SUSTAINABLE PEDAGOGICAL RESEARCH IN HIGHER EDUCATION

The Political, Institutional and Financial Challenges

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BRINGING PEDAGOGICAL INNOVATION INTO THE UNIVERSITY CAMPUS: PROMOTING STUDENTS' CRITICAL THINKING AND TEACHERS' PRACTICES

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Introduction

Critical thinking 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, 2016b) 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 critical thinking goes beyond the personal and social life spheres, reaching educational (OECD, 2019) and professional (Vieira, Tenreiro-Vieira, & Martins, 2011) ones. We shall focus on its relevance in higher education, for critical thinking is at the heart of the mission of higher education (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 critical thinking in the university classroom (Hauke, 2019). Thus, the promotion of critical thinking is still considered to be pedagogical innovation. Apart from that, an Organisation for Economic Co-operation and Development (OECD) report stresses that critical thinking 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 critical thinking; students' active participation in building knowl-
edge; collaborative learning; solving real-life problems; and technological means
(Paniagua & Istance, 2018).

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

1. How do you define critical thinking?
2. How do you promote critical thinking in higher education?
3. What are good critical thinking practices in higher education?

By answering these three questions, we aim to contribute to faculties' under-
standing of what critical thinking 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' critical thinking. Additionally, considerations are offered
concerning the sustainability of such good practices, by bringing together the
lines of research in critical thinking and the pedagogical research in higher edu-
cation 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 devel-
opment of critical thinking.

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

How do you define critical thinking?

Critical thinking 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 critical thinking (cf. Table 6.1). *Standing on
the shoulders of such giants*, critical thinking 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* critical thinking is to find the best explanation
for a given problem; to solve it effectively (Saiz, 2017). Thus, critical think-
ing not only entails thought, but also action, applicability, attainment (Franco,
Vieira, & Tenreiro-Vieira, 2018; Saiz, 2020).

TABLE 6.1 Critical thinking definitions by key-authors

Author	Definition
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 *analyze* thinking, they *assess* thinking, and they *improve* thinking (as a result)" (2005, p. 28, use of italics by author)

How do you promote critical thinking in higher education?

Critical thinking 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 critical thinking in higher education seems
to be a work-in-progress process. Not only do university teachers seem to lack
a grounded conceptual understanding of critical thinking, but they also seem to
be in need of (more) active methodologies to promote students' critical thinking
(Bezanilla, Fernández-Nogueira, Poblete, & Galindo-Domínguez, 2019). This
could be due to critical thinking being *at the heart* of higher education but not
at hand; i.e., it is claimed to be a core mission, but within institutions, practical
efforts to guide faculty in fostering critical thinking 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 (Sousa & Vieira, 2018). Consequently, teaching competency
could derive from prior personal learning experiences as students and from expe-
riences with students (Fletcher, 2017). In sum, while students must be given
opportunities to develop their critical thinking, teachers must be given formal
education opportunities to design didactic-pedagogical practices that include
strategies oriented to promoting their students' critical thinking.

What are good critical thinking practices in higher education?

Critical thinking 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 strate-
gies that faculty use most frequently to promote students' critical thinking 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 critical thinking, namely questioning, conceptual maps, oriented debate about controversial topics, and problem-based learning (Vieira & Tenreiro-Vieira, 2016a).

Despite faculties' eventual gaps pertaining to critical thinking 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 (ibid 1995, p. 47). As for a *good* critical thinking practice, it must include strategies and activities that are oriented deliberately, explicitly, and systematically to promote critical thinking (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' critical thinking. While the formerfocuses predominantly on the promotion of critical thinking via faculty development, the latter focuses fundamentally on the promotion of students' critical thinking. 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 recognised 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 20years.

Referring explicitly to critical thinking at the University of Aveiro, we can mention the integration of Vieira and of Tenreiro-Vieira in the CIDTFF (*Centro de Investigação Didática e Tecnologia na Formação de Formadores*) – 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 critical thinking in all teaching levels.

In what refers to core conceptual frameworks, the ones used at the University of Aveiro are essentially from Robert H. Ennis and Matthew Lipman. According to an integrative revision by Saiz, Rivas, and Olivares (2015), the studies examined present evidence of the mobilisation of critical thinking, 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 6to 15 years old), to teach science.

In light of such studies and research paths, such as described in Vieira and Tenreiro-Vieira (2016a, 2016b), critical thinking 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 critical thinking in its designation and objectives. There are, however, courses/curricular units, such as Didactics of the Sciences for Elementary Education, for first year master's students, that promote future teachers' critical thinking, while capitalising the potential of learning and online communities of practice (Vieira, 2018a, 2018b). Practical examples of how critical thinking has been promoted are presented in this course/curricular unit, using, for instance, the FA^{2}IA approach (Vieira & Tenreiro-Vieira, 2016b) to question future teachers.

In this context, the goal is to support the clear and explicit mobilisation of critical thinking 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 critical thinking (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' critical thinking and creativity (e.g., logbook for metacognitive reflection). Further examples of initiatives include a critical thinking 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 first year psychology students. The main goal of this course is to develop students' critical thinking 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 critical thinking skills that are sought in the learning process must be grounded on a specific notion of critical thinking, which is to attain the best explanation for a fact, phenomenon, or problem, to understand it or solve it efficiently (Saiz, 2017, 2020). It is important to note that these fundamental skills are the cognitive components of critical thinking. 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 critical thinking; 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 critical thinking 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, critical thinking is accomplished whenever change is achieved by solving problems efficiently. Critical thinking 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 critical thinking 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, 2020; Saiz & Rivas, 2016, 2017;Saiz, Rivas, & Olivares, 2015).

Rivas and Saiz' approach to the development of in-class critical thinking 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 critical thinking, 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. Critical thinking 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 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

The relevance of promoting university students' critical thinking and providing faculty development opportunities so teachers learn how to do so, is clear by now. Despite current shortcomings, there are good critical thinking 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 critical thinking practices sustainable? To answer this question, we will bring together the two lines of research in critical thinking presented here (undertaken at University of Aveiro and Salamanca) with the pedagogical research in higher education 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' critical thinking, by working directly with students or with their teachers in the context of faculty development (e.g., Butler, Halpern, Saiz and Rivas, Vieira and Tenreiro-Vieira, etc.). Many of those authors are both teachers and researchers, whose efforts to improve their *critical thinking-friendly teaching* inspire their lines of research, and whose research results, in turn, raise the efficiency of their *critical thinking-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 higher education (Guerra, Franco, & Seabra, 2018). Regarding the promotion of critical thinking in higher education, 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 critical thinking in higher education, by working with either students or teachers. The primary author of this chapter is merely 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 critical thinking in higher education 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 higher education (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 higher education 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 critical thinking carried out by university teachers who conduct research, in the specific case of the two universities provided as an example of good critical thinking 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 higher education: creating networks to share good practices; sharing guidelines on how to implement continued professional development for teachers to promote critical thinking; 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 critical thinking, 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 critical thinking will not be forsaken.

Final considerations

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, 2020). 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' critical thinking falls into this second paradigm. A critical thinking-friendly education fosters inquiry and the search for the best explanation possible to attempt to solve relevant real-life problems collaboratively (Saiz, 2020). By having critical thinking both *at heart* and *at hand*, higher education 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' critical thinking; on the other hand, faculty development to assist university teachers in teaching deliberately, explicitly, and systematically to produce critical thinking. More importantly, it requires the work of teachers and researchers devoted to the study and promotion of critical thinking, as well as the institutional and political will to assure that the promotion of students' critical thinking 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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7

HOW TO ENCOURAGE CRITICAL THINKING USING SOCIAL MEDIA IN HIGHER EDUCATION

Ruth Pinedo and Cristina Gil-Puente

Introduction

This chapter presents the results of a study carried out in the University of Valladolid to find out whether the use of Twitter, as an example of social media, can help encourage thinking and learning in higher education. The use of social media and other information and communication technologies (ICT) resources in teaching is becoming more widespread, but it is necessary to clarify and plan it for the fulfilment of specific goals in the classroom. In this case, we used Twitter as a vessel to make thinking and learning visible and share them in a variety of subjects on early childhood and elementary education programmes at the University of Valladolid. The goals of the study were: (i) to explore the thinking moves used by students in tweet production and to analyse the evolution of their thinking skills over the course of academic years, and (ii) to analyse the relationship between thinking moves and grades.

Critical thinking as a key competence in higher education

The demand for the development of competences such as critical thinking in education and the changes contemporary society is going through have rekindled interest in this issue. It is considered fundamental to foster the high-level cognitive abilities that are part of critical thinking, such as reasoning, analysis, argumentation, problem-solving, or hypothesis formulation – also identified with the skills involved in scientific thinking – in higher education students (Manassero & Vázquez, 2017).