an algorithm to proceed in each module as a biweekly cycle of learning experiences for adapting to online mode. Finally, section 5 presents the conclusions.

2. STATE OF ART

Teaching the fundamentals of web programming is a process that requires student emancipation to adapt to a study method that promotes greater autonomy for the acquisition of cognitive skills, which fall under what to define as Computational Thinking [2]. The programming learning process is highly complex [3], which causes specific difficulties studied for several years [4][5]. Even though Jeannette Wing defined computational thinking in 2006 [2], the term was previously published. The key to computational thinking is "abstraction"; that is, how the problem's essentials are grasped and decomposed into subproblems until they find solution patterns, where automation is more straightforward through an algorithm.

In this context, the four main cognitive processes stand out:

- Abstraction - Focus on the most relevant information while ignoring superfluous implementation details.
- Decomposition - Address a problem by decomposing it into more straightforward and more accessible to solve subproblems.
- Creation of algorithms - Develop a detailed solution to a problem, step by step.
- Pattern recognition - Identifying similarities between problems helps to find standardized solutions.

Another topic to discuss is the design of distance learning courses and the teacher's role. Distance learning courses present several aspects which articulation represents both complexity and challenge in its design, as in teaching. The authors [6] refer to this issue with the teaching presence concept. This concept integrates a multifaceted triad (teaching presence, cognitive presence, and social presence) that establishes a theoretical framework for the design of non-classroom courses. These three areas help the purpose of achieving the learning objectives. While teaching covers the course design, selecting technologies, and learning modes of learning, considering student discussion and motivation activities, cognitive presence affirms critical thinking. Thus, learning occurs through the construction and confirmation of meanings/knowledge, supported by reflection and speech. Finally, the highlight is the importance of social presence in the learning community. Each student prints a motivating and communicative presence between peers

and teachers, affirming their online space characteristics in their learning experience. This model is called a Community of Inquiry and ensures that the teacher's role maintains loyalty with the one taken in the classroom. The context changes, but the design process, facilitation, and direction of cognitive and social processes to realize personally meaningful and educationally worthwhile learning outcomes remain on the teacher's side. The changes are as following: proceeding way with both created contents and interlocutors, with reinforcement in communicating between the participants.

The teacher's presence measures all components of a course (the dialogue between and among teacher and students and includes course readings, web explorations, exercises, and individual and collaborative projects), without forgetting that learning is student-centred.

Creating online spaces for learning experiences is also very important, where the rule is to facilitate interaction among students. Communication is a foundational element of educational theory [7]; students can feel confused and discouraged without clear communication. The teacher must keep an eye on this communicational aspect and equip himself with a set of procedures / acceptable practices to keep students connected to the community created in the meantime.

The authors [8] talk about five acceptable practices for maintaining online space as a learning experience:

- Clear Communication
- Types of Communication and Interaction
- Humanizing Online Learning
- Synchronous Interactive Sessions
- Dealing with Student Issues

Comparing the teacher's roles mentioned by [1], on the Community of Inquiry framework (Teaching presence concept) with the acceptable preview practices, there is a commitment to the design of solid online courses. The conception and design of online courses must have the teacher as a facilitator of the interaction, with a strong focus on the student-student interaction. This role reaches by creating discussion groups of each virtual class, implying their prior planning and strategies activation of learning, stimulating students' initiative and involvement, and guaranteeing their commitment and guiding the nature of their work.

3. ANALYZE OF FACE-TO-FACE COURSE DESIGN

This section analyzes the programming teaching course structure, specifically, Web and Multimedia II, where the learning objectives correspond to the acquisition of knowledge of building dynamic websites with the appropriate web technologies. With this analysis, it intends to establish as a starting point the context of the curricular unit and the design of the learning structure: objectives, content, and both formative and summative activities.

3.1 Context of the course

Web and Multimedia II is a curricular unit of the 2nd semester of the 1st year with 4 ECTS with 60 hours of theoretical-practical contact in 108 hours, with a total of 4 hours of theoretical-practical classes per week. According to the academic calendar of the institution, classes run for 15 weeks.

The discipline has a distributed evaluation with a final exam, composed of components of continuous assessment

(AC) through 3 practical assignments and a final exam (EF). The following expression gives the formula for calculating the final grade:

$$Grade = AC * 0.40 + EF * 0.60$$

The primary bibliography is made available on an LMS platform that allows for phased learning in discrete work modules of 2 to 3 hours, in autonomy, thus facilitating the adoption of a more active learning methodology.

3.2 Design of the learning structure

The programmatic contents proposed for teaching web programming are HTML, CSS3, and JavaScript, reflecting its learning objectives. Students should start by learning how to create and format web pages using the HTML formatting codes. The next step is to apply styles using the resources provided by the CSS3 language. The JavaScript language is presented in the context of execution by the browser's JavaScript engine. From this stage, students must know to enable them to develop web applications using the primary programmatic interfaces, namely audio and video, canvas, web storage, drag and drop, geolocation, and WebSocket.

As for the teaching methodology, the presented contents allow the test/validation on a computer by realizing the teacher proposed projects and developed by students in small groups. The projects proposed to students should evolve from relatively simple exercises to real web applications, which explore the various domains of the programmatic interfaces provided by HTML5 technology.

The learning path recommended by the teaching methodology, based on the creation of progressive complexity programs, aims to ensure that students acquire the skills that enable them to achieve the fundamental objective of developing Web applications using several languages like HTML5, CSS, and JavaScript.

The main objective to be achieved is to develop a motivating and engaging learning environment that encourages students to study programming regularly while maintaining short-term goals (1 or 2 weeks). In this way, it is possible to leverage the acquisition of computational thinking skills and independently develop low/medium complexity programs, which are essential for progress throughout the course.

Practical work is done in groups to promote collaborative work and team spirit. This realization occurs in the transition between phases of the syllabus, aiming for the latest work covering all the contents covered.

4. PROPOSAL ONLINE COURSE DESIGN

The best practices in the design of distance learning courses have a focus on students' motivation to ensure their involvement in the proposed learning. An online course structure in higher education confronts teachers with a new awareness of being in a relationship among students. Regardless of the courses, there is a set of components/activities that will consider promoting active learning, contextualized with synchronous and asynchronous moments.

4.1 Online course design

In the previous section, the face-to-face course structure is the support based mainly on both one-way communication or discussion between instructor and students (for instance, discussion forums) [9], presenting the content articulation with the learning method oriented to the practical application of the acquired content. The applied approach reflects an ordinary course of classroom teaching, where personal contact prevails with the definition of a set of activities in and outside the classroom. In the online course design, the experience portrayed in state of the art indicates that this aspect of face-to-face (synchronous activities always possible) may exist. It is one of the primary vehicles of creating and maintaining interest in carrying out the presented training course. This interest can be stimulated by creating small group discussions, where students communicate with each other, using the class as a support network [9]. Here, the importance of the three presences mentioned above that help the course design success in constructing the online learning space leaves reinforced. A course structure assumes this primary objective if it is designed in three stages: onboarding, scaffolding, final project. This approach is similar to Kevin Werbach's of Identify, Onboarding, Scaffolding, and Mastery applied to gamification strategies [10][11]. Its replications our case, the teaching process emancipation is promoted, developing short teaching iteration cycles + autonomous learning + formative assessment. The entire online course has an online stage setting (onboarding), not only to know the "rules of the game" (course program, tools, and evaluation deadlines), but also the presentation of the course actors strengthening interaction between students. This interaction is the critical pillar for online mode, as students' motivation is vital to complete the designed course.

The second stage calls scaffolding. The student sees his learning divided into biweekly cycles, accessing content, developing challenges of increasing difficulty, in parallel with other discussion activities between students and teachers, access to content, and practical training evaluation activities [12].

Finally, the final project, where students, divided into groups of three elements previously, are subject to a final evaluation, development, and presentation of a project approved by the teacher.

4.2 Proposal for biweekly cycle itinerary

An online course permanent challenge is to keep students in the space created for learning and motivated in the learning progression.

Both a learning technique set [13] and Werbach gamification strategies [11] are a substantial contribution or inspiration of our algorithm proposal to teacher routines in a bi-weekly cycle, where each represents a module of the content. Each cycle is marked by constant attention by the students' interaction, as indicated in the following sequence:

- Open module on Monday;
- Two days later, if there is little participation, encourage the class;
- On Friday, if there is little participation, comment on what has already happened and wish the weekend is an excellent opportunity for the study. The

comment on the participation that occurred may allow for highlighting misinterpretations of what was studied;

- On the Wednesday of the second week, directly contact students who are not yet active to encourage them
- On Friday, before the last weekend of the topic, contact directly and in a personalized way, students without activity, to understand how the teacher can help them be active.

This format ensures that the teacher's presence works as one of the links for active and motivating learning.

Another element to keep in mind is the activities to be carried out during the scaffolding phase, which must go beyond a simplistic logic of just "studying, delivering, answering questions". Thus, the division of work into more interactive phases promotes group discussion through discussion forums. Students can share action plans/architectures/schemes and analyze them according to an analysis rubric defined by the teacher. Another way is the discussion of a demonstrative example using concrete aspects of theoretical and practical matters. Finally, to apply an automatic diagnostic so that students are aware of problems/ interpretations/dilemmas that the mere study does not raise.

To get active learning to reinforce, there is also the "round robins" (Workshop or Hot Potatoes activity) where students evaluate each other as an exercise in analyzing and applying concepts or follow up on what others have started.

There are still obstacles to this formulation of the algorithm, especially for courses with many students (over 50) where activities will have to be mass-based on automatic tests, topics of debate, or problems to solve. The teacher can then comment on which are the big one themes or misunderstandings in the discussion of the last two days (because it is not possible to answer individually to 80 or 100 students).

5. CONCLUSION

Rethinking the approaches used in teaching because of the implications of the COVID-19 pandemic puts teaching in need of adjusting to other distance learning modes. The distance learning paradigm is not new, and it assumes itself as essential to continue to guarantee the learning experience achieved in classroom classes. However, as we can see with the analysis carried out in this article, the participants' roles in the experience remain, but with new responsibilities, especially for teachers who have to redesign the learning structures, with a new way of being in teaching, online space learning. The role of the teacher in the organization is essential for active, student-centred learning. The connection with the students will be strong enough not only for this interaction but capable of building interaction between the students.

The algorithm proposal presented for an online course operation reflects this principle with a bi-weekly learning/ progression cycle in the proposed content but always focused on the students' involvement and motivation. In distance learning, aspects such as elaborated content, training activities, automatic assessments, technological platforms for communication, and learning are essential. However, the teacher is the facilitator for

students to complete the objectives they propose.

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