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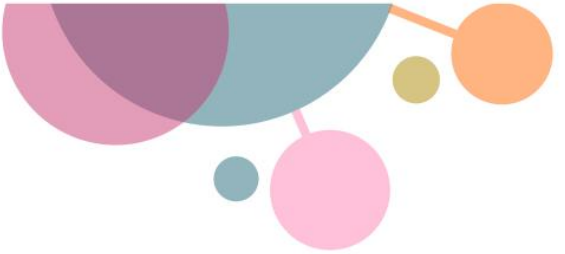

Campus Digitales en la Educación Superior

Experiencias e investigaciones

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Cognitive Computing in the Classroom Using Blended Learning Strategies

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Introduction

Cognitive Computing involves many terms and concepts associated with the areas of computer science and neurosciences. We define Cognitive Computation as the manipulation of symbols in order to obtain new symbols of interest, both to solve tasks and to design new systems.

Cognitive computing is an emerging area in higher education. For this reason, it has become necessary to introduce to the university community (teachers and students) the fundamental concepts of its two supporting areas: a) artificial and natural computing; and b) neurosciences, with the remarkable advances of the last two decades.

The current state of World education, according to the PISA reports, is one where the in the academic and teaching

community is not producing the quality results expected from a modern society (OECD, 2014 and 2016). Two deficiencies have been identified in the research literature: the curriculum is obsolete for our modern society demands, and the teaching methodologies are outdated according to advances in modern neuroscience. To address this situation, a new set of teaching methodologies and fundamental cognitive contents are being explored. Here we present some work in the area Cognitive Computing that offers a sound alternative and a path to its implementation.

The experiences described in this communication detail the main activities that our research group is developing as part of project on educational innovation at the University of the Basque Country. We are an interdisciplinary group and we teach both at the Faculty of Education of Bilbao and at the School of Engineering of Bilbao. At present, we are developing the project "Application of Cognitive Computing in Education" (ACCE).

Our objective in this communication is to disseminate the experience carried out with three groups of participants: a) all members of the research group; b) a workshop at the international conference REDES-INNOVAESTIC 2018; and c) university students from several Spanish institutions.) These experiences explored fundamental ideas of cognitive computing, and strategies developed for their immediate integration in the classroom.

To help achieve this goal, we designed and implemented a set of resources (videos, Google forms, questionnaires, publications, interactive tools and online platforms.) Also, as part of the blended learning modality selected for the project, these resources were later integrated into face-to-face sessions with participants.

Method

We have integrated the use of cognitive computing strategies in the classroom using a set of common resources with the three groups of participants of the project. In the three groups we used the blended modality: the combination of digital resources and communication, dialog and debate among the group participants.

The experience was carried out in three academic modalities: a) all members of our research team went through the process of self-training in the area of cognitive computing as a group (in work meetings, without a time limit, in an informal workshop environment); b) the training of professors participating in the conference REDES-INNOVAESTIC 2018, in a workshop format (voluntary participation with a duration of 90 minutes in a computer room); and c) students from faculties of education of four Spanish universities as part of a research experiment (voluntary participation by invitation of their teachers in a 15 minutes experience).

The ACCE project is the natural continuation of the research work that our group is developing over the last ten years. During this time, we have developed multiple activities for the dissemination and transfer of knowledge of Cognitive Computing to the academic and teaching community. These activities include: the provision of on-site workshops and online workshops for Spanish participants; the creation a MOOC course in MiriadaX, for Spanish and Latin American participants; the dissemination of these initiatives in the forms of invited lectures, oral and written communications.

Figure 1 shows the home page of the ACCE portal (http://ehu.eus/ACCE). This portal is dedicated to the dissemination and integration of Cognitive Computation in the classroom. In this portal we integrate the relevant information of the project, the activities developed, and the corresponding multimedia resources (materials of workshops, publications and recordings of conferences).

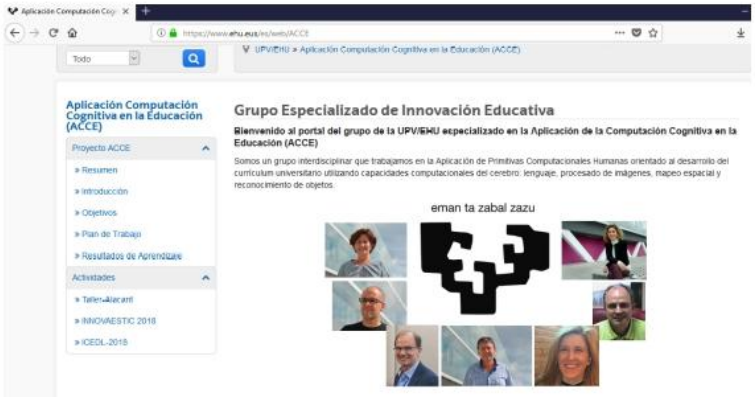

Figure 1. Web portal of the project Application of Cognitive Computing in Education (ACCE)

The blended learning modality was well suited for the objectives of the ACCE project. The presence of students in the classroom with the teacher makes it easier to perform tasks collaboratively, and the use of teaching resources through online platforms and services increases the motivation, participation and academic performance of students (Basogain et al., 2017).

Results

Each of the three academic modalities of the project produced a set of measurable results. In the first modality, the members of the research team successfully acquired core concepts of computing (artificial languages, primitives, symbols, manipulation of symbols, algorithms, processes, computer virtual machines, isomorphic problems, etc.) and basic

knowledge in the area of brain cognitive models (System-1, System-2, heuristics, reasoning, human cognitive primitives, cognitive human virtual machines, etc.) (Kahneman, 2011; Pinker, 1999; Minsky, 1988).

The acquired knowledge in the areas of computing and cognitive models allow the member of the group the design and implementation of teaching materials for their own university students and in their own classrooms (Information Technologies in Education, Digital Control of Systems, Computer Control, etc.) These newly developed teaching materials find their pedagogical power in harnessing the computational capabilities of the human brain.

In the second modality, the teachers attending the workshop at REDES-INNOVAESTIC 2018 acquired basic principles on the proposed computational framework (including Type A and Type B problems, formal measurement of complexity of problems, and multi-step resolution of traditional Type-A problems) (Olabe et al., 2014). The teachers also expressed interest in knowing new ways to overcome the apparent cognitive limitations of the brain, and to capitalize on the potentialities of the human cognitive abilities (Olabe et al., 2018.)

Figure 2 shows a moment of the workshop on Cognitive Computation in the classroom. The workshop is taught in

blended mode using the online resources of the workshop and the presence of the attendees.

Figure 2. Blended Workshop of Cognitive Computation at REDES-INNOVAESTIC 2018

In the third modality, students from several faculties of education in Spain were introduced to the concept of cognitive virtual machines (Olabe et al., 2016). These virtual machines were applied to help them solve complex problems via parallel isomorphic problems. The student obtained remarkable result in the resolution of their tasks. In addition, they positively evaluated the 'pedagogical value' of the methodology used.

The ACCE project promotes the use of the computational capabilities of the human brain when teaching university students. As part of the outcomes of the ACCE project a set of ad-hoc examples were created. These examples are intended to

motivate communication between students and teacher. They also promote the communication among students of different disciplines in order to achieve a common goal (Smith, et al. 2009).

Conclusions

Our research team has been working on the integration of computational thinking in the classroom for over ten years. In this article we present the effects of cognitive computation in the classroom within the framework of the ACCE project, a project on educational innovation of the Basque Country university. The fundamental goal of the project is to analyze, create and implement educational materials for the use of the computational capacities of the human brain for learning and teaching university students (Frederick, 2005; Funke, 2010).

The main conclusions of this article include:

1. Cognitive computing in the classroom begins to take its first steps in the university community. Cognitive computing is an emerging area in the world of education that needs to be developed and disseminated. According to early results, its application in the classroom will dramatically improve the academic performance of our students as well as the development of their cognitive potentials.

2. Digital education offers the use of digital resources for the implementation of cognitive computing in the classroom. The use of tools and digital resources enhances the development and dissemination of cognitive computing in the classroom. The web portal of the ACCE project offers an online space with didactic resources of cognitive computation in the classroom.

3. Blended learning allows the successful implementation of a wide range of learning scenarios. The blended learning in this project achieves a high degree of effectiveness and motivation in the participants of workshops, seminars and experiences.

Cognitive computation needs to be developed and disseminated in the world of education. Our group continues to work on new projects that contribute to this task of bringing cognitive computing to the classroom.

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