

Bringing pedagogical innovation into the university campus: Promoting students' critical thinking and teachers' practices

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Abstract: Regardless of the relevance that universities around the world bestow on it today, there are still efforts being made to assure the effective inclusion of critical thinking in university classrooms. Thus, the promotion of critical thinking is considered to be pedagogical innovation. In this chapter, we focus on pedagogical innovation in higher education, more specifically, on teaching practices aimed at the deliberate, explicit, and systematic promotion of students' critical thinking. We put forward the example from two different universities in two different countries – Portugal and Spain – of how critical thinking can be fostered via teaching-learning strategies that are oriented to its effective promotion. From the analysis of both cases of good practices, we identify a set of theoretical and practical guidelines to assist university teachers who wish to invite critical thinking into their classrooms. Considerations are offered regarding the importance of including critical thinking in faculty development. To make the promotion of critical thinking viable and sustainable, before teaching to engender critical thinking, teachers themselves need opportunities to learn how to do so.

Keywords: critical thinking; higher education; faculty development; cross-cultural study.

Introduction

Critical thinking (CT) is commonly traced back to Ancient Greece, with Athenian philosophers such as Socrates and his question-answer-ad-infinitum maieutic method, but its genesis could be further in the past. “The ancient philosophical tradition saw it both as a way to have a good and happy life and as a means toward good government” (OECD, 2019, p. 20). Presently, we still find it relevant in the spheres of personal (Butler, Pentoney, & Bong, 2017) and social (Vieira, Tenreiro-Vieira, & Martins, 2011) life, as well as the crux of democracy (Giroux, 2019). Indeed, “in modern societies, people are expected to exercise their critical thinking as an integral part of being a citizen, with the ability to make an independent and well-grounded opinion to vote, weigh the quality of arguments presented in the media and other sources of authority” (OECD, 2019, p. 20).

The relevance of CT goes beyond the personal and social life spheres, reaching educational (OECD, 2019) and professional (World Bank, 2018) ones. We shall focus on its relevance in higher education (HE), for CT is at the heart of HE's mission (Hauke, 2019).

Regardless of the longevity of its practice and the relevance bestowed on it by universities, there are still efforts being made to assure the effective inclusion of CT in the university classroom (Hauke, 2019). Thus, the promotion of CT is still considered to be pedagogical innovation. Apart from that, an OECD report stresses that CT permeates all six clusters of innovative pedagogies (*blended learning, computational thinking, embodied learning, experiential learning, gamification, and multiliteracies and discussion-based teaching*), for they entail: the promotion of CT; students' active participation in building knowledge; collaborative learning; solving real-life problems; and technological means (Paniagua & Istance, 2018).

In light of the urge to create formal opportunities to promote CT in HE, it is first necessary to better understand what we refer to when we cite CT and how to stimulate its promotion. In fact, faculty may not yet be fully aware of the meaning of CT and the importance of promoting CT in classrooms (Janssen et al., 2019). Hence, this chapter addresses three questions:

- (1) How do you define CT?
- (2) How do you promote CT in HE?
- (3) What are good CT practices in HE?

By answering these three questions, we aim to contribute to faculties' understanding of what CT is and how it may be promoted. To that end, we provide good practice examples from University of Aveiro (Portugal) and University of Salamanca (Spain). These examples show how efforts can be made to promote students' CT. Additionally, considerations are offered

concerning the sustainability of such good practices, by bringing together the lines of research in CT and the pedagogical research in HE that supports their emergence. We expect this chapter to be inviting and helpful to teachers who wish to make changes to their teaching practices, going beyond content and the status quo and guiding their students towards the development of CT.

To start with a fundamental concern, we shall attempt to answer briefly the three questions posed earlier, which will help to delineate this chapter.

(1) How do you define CT?

CT is far from being a straightforwardly definable construct. Aside from its own structural complexity, different disciplines and authors approach it differently (Franco & Almeida, 2017). There are, however, key-authors, from areas as diverse as philosophy, psychology, and education, whose work must be addressed when attempting to define CT (cf. Table 1.1). *Standing on the shoulders of such giants*, CT may be understood as a higher form of thinking that integrates skills, dispositions, knowledge and thinking criteria, which can be used in everyday (personal, social, educational, professional) life spheres to find explanations, make decisions, and solve problems (Franco, Vieira, & Saiz, 2017). Indeed, *to practice* CT is to find the best explanation for a given problem, to solve it effectively (Saiz, 2017). Thus, CT entails thought, but also action, applicability, attainment (Franco, Vieira, & Tenreiro-Vieira, 2018; Saiz, 2018).

(2) How do you promote CT in HE?

CT is far from being an effortlessly developable competency. Despite its transversal relevance and even though universities identify it as a core mission, the concretisation of CT in HE seems to be a work-in-progress process. Not only do university teachers seem to lack a grounded conceptual understanding of CT, but they also seem to be in need of (more) active

methodologies to promote students' CT (Bezanilla, Fernández-Nogueira, Poblete, & Galindo-Domínguez, 2019). This could be due to CT being *at the heart* of HE but not *at hand*; i.e., it is claimed to be a core mission, but within institutions, practical efforts to guide faculty in fostering CT in class may be missing. There is also the issue of faculty not always possessing formal didactic-pedagogical education to teach (Bireaud, 1995). It should be noted that didactic-pedagogical practices entail a teacher's perspectives about teaching-learning, and her/his management of class contents and events, in addition to all the required daily professional actions (Vieira, 2003). Consequently, teaching competency could derive from prior personal learning experiences as students and from experiences with students (Fletcher, 2017). In sum, while students must be given opportunities to develop their CT, teachers must be given formal education opportunities to design didactic-pedagogical practices that include strategies oriented to promoting their students' CT.

(3) What are good CT practices in HE?

CT is far from being an easily implemented practice. It requires formal opportunities to promote it deliberately, explicitly, and systematically (Franco et al., 2018). According to Bezanilla et al. (2019), the type of strategies that faculty use most frequently to promote students' CT falls into one of three groups: oral and written communication, reading and text analysis; case studies, collaborative learning, real-life based projects/problems; assessment, feedback, questioning, interpretation, research, and lectures. Surely, there is a variety of strategies that can be implemented according to learning processes and students' characteristics. Still, some strategies are particularly efficient in promoting CT, namely questioning, conceptual maps, oriented debate about controversial topics, and problem-based learning (Vieira & Tenreiro-Vieira, 2016a).

Despite faculties' eventual gaps pertaining to CT conceptualisation and promotion, as well as formal didactic-pedagogical education, teachers are indeed practicing pedagogy, even

if they are oblivious to this (Bireaud, 1995). A “good practice” refers to a pedagogical method in which the different practices are organised coherently and form a set of strategies that are logically articulated to accomplish a given objective (idem, 1995, p. 47). As for a “good CT practice”, it must include strategies and activities that are oriented deliberately, explicitly, and systematically to promote CT (Franco et al., 2018; Vieira & Tenreiro-Vieira, 2016a). To exemplify how such promotion may be performed, we shall present good practice examples from University of Aveiro (Portugal) and University of Salamanca (Spain), which show possible actions to promote students’ CT. While the first focuses predominantly on the promotion of CT via faculty development, the latter focuses fundamentally on the promotion of students’ CT. Each case will be described below in further detail.

The case of the University of Aveiro, Portugal

Since its creation in 1973, University of Aveiro has invested in courses in areas that were considered innovative in Portugal, such as faculty development. In the years to follow, the first Integrated Centre for Teacher Training in the country was created. Teacher education integrated the academic formation in that specialty and the pedagogical practice in schools, which represented an innovative perspective for that time, ultimately recognized as a hallmark of this university (Rodrigues & Martins, 2018). From that point to the present, faculty development (from kindergarten to university teachers) has become a goal. Naturally, through almost 50 years, there have been several changes at the University of Aveiro, derived from circumstances such as the enactment of the 1986 Law of the Education System and its successive amendments, and the implementation of the Bologna Process. These have implications for faculty development. In addition, the growing research in the field of education, in particular in the area of supervision and in a few of its specific didactics (e.g., Didactics of the Sciences), helped to consolidate and to substantiate some of the changes.

Accordingly, some of the benchmarks used in faculty development at the University of

Aveiro are based on authors such as John Dewey, Edgar Morin, Donald Schön, and Kenneth Zeichner (Sá-Chaves, 2009). These authors stress the relevance of reflexive, ecological, complex, and investigative thinking in and concerning action, which enables professionals (particularly those who work in education) to perform and speak with the power of reason, in the context of a “reflexive school” (Alarcão, Andrade, Couceiro, Santos, & Vieira, 2006). This has been reinforced and broadened in the past twenty years.

Referring explicitly to CT at the University of Aveiro, we can mention the integration of Vieira and of Tenreiro-Vieira in the Research Centre on Didactics and Technology in the Education of Trainers, which introduced goals such as promoting critical and creative thinking, in particular through topics involving teaching science and technology. From that moment and throughout the past 15 years, the research and faculty development efforts that the two researchers have developed and for which they have provided tutoring (as well as other researchers at this research centre) focus on three main areas: faculty development; conceptual frameworks and benchmarks; and strategies and activities to promote CT in all teaching levels.

In what refers to core conceptual frameworks, the ones used at the University of Aveiro are essentially from Ennis and Lipman. According to an integrative revision by Sousa and Vieira (2018), the studies examined present evidence of the mobilisation of CT, and show that a diversity of didactic strategies and activities has been designed and implemented, in particular, in elementary education (compulsory from the ages of six to 15 years old), to teach science.

In light of such studies and research paths, such as described in Vieira and Tenreiro-Vieira (2016a, 2016b), CT is understood in four dimensions – skills (e.g., to analyse the validity of arguments, to assess the credibility of sources); dispositions/attitudes (e.g., to have an open mind, to attempt to be well-informed); a base of knowledge (e.g., concepts, ideas, theories); and thinking criteria/norms (e.g., precision, clarity) – which are fundamental to solving

problems in the frame of the interrelations of science, technology, and society. Nonetheless, despite such advances, at the University of Aveiro there is still no course (“curricular unit”, in the frame of the Bologna Process) that explicitly mentions CT in its designation and objectives. There are, however, courses/curricular units, such as Didactics of the Sciences for Elementary Education, for 1st year Master's students, that promote future teachers’ CT, while capitalising the potential of learning and online communities of practice (Vieira, 2018a, 2018b). Practical examples of how CT has been promoted are presented in this course/curricular unit, using, for instance, the FA²IA approach (Vieira & Tenreiro-Vieira, 2016b) to question future teachers.

In this context, the goal is to support the clear and explicit mobilisation of CT by means of strategies and didactic resources, as well as in future teachers’ practices, particularly in the courses/curricular units Supervised Pedagogical Practice and Educational Guidance Seminar, in the second year of the course and taking place in elementary education schools. Studies have been carried out, many of them focused on the promotion of CT (in the context of Master's theses, final reports, and projects), available in the university’s repository.

Other examples of practices may be found in courses from other areas of study in this university, such as engineering and design. For example, Clemente, Tschimmel, and Vieira (2016) present proposals for the promotion of students’ CT and creativity (e.g., logbook for metacognitive reflection). Further examples of initiatives include a CT promotion programme for teachers at the University of Aveiro (Franco & Vieira, 2019), and the participation in an OECD project entitled “Fostering and Assessing Creativity and Critical Thinking Skills in Higher Education”.

The case of the University of Salamanca, Spain

At the University of Salamanca, Rivas and Saiz have 20 years experience teaching the Psychology of Thought compulsory course to 1st year psychology students. The main goal of this course is to develop students’ CT skills, which are procedural. To develop them, students

must learn skills that go beyond theoretical content, and to accomplish this it is necessary to use procedural methodologies with an active pedagogical focus and many practical activities.

The CT skills that are sought in the learning process must be grounded on a specific notion of CT, which is to attain the best explanation for a fact, phenomenon, or problem, to understand it or solve it efficiently (Saiz, 2017, 2018). It is important to note that these fundamental skills are CT's cognitive components. There are also non-cognitive components. Since the nature of thinking is essentially propositional (we think because of and for something), the motivational and dispositional components of thinking also play a key role.

To understand Rivas and Saiz' programme, it is indispensable to stress a few aspects of its theoretical framing. First, efficiency is a decisive factor in learning CT; the goal is action and change, which are only viable with efficiency. Thus, searching for the best explanation is an eminently practical goal. Instruction should focus on solving problems in the best possible way, not only on finding a solution. Second, the model implemented by Rivas and Saiz offers an explanation of how the different skills are related, which is important to approaching them in practice. Third, Rivas and Saiz promote CT skills by using tasks that integrate skills; more importantly, they do not attempt to promote all of them nor do they treat them equally. They steer their teaching methodology towards: learning to see; learning to combine deductive and causal structures; learning to rule out explanations/hypotheses.

According to their approach, CT is accomplished whenever change is achieved by solving problems efficiently. CT is considered a problem-solving task, and resolution depends on decision-making, which in turn requires explanation and argumentation. Here, explanation is the strongest mechanism, coordinating all the processes to achieve efficiency. Reaching the best explanation is grounded on deductions sustained by unequivocal facts.

These are the foundations of Rivas and Saiz' teaching methodology DIAPROVE (DIAGnosis, PROgnosis, and VERification). Their first commitment is to teaching students how

to see what really matters, i.e., to give space to diagnosis – to learn to observe the facts in context. Finding the facts that are decisive requires a skill that must be developed; without it, reasoning cannot be efficient. Their second and third commitments – prognosis and verification – cannot be separately achieved. With the procedures to disconfirm hypotheses, by combining facts and principles, Rivas and Saiz stress that it is possible to provide an explanation that is not just very likely, but completely right – always in a specific context. One of the challenges of being efficient in solving problems through the best explanation lies precisely here: in converting a likelihood into a certainty. In sum, with an accurate observation, a correct combination of facts and principles, and a precise implementation of disconfirmation procedures, it is possible to achieve maximum efficiency in problem-solving. When Rivas and Saiz claim that to exercise CT is to achieve the best explanation for a fact, phenomenon, or problem, what they mean is that, in that context, there cannot be another. By achieving this, the solution or prognosis is assured (Rivas & Saiz, 2016, 2019; Saiz, 2018; Saiz & Rivas, 2016, 2017; Saiz, Rivas, & Olivares, 2015).

Rivas and Saiz' approach to the development of in-class CT skills involves working from the most general skills to the most specific ones. For this reason, it is crucial to seek the problem-solving process in CT, which will enable the teacher to integrate all the skills that are at play for the accomplishment of efficiency and change. Rivas and Saiz created a general guide, so their approach may be applied to any type of problem. CT must produce a change by means of efficiency in problem-solving so, throughout the teaching-learning process, there are steps that are especially important: the first is a proper observation of unequivocal facts; the second is to determine the reason/motive for an action; then, it is necessary to simulate the events causally, to find meaning in the problem/situation; the fourth and most decisive step of all eight is to reach an accurate prognosis. If students reach this moment with certainty, they

may claim that they are capable of verifying their explanatory hypothesis. As a whole, this approach makes Rivas and Saiz' teaching methodology fairly easy to implement.

The sustainability of such good critical thinking practices and of the research supporting them: Final considerations

The relevance of promoting university students' CT and providing faculty development opportunities so teachers learn how to do so, is clear by now. Despite current shortcomings, there are good CT practices underway, as can be seen by the two examples provided in this chapter, derived from University of Aveiro (Portugal) and University of Salamanca (Spain). At this point, a new question has arisen: To what extent are these CT practices sustainable? To answer this question, we will bring together the two lines of research in CT here presented (undertaken at University of Aveiro and Salamanca) with the pedagogical research in HE in general that supports the emergence and sustainability of such research.

There are many authors with sustainable contributions to advances in promoting and developing university students' CT, by working directly with students or with their teachers in the context of faculty development (e.g., Halpern, Saiz and Rivas, Vieira and Tenreiro-Vieira, Butler, etc.). Many of those authors are both teachers and researchers, whose efforts to improve their "CT friendly teaching" inspire their lines of research, and whose research results, in turn, raise the efficiency of their "CT-friendly teaching". The same feedback cycle happens with whomever works with teachers.

Certainly, research and teaching are often intertwined, which is a significant variable in the enhancement of HE (Guerra, Franco, & Seabra, 2018). Regarding the promotion of CT in HE, some authors work exclusively in the context of funded pedagogical research projects. Even though university pedagogy has a history of not being a rampant research area (Bireaud, 1995), which is a trend that remains current (do Ó, Almeida, Viana, Sanches, & Paz, 2019), there is indeed funding that is allocated to research projects regarding the promotion of CT in

HE, by working with either students or teachers. The primary author of this chapter is but one example of a researcher receiving a fellowship to conduct postdoctoral research, in a national candidature. Funding was provided with the knowledge that the promotion of CT in HE is envisioned as a much-desired pedagogical innovation that is relevant today, to meet international agendas and present and future challenges.

To become sustainable, pedagogical research in HE (and subsequent pedagogical innovation that emerges from it) faces a set of challenges (especially if it is funded pedagogical research), which pertains to lines of funding, the (dis)continuity of grants, the (dis)interest of HE institutions in hosting the project, etc. In fact, the pedagogical innovation produced in the context of funded projects often lacks sustainability, failing to outlive the end of the funding period (Guerra & Costa, 2016). In the case of the promotion of CT carried out by university teachers who conduct research, in the specific case of the two universities provided as an example of “good CT practices” in this chapter, those efforts derive mostly from a personal and professional interest from the teacher, aside from a potential institutional interest. Either way, the pedagogical innovation that emerges from their work does not lack sustainability, considering its longevity and the development of conceptual and teaching models from it.

Nonetheless, there are efforts available to assure the sustainability of such pedagogical research in the context of HE: creating networks to share good practices; sharing guidelines on how to implement continued professional development for teachers to promote CT; creating institutional, national, and international recommendations on how to promote education and innovation in this area; and as a very important action, continuing to carry out reliable and valid research showing the impact of the promotion of CT, and to assure the dissemination of such results. As long as there are teachers who have input into their pedagogical practices and who have an interest in this field, as well as the institutional and political will to foment and fund it, the promotion of CT will not be forsaken.

Conclusions

Given the cyclical changes that society has experienced and is experiencing, (higher) education faces a set of new challenges concerning information and technology, education, the world of work, personal needs, and also, social needs (Saiz, 2018). Consequently, the educational system must undergo transformation, breaking free from a rather obsolete teaching-learning paradigm, encouraging an active, participative, and reflexive one instead. The promotion of students' CT falls into this second paradigm. A CT-friendly education fosters inquiry and the search for the best explanation possible to attempt to solve relevant real-life problems collaboratively (Saiz, 2018). By having CT both *at heart* and *at hand*, HE will bring pedagogical innovation into the university campus. Yet this requires a parallel effort: on the one hand, the deliberate, explicit, and systematic promotion of students' CT; on the other hand, faculty development to assist university teachers in teaching deliberately, explicitly, and systematically to produce CT. More importantly, it requires the work of teachers and researchers devoted to the study and promotion of CT, as well as the institutional and political will to assure that the promotion of students' CT and of teachers' continued professional development is fomented, in order to encourage critical thinkers who can thrive in their personal, social, educational, and professional life spheres.

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Table 1.1 Critical thinking definitions by key-authors

<i>Author</i>	<i>Definition</i>
Ennis	“reflective and reasonable thinking that is focused on deciding what to believe or do” (1985, p. 45)
Facione	“purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based”(1992, p. 28)
Halpern	“the deliberate use of skills and strategies that increase the probability of a desirable outcome” (1998, p. 449)
Paul	“the art of thinking about thinking in an intellectually disciplined manner. Critical thinkers explicitly focus on thinking in three interrelated phases. They <i>analyze</i> thinking, they <i>assess</i> thinking, and they <i>improve</i> thinking (as a result)”(2005, p. 28, use of italics by author)