Educating for critical thinking in university: The criticality of critical thinking in education and everyday life

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Abstract: Nowadays, both on-line and "off-line" lives seem to be bound to the terms of democratization of information. While this brings clear advantages, does free and fast access to plenty of information entail that individuals are better informed and well-equipped to think reasonably, make decisions, and solve problems? In a time apparently governed by fraudulent decision-makers, floppy media, fake news, and frantic information, it is essential to know how to think critically. Critical thinking is crucial along schooling, in the world of work, in personal everyday life, and in life as members of a society. Nonetheless, critical thinking is not innate and effortless; it must be developed and mobilized with deliberation in a systematic way. Researchers and international agencies agree that it is critical to have critical thinking to face present-futurist challenges such as the United Nation's 17 *Sustainable Development Goals*. But before individuals learn to become critical thinkers, teachers themselves need teacher education opportunities to learn how to use their critical thinking abilities, and how to spark students' critical thinking potential and promote it. Here, the role played by education in developing critical thinking is stressed, and specific teaching-learning strategies that have shown to be effective are identified.

Keywords: critical thinking, higher education, teacher education, transference, 4 Cs

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Pédagogie pour la pensée critique dans l'université: la critique de la pensée critique dans l'éducation et la vie quotidienne

Résumé: Aujourd'hui, les vies en et "hors" ligne semblent être liées aux termes de la démocratisation de l'information. Bien que cela apporte des avantages, un accès libre et rapide à de nombreuses informations implique-t-il que les individus sont mieux informés et mieux outillés pour penser raisonnablement, prendre des décisions et résoudre des problèmes? Dans un temps apparemment gouverné par des décideurs frauduleux, médias bâclés, fausses nouvelles, et informations frénétiques, il est essentiel de savoir comment penser de façon critique. La pensée critique est indispensable au long de la scolarité, dans le monde du travail, la vie quotidienne et la vie en société. Néanmoins, la pensée critique doit être développé et mobilisé avec délibération de manière systématique. Les chercheurs et les agences internationales s'accordent à dire qu'il est essentiel d'avoir une pensée critique pour faire face aux défis actuels-futuristes tels que les 17 *Objectifs de Développement Durable* des Nations Unies. Mais avant que les individus apprennent à devenir des penseurs critiques, les enseignants ont besoin d'opportunités de formation pour apprendre à utiliser leurs capacités de pensée critique, et comment stimuler le potentiel de pensée critique des élèves. Ici, le rôle joué par l'éducation dans le développement de la pensée critique est souligné, et des stratégies spécifiques d'enseignement-apprentissage qui se sont révélées efficaces sont identifiées.

Mots-clés: pensée critique, enseignement supérieur, formation des enseignants, transfert, 4 Cs

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Introduction to critical thinking

Simply put, Critical Thinking (CT) may be understood as "thinking about thinking in an intellectually disciplined manner" (Paul, 2005, p. 28), which is "purposeful, reasoned, and goal-directed" (Halpern, 1998, p. 450), aimed at "deciding what to believe or do" (Ennis, 2011, p. 1). In light of its characteristics and goals, CT is seen as essential – thus coveted – in the academic (Phan, 2010), professional (Johnson, 2012), personal (Butler, Pentoney, & Bong, 2017; Franco, Costa, & Almeida, 2017), and social (Vieira, Tenreiro-Vieira, & Martins, 2011) life spheres.

In the academic sphere, and despite its transversal importance along schooling (Lipman, 2003), we shall focus on CT in Higher Education. Here, CT is time and again acknowledged officially as an essential learning outcome, and yet, such importance may not always echo into clear measures that make CT viable and evident in Higher Education institutions (Liu, Frankel, & Roohr, 2014). Indeed, the intentions, guidelines, and goals that are conveyed in the curriculum and institutional discourse should be compliant with the curriculum that is actually implemented and with teachers' practices. And yet, this is not always the case: while the projected curriculum pertains to CT, the actual daily practices that are put into action by teachers do not always include opportunities for students to develop their CT poten-

tial. To illustrate this, we may refer to a well-known study. According to the results presented by Arum and Roksa (2011) in a study conducted in the USA with 2,300 students from 24 universities, a very considerable 45% of students did not present significant improvement in CT ability after two years of college. Considering that the sample under study was not attending particular classes/courses in which teachers' practices were specifically oriented to the promotion of students' CT potential, such results are explicable. As pointed by the authors, CT is broadly assumed to be developed in Higher Education, as well as other "21st century skills", and yet, in light of this study's results, mere university attendance does not necessarily entail that such fundamental skills are being targeted. Something else may be lacking.

CT is important not only in the classroom, to obtain the very cherished *academic success*, but also, and perhaps most importantly, in everyday life, when time comes for dialogical interaction and decision making and problem solving. For this reason, CT should be imbued in individuals' personal and public life spheres, and it should be put into practice every time it is necessary: to search, interpret and use information; to dialogue; to present a personal point of view or a valid argument; to make sound decisions; to solve problems efficiently; and more. All this (and more) catalyzed and sustained by dispositions such as reflexivity, deliberation, persistence, and cognitive flexibility, which are at the core of CT (Saiz, 2017).

But this does not happen efficiently without effort. Students may and must be given opportunities to improve their CT level (Vieira & Tenreiro-Vieira, 2016; Saiz, 2018). Individuals need to learn how to think critically, especially in a time that seems to be governed by fraudulent decision-makers, floppy media, fake news, and frantic information. The very recent scandal involving Facebook and Cambridge Analytica, in which the data collected by the most popular social network in the world were sold to the aforementioned company and used, for instance, to influence the public opinion in the context of the last elections in the USA, is but a symptom of the problem. Very serious issues arise from this, concerning how private really are our personal details once they become on-line, and the severe breaches of trust such as the one committed by Facebook. It is not by chance, perhaps, that the General Data Protection Regulation implemented in the EU has been reformed this year. But there is one issue concerning each individual directly that must be addressed: to what extent do we, as consumers/decision-makers, make a significant effort to be(come) informed about the terms we sign every time we wish to join a new social network or subscribe a newsletter or make a similar decision, or any meaningful decision at all, and we press "enter" without bothering to read what is written in small print? The New Media have created the possibility of quite effortlessly and promptly broadcasting opinion and sharing information within the *world wide web*. The negative side of two-faced democratization of information is that, very often, the web is flooded with (take your pick) fake/incomplete/deceptive/biased/wrongful/prejudiced information, which is somewhat easily consumed by the average person without second thoughts, no questions asked. Here lies the true problem, the one that must be tackled.

Present times require the ability, disposition, knowledge, and criteria (all four key-dimensions of CT) to find one's way amidst such contemporary challenges. For instance, according to the World Economic Forum 2016 report on *The Future of Jobs*, several of the major employers in the world anticipate that, within change trends concerning employment up to 2020, CT is a key-occupational skill. If that timeline is extended up to 2030, we find CT again – as well as some of its particular abilities and dispositions (e.g., complex problem solving, judgment and decision making, deductive and inductive reasoning, etc.) – in the list of features that are anticipated to be needed in order to face future occupational demands (Bakhshi, Downing, Osborne, & Schneider, 2017). As for the World Bank's 2018 report on *Learning to Realize Education's Promise*, focused on learning as *the* way to prepare individuals for the future, it stresses the need to promote a range of skills, and here, CT is recognized as a foundational skill.

1. Critical thinking and teacher education

Not happening efficiently without effort, CT requires teaching. The crux of the matter is that general teacher education (initial and continuous) does not always include the promotion of CT, for different reasons (Vieira & Tenreiro-Vieira, 2016), such as the entrenched focus on transmissive knowledge that still lingers in the teaching-learning process (Gonçalves & Vieira, 2015). Perhaps consequently, teachers lack knowledge about CT and how to promote it explicitly, deliberately, and systematically (Choy & Cheah, 2009). However, before individuals learn to become critical thinkers, teachers themselves need teacher education opportunities to learn how to promote CT in their students. If teachers, through teacher education, become aware and deliberate about CT, they may create opportunities for their students to become critical thinkers, inside campus and in their daily lives (Franco, Vieira, & Saiz, 2017).

In light of studies focused on the importance of the promotion of CT in the classroom, we propose teacher education that includes – and conveys – a set of dimensions, which should later be welcomed into that same classroom. First, teacher education should comprise – and model – a deliberate and explicit inclusion, as well as a systematic promotion, of CT abilities and dispositions, open to students' everyday lives and real issues (Alwehaibi, 2012; Franco, Butler, & Halpern, 2015; O'Donnell, Francis, & Mahurin, 2008). Second, the kind of strategies selected to promote CT must be performed in a group (or a community of learners), in which students must reflect, argument, counter-argument and reach integration, create, experiment, make decisions, and solve problems together, hence learn how to collaborate for a common and meaningful goal/good (Buskist & Irons, 2008; Shehab & Nussbaum, 2015). Keeping this in mind, teacher education may replicate this learning scenario by placing teachers in the kind of collaborative environment that their students will be working in. Third, nowadays it is compulsory to maximize the potential of digital tools and virtual teaching-learning environments, not only to challenge students and

stimulate them to become more active learners, but also to meet their "Millennial" or "Generation Z" technological characteristics and needs, and even to help develop their digital literacy and competence (Eftekhari, Sotoudehnama, & Marandi, 2016; Mandernach, 2006; Saadé, Morin, & Thomas, 2012). This dimension may also be embraced in teacher education, by assisting teachers to later on make the most of the digital and virtual improvements that are made available today.

Thus, teacher education shall be appealing, not only to CT, but to all *4 Cs* of the much in vogue "21st century" thoughtful learning: *Communication*, *Collaboration*, *Creativity* and, of course, *Critical Thinking*. *Communication* concerns the ability to comprehend meaning, and to express one's own thoughts, ideas, and points of view in a clear, precise way, whether it is using an oral, written, or non-verbal language format, in a multiplicity of contexts and using a diversity of means (including technologic). *Collaboration* regards the ability-disposition to interact in the context of a group of people, some of which will surely have different backgrounds, characteristics, and perspectives on one same matter, and to cooperate with others in order to accomplish a common goal, which entails the openness to debate and compromise. *Creativity* pertains to the ability to think and to create in an innovative way, designing original and useful ways to perform everyday activities, while maintaining a persistent and open attitude in terms of accepting input from others and staying focused on the desired goal, no matter how elusive it is. Finally (or first of all), *Critical Thinking* is the ability-disposition to think reasonably, not only to have a grounded perspective about the myriad of current topics that affect the individual personally and as a member of society, but also to make complex decisions and to solve challenging problems (National Education Association, 2012).

To truly create space for the promotion of CT in the classroom, in the context of all 4Cs of thoughtful learning, teacher (initial and continuous) education is essential. Only this way can teachers learn particular strategies that, if implemented explicitly, deliberately, and systematically, will gain an orientation that may catalyze the maximization of students' potential to think critically. In order to be successful in promoting students' ability and disposition to think critically (inside and beyond the classroom), teacher education must concentrate on students' ability to reflect and create ideas and make decisions and generate solutions, and to communicate their own thoughts and values in their own words to others, in a collaborative dialogic environment. Such an approach should create the grounds for CT to emerge and transfer to other spheres of students' lives, in the form of ethical, committed and active citizenship in the community. In a time of social change and unprecedented challenges, changes are needed in teachers' pedagogical practices, challenging them to meet the needs and characteristics of today's (and tomorrow's) students.

We may provide two simple examples concerning possibilities on how to promote CT in teacher initial education and in teacher continuous education – there are many others. Regarding teacher initial education, in a study by Vong and Kaewurai (2017), a model of how to improve future teachers' CT ability and ability to teach for CT is presented. This model to teach for CT, whose purpose was to enable train-

ee students to improve their own CT while learning how to develop their future students' CT, includes eight steps: "triggering activity, identifying the problem, investigating related data, discussing findings, evaluating the findings, creating solutions, presenting solutions, and reflecting on solutions" (Vong & Kaewurai, 2017, p. 90). Together, these eight steps include activities such as discussion in small group, collaborative tasks, coming up with new ideas and solutions, and identifying problems and testing hypotheses, thus calling for the 4Cs of thoughtful learning mentioned earlier: communication, collaboration, creativity and CT. According to the authors, this model showed to be effective in improving trainee students'/future teachers' CT ability and ability to develop CT.

As for teacher continuous education, in the frame of an ongoing research project on the promotion of CT in teacher education, we present a possibility of a session to sensitize teachers to CT, aimed at teachers in general (from Elementary School to Higher Education). The two main purposes of this one and a half hour session are (i) to encourage teachers to re-evaluate their pedagogical assumptions and practices, and (ii) to guide teachers in deepening their understanding about the relevance of promoting CT – explicitly, deliberately, and systematically – in class, inciting them to include CT in their daily pedagogical practices (Franco & Vieira, in press). This session is divided in six key-moments:

(i) Setting the tone for the session (estimate time: 10 minutes): Presentation of the trainers and of the goals for the session;

(ii) Activity 1 (estimate time: 15 minutes): In the frame of participants' conceptions about CT, each participant is asked to write down if she/he considers important to promote CT and, if so, why, and also, to explain her/his personal conception of CT, followed by a moment in group in which written answers are shared and guide a reflection in a large group;

(iii) Framework 1 (estimate time: 15 minutes): The definition(s) of CT is/are provided, as well as the relevance of its inclusion in the curricula (in terms of academic, professional, personal, and social gains, in light of current reports and guidelines from international entities), its development potential, and how its promotion may be done;

(iv) Activity 2 (estimate time: 20 minutes): Presentation and analysis of a current controversial social issue (e.g., euthanasia, abortion, or even cannabis use for medicinal purposes), with the identification of pros and cons, and a final standing, first in small group and then in a large group;

(v) Framework 2 (estimate time: 20 minutes): A list of CT abilities and dispositions is shown in a PowerPoint presentation, and participants are asked to identify the ones that were used (the most) to perform Activity 2. The trainers bridge the gap between such CT abilities-dispositions and the promotion of students' CT potential via deliberate and explicit teaching-learning strategies used systematically.

(vi) Wrapping up the session (estimate time: 10 minutes): The trainers ask participants about the difficulties experienced to perform Activity 2, linking them to barriers to CT, one of those being the lack of deliberate, explicit, and systematic use of teaching-learning strategies oriented to the promotion of CT in class. Participants are given the opportunity to participate in a free program comprised of a set of five sessions (two hours each), in which specific teaching-learning strategies are presented and put into practice, and teachers are guided in using them in class with an orientation towards the promotion of CT. A few examples of such strategies are questioning, argumentation, and concept maps, yet there are others that emerge from the literature as effective in promoting CT (e.g., Tenreiro-Vieira & Vieira, 2014).

Following, in the context of the role played by Education in developing CT, we shall focus on such teaching-learning strategies that have shown to be effective in promoting students' CT.

2. Critical thinking promotion: what teaching-learning strategies?

A new paradigm of Education is called for, one that requires, as a consequence, renewed teachers' practices (Saiz, 2018). UNESCO (2015) has been repeatedly stressing that we (citizens, educators, political leaders, etc.) must rethink our common understanding of Education. Instead of focusing on the improvement of students, Education must start focusing on the improvement of the world, enabling each individual to be an active part of that process. The idea of educating individuals for a "*public good*" arises, with Education and knowledge being pointed out as "*global common goods*" (UNESCO, 2015, p. 18, italicization by the author). Indeed, learning is not the ultimate goal of Education, seeing that individuals learn in order to attain/create useful, desired goals. Specially in a time of relentless possibilities created by technology, which creates the scenario for individuals to learn, work, and exist in a close yet heterogeneous network, individuals may now be empowered to learn and attain great goals with local/national/world impact (Prensky, 2016).

In order to enable the aforementioned new paradigm of Education, researchers and educators today call for a set of "innovative pedagogies", seeing that "pedagogy is at the core of teaching and learning" (Paniagua & Istance, 2018, p. 20). In line with a very recent OECD report, there is a set of six clusters of innovative pedagogies, in terms of particular learning theories and pedagogical approaches, namely: *Blended Learning*, focused on rethinking how the teaching-learning process is organized, whether inside or outside school (inverted classroom is an example); *Computational Thinking*, focused on individuals' ability to solve problems; *Embodied Learning*, focused on the individual as a whole, including the artistic, emotional, physical, and social facets; *Experiential Learning*, focused on the experience of, and the reflection on, the surrounding context; *Gamification*, focused on the relevance of games and playing in the learning process; and *Multiliteracies and Discussion-Based Teaching*, focused on critical literacy in its many forms. Even though they are organized in a set of clusters, all six types of pedagogies share one same nature,

which is a focus on the promotion of CT, also done using real-life problems and projects, while assuming an active commitment of who learns, in collaboration with other learners, making the most of technological means (Paniagua & Istance, 2018). Notwithstanding the call for innovation in teachers' pedagogical practices, it is important to note that teacher (continuous) education is necessary to enable teachers to add an innovative touch to their classes, since it is a process with perceived difficulties, such as lack of time to attend teacher education (Martínez, Cabezas, & Soler, 2018).

In regard to CT in particular, a "renewed vision of education should include developing critical thinking, independent judgment and debate" (UNESCO, 2015, p. 32). As for innovative pedagogy, innovative practices – grounded on theoretical models that presume an active pedagogy, a student-centered and culture-relevant pedagogy, as well as inclusive education (Paniagua & Istance, 2018) – are focused on learning communities, real-world projects with local meaning and real-world implications and impacts, "hands on" activities, and interdisciplinarity. Through these, teachers become facilitators/mediators who can empower students to develop transversal skills, as well as the knowledge about how and when to implement such skills, both sensibly and ecologically (Prensky, 2016; Saiz, 2018). Sure enough, if students are being educated to become critical thinkers, it is aimed at serving a higher purpose still: that these individuals become equipped to devolve into active, participatory agents in the world – of work, surely, but also of their surrounding (and our global) community. Thus is possible since critical thinkers are prone to approaching common public challenges with a hands on conduct ignited by an ethical and committed attitude (Vieira et al., 2011).

There are specific teaching-learning strategies *oriented* to the promotion of CT (Vieira & Tenreiro-Vieira, 2005), which are identified in the literature as fostering CT. Teachers can create activities in which students must: write an argumentative essay, and explain one's thinking and point of view in one's own words (Alzate, López, & Zuluaga, 2014; Veiga, Costa, Cardoso, & Jácomo, 2016; Vieira et al., 2011); search for information in order to answer a question (Alzate et al., 2014); question (Alzate et al., 2014; Saiz, 2018; Vieira & Tenreiro-Vieira, 2016); elaborate concept maps (Vieira & Tenreiro-Vieira, 2016); read and write scientific papers (Dunn, Halonen, & Smith, 2008); work collaboratively (Alzate et al., 2014; Kim & Jeong, 2018; Saiz, 2018; Vong & Kaewurai, 2017); solve significant real-life problems (Saiz, 2018). There are other strategies though, such as the "circle of knowledge" (i.e., presentation of an issue and its discussion, first in a small group, and then with the entire class, to give it closure) (Alzate et al., 2014); "constructive controversy" (i.e., presentation of an issue, followed by the identification and analysis of pros and cons) (Alzate et al., 2014); *Problem-Based Learning* (Alzate et al., 2014; Núñez-López, Ávila-Palet, & Olivares-Olivares, 2017; Saiz, 2018; Vieira & Tenreiro-Vieira, 2016); *Flipped/Inverted Classroom* (Smith, Rama, & Helms, 2018); the use of case studies (Popil, 2011); oriented debate using controversial issues (Dunn et al., 2008; Veiga et al., 2016; Vieira & Tenreiro-Vieira, 2016; Vieira et

al., 2011); the use of movies or television series, in order to ignite moments of reflection, analysis, debate, etc. (Dunn et al., 2008); to explore the new technological means in order to magnify the impact of writing activities (Kim & Jeong, 2018) or students' interactivity (Saadé, Morin, & Thomas, 2012).

Nonetheless, it is important to note that the strategy alone is not sufficient to promote CT; for instance, *Problem-Based Learning* will only prove to promote CT if it is used with such an orientation. Just to give one example, in a study by Vieira and Tenreiro-Vieira (2016), with future teachers, the authors found that the teaching-learning strategy used must be explicitly oriented to CT, otherwise it will not have a significant impact in increasing participants' level of CT. In this specific study, when oriented to promote CT, the teaching-learning strategy proved to be successful in contributing for a higher level of CT.

Along such CT "friendly" teaching-learning strategies, there are topics that might be particularly motivating to use in class to initiate an oriented debate or to ignite a "circle of knowledge", for instance. Citizens should have scientific literacy, which includes building scientific knowledge, and developing CT abilities and dispositions (Ossa-Cornejo, Palma-Luengo, Lagos-San Martín, & Díaz-Larenas, 2018; Tenreiro-Vieira & Vieira, 2000). This is particularly imperative in "post-truth times" as today, when fake news proliferate, and anti-science attitudes are modeled by our own political leaders. At the same time, citizens seem to have a distant relationship with science and to be unwilling to try to understand how scientific products function in fact. So, not only may individuals benefit from maximizing the quality of their CT abilities, but also will they have gains in their scientific abilities, since they walk hand in hand (Ossa-Cornejo et al., 2018). In light of this, an example of fake news or scientific fraud may be used in class as a starting point to discuss empirical facts versus personal opinions, scientific data versus the use of anecdotes, the dangers of post-truth and anti-science, the improvements created by science and its boundaries, among many other matters.

Aside from current and relevant topics to discuss in class, it is important to guide students in gaining awareness about cognitive bias (Saiz, 2018), which describes errors of thinking committed systematically, impairing rational thinking and behavior (Kahneman, 2011). According to Lauwereyns (2010, p. 5) the mind has the tendency to "choose the theory of least resistance, or the cheapest concept". This rule of cognitive economy leads time and again to one using heuristics – i.e., "a simple procedure that helps find adequate, though often imperfect, answers to difficult questions" (Kahneman, 2011, p. 98) – to make decisions promptly. While in some situations heuristics may lead to right answers, in other circumstances they create the context for biased thinking. So very often individuals think, thus behave, according to individual fallacies and cognitive biases. There is the *sunk cost fallacy* (i.e., when, in face of the investment made so far, one continues investing in something, even though it should be present and future gains grounding the decision to keep versus quit investing); the *conjunction fallacy* (i.e., when one mistakenly assumes that multiple conditions – which together seem to create a more plausible event – are more

likely to happen than one single condition); *confirmation bias* (i.e., one's tendency to search for and interpret information in light of what is already known and believed, with disregard for any disconfirming evidence); *hindsight bias* (i.e., when one believes that an event was predictable all along – only after it happened –, without any evidence that it would happen prior to it happening); among many others (Kahneman, 2011). Only becoming aware of such examples of faulty reasoning may students attempt to prevent falling under their spell.

Conclusion

Between April and June (12th) 2018, a total of nine people were lynched by mobs in India, subsequent to fake videos and text messages concerning child kidnappers on the loose being shared via WhatsApp – a very popular medium in that country, one that is also used by political parties to reach their electorate – and even being published in some local newspapers (Martins, 2018). Evidently there are other variables to be accounted for in explaining phenomena like this. Nonetheless, this is but an example of the way truth and deception very often and easily mix in real life, a process that is now accelerated by the possibilities of the new means of communication, which are "fast and furious" in the exchange of information and in the dissemination of big data. There are other reasons, though, why individuals should think critically in their personal and social lives, becoming able to think reasonably, make informed decisions, and solve multifaceted challenges, while avoiding being held hostage by cognitive bias and erroneous information, such as fake news, and its inherent propaganda and prejudice. "History does not repeat, but it does instruct" (Snyder, 2017, p. 9). So past mistakes instruct instead of repeat, each individual must take responsibility and stand out as someone who is able to think and find one's own thinking framework, expressing informed personal ideas and perspectives, which are founded on facts and empirical articles, and print journalism (Snyder, 2017).

Researchers and international agencies (e.g., UNESCO, 2015; World Bank, 2018; World Economic Forum, 2016) agree that it is critical to have CT, in order to face present-futurist challenges such as the ones incorporated in the 17 *Sustainable Development Goals* pertaining to ending poverty and hunger and inequity and unsustainable consumption behaviors, and assuring basic rights such as living in peace and having access to clean water, sustainable energy, and employment, thus creating the possibility of healthy, inclusive, educated lives for all, "leave no one behind" (United Nations, 2017, p. 2). The paradox is that individuals are expected to be critical thinkers without having had access to formal opportunities to develop their CT potential along schooling. At the same time, teachers are expected to know how to use their CT abilities, and also, to know how to ignite and promote their students' CT potential, without having had (initial/continuous) teacher education opportunities to learn how to do so.

Education may not be the solution to all evils, but it does play a role in finding solutions for the challenges created by the United Nation's *Sustainable Development Goals*, besides others that a globalized future may bring, and which require one not only to think, but also to act critically. Also, it has a role in developing CT, with specific teaching-learning strategies showing to be effective in promoting that right mix of abilities, dispositions, knowledge, and thinking criteria that together create CT. Here, innovative pedagogies are called upon to enable the promotion of CT, by using real-world challenges, ecological projects, collaborative relationships, and technological resources. In this context, teachers play an exceptionally important part: "the role of teachers and other educators remains central to fostering critical thinking and independent judgment, instead of unreflective conformity" (UNESCO, 2015, p. 83). For this reason, teachers must pursue opportunities of teacher education, and Higher Education institutions must continue their efforts in bringing CT to campus, not only inside the classroom, but also into the institutional discourse and the academic environment itself, in order to create real CT opportunities for all.

References

Alwehaibi, H. U. (2012). Novel program to promote critical thinking among higher education students: Empirical study from Saudi Arabia. *Asian Social Science, 8*(2), 193-204.

Álzate, O. E. T., López, J. R. Z., & Zuluaga, Y. E. L. (2017). *Pensamiento crítico en el aula de ciencias* [Critical thinking in science class]. Manizales, Colombia: Editorial Universidad de Caldas.

Arum, R., & Roksa, J. (2011). Limited learning on college campuses. *Society, 48*, 203-207.

Bakhshi, H., Downing, J., Osborne, M., & Schneider, P. (2017). *The future of skills: Employment in 2030*. London, UK: Pearson and Nesta.

Buskist, W., & Irons, J. G. (2008). Simple strategies for teaching your students to think critically. In D. S. Dunn, J. S. Halonen, & R. A. Smith (Eds.), *Teaching critical thinking in psychology: A handbook of best practices* (pp. 49-57). Malden, MA: Blackwell Publishing.

Butler, H. A., Pentoney, C., & Bong, M. P. (2017). Predicting real-world outcomes: Critical thinking ability is a better predictor of life decisions than intelligence. *Thinking Skills and Creativity, 25*, 38-46.

Choy, S. C., & Cheah, P. K. (2009). Teacher perceptions of critical thinking among students and its influence on higher education. *International Journal of Teaching and Learning in Higher Education, 20*(2), 198-206.

Dunn, D. S., Halonen, J. S., & Smith, R. A. (2008). *Teaching critical thinking in psychology: A handbook of best practices*. Malden, MA: Blackwell Publishing.

Eftekhari, M., Sotoudehnama, E., & Marandi, S. S. (2016). Computer-aided argument mapping in an EFL setting: Does technology precede traditional paper and pencil approach in developing critical thinking? *Educational Technology Research and Development, 64*(2), 339-357.

Ennis, R. H. (2011). *The nature of critical thinking: An outline of critical thinking dispositions and abilities*. Retrieved March 13, 2018, from http://faculty.education.illinois.edu/rhennis/documents/TheNatureofCriticalThinking_517 11_000.pdf

Franco, A. H. R., Butler, H. A., & Halpern, D. F. (2015). Teaching critical thinking to promote learning. In D. S. Dunn (Ed.), *The Oxford handbook of undergraduate psychology education* (pp. 65-74). New York, NY: Oxford University Press.

Franco, A. R., Costa, P. S., & Almeida, L. S. (2017). Do critical thinkers drink too much alcohol, forget to do class assignments, or cheat on exams? Using a critical thinking measure to predict college students' real-world outcomes. *Psychological Studies, 62*(2), 178-187.

Franco, A. R., & Vieira, R. M. (in press). O pensamento crítico na formação de professores: Uma proposta para o ensino superior [Critical thinking in teacher education: A proposal for higher education]. In P. M. Iglesia (Ed.), *Proceedings of the IV International Symposium of Science Teaching*.

Franco, A., Vieira, R. M., & Saiz, C. (2017). O pensamento crítico: As mudanças necessárias no contexto universitário [Critical thinking: The changes that are necessary in university]. *Revista de Estudios e Investigación en Psicología y Educación, vol. extr.*(7), A7012-A7016.

Gonçalves, E., & Vieira, R. M. (2015). Aprender ciências e desenvolver o pensamento crítico: Percursos educativos no 1.º ciclo do ensino básico [Learning sciences and developing critical thinking: Educational paths in the 1st cycle of basic education]. *Indagatio Didactica, 7*(1), 7-24

Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*(4), 449-455.

Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus, & Giroux.

Kim, H. S., & Jeong, K. O. (2018). Developing problem-solving and critical thinking ability with the use of crowdsourcing in university writing instruction. *Journal of Theoretical and Applied Information Technology, 96*(5), 1377-1386.

Lauwereyns, J. (2010). *The anatomy of bias: How neural circuits weigh the options*. Cambridge, MA: Massachusetts Institute of Technology.

Lipman, M. (2003). Education for critical thinking. In R. Curren (Ed.), *Philosophy of education: An anthology* (pp. 427-434). Malden, MA: Blackwell Publishing.

Liu, O. L., Frankel, L., & Roohr, K. C. (2014). Assessing critical thinking in higher education: Current state and directions for next-generation assessment. *ETS Research Report*, RR-14-10.

Mandernach, B. J. (2006). Thinking critically about critical thinking: Integrating online tools to promote critical thinking. *Insight: A Collection of Faculty Scholarship, 1*, 41-50.

Martínez, M. J. I., Cabezas, I. L., & Soler, I. R. (2018). La calidad e innovación educativa en la formación continua docente: Un estudio cualitativo en dos centros educativos [Educational quality and innovation in teacher training: A qualitative study in two schools]. *Revista Iberoamericana de Educación, 77*(1), 13-34.

Martins, A. (2018, June 12). Mais duas pessoas mortas após mensagens falsas no WhatsApp [Two more people killed following fake text messages in WhatsApp]. *Público*, p. 24.

National Education Association. (2012). *Preparing 21st century students for a global society: An educator's guide to "the four Cs"*. Washington, DC. Retrieved March 13, 2018, from http://www.nea.org/assets/docs/A-Guide-to-Four-Cs.pdf

Núñez-López, S. N., Ávila-Palet, J. E., & Olivares-Olivares, S. L. (2017). El desarrollo del pensamiento crítico por medio del aprendizaje basado en problemas [The development of critical thinking abilities in university students by means of problem-based learning]. *Revista Iberoamericana de Educación Superior, 8*(23), 1-19.

O'Donnell, S. L., Francis, A. L., & Mahurin, S. L. (2008). Critical thinking on contemporary issues. In D. S. Dunn, J. S. Halonen, & R. A. Smith (Eds.), *Teaching critical thinking in psychology: A handbook of best practices* (pp. 117-126). Malden, MA: Blackwell Publishing.

Ossa-Cornejo, C., Palma-Luengo, M., Lagos-San Martín, N., & Díaz-Larenas, C. (2018). Evaluación del pensamiento crítico y científico en estudiantes de pedagogía de una universidad chilena [Critical and scientific thinking assessment in preservice teachers at a Chilean university]. *Revista Electrónica Educare, 22*(2), 1-18.

Paniagua, A., & Istance, D. (2018), *Teachers as designers of learning environments: The importance of innovative pedagogies*. Educational Research and Innovation, OECD Publishing, Paris. Retrieved July 5, 2018, from https://doi.org/10.1787/9789264085374-en.

Paul, R. (2005). The state of critical thinking today. *New Directions for Community Colleges, 130*(Summer), 27-38.

Phan, H. P. (2010). Critical thinking as a self-regulatory process component in teaching and learning. *Psicothema, 22*(2), 284-292.

Popil, I. (2011). Promotion of critical thinking by using case studies as teaching methods. *Nurse Education Today, 31*(2), 204-207.

Prensky, M. (2016). *Education to better their world: Unleashing the power of 21st century kids*. New York, NY: Teachers College Press.

Saadé, R. G., Morin, D., & Thomas, J. D. E. (2012). Critical thinking in e-learning environments. *Computers in Human Behavior, 28*(5), 1608-1617.

Saiz, C. S. (2017). *Pensamiento crítico y cambio* [Critical thinking and change]. Madrid, Spain: Ediciones Pirámide.

Saiz, C. (2018). *Pensamiento crítico y eficácia* [Critical thinking and efficiency]. Madrid, Spain: Ediciones Pirámide.

Shehab, H. M., & Nussbaum, M. (2015). Cognitive load of critical thinking strategies. *Learning and Instruction, 35*, 51-61.

Smith, T. E., Rama, P. S., & Helms, J. R. (2018). Teaching critical thinking in a GE class: A flipped model. *Thinking Skills and Creativity, 28*, 73-83.

Snyder, T. (2017). *On tyranny – Twenty lessons from the twentieth century*. London, UK: The Bodley Head.

Tenreiro-Vieira, C., & Vieira, R. M. (2000). *Promover o pensamento crítico dos alunos – Propostas concretas para a sala de aula* [Promoting students' critical thinking – Concrete proposals for the classroom]. Porto, Portugal: Porto Editora.

Tenreiro-Vieira, C., & Vieira, R. M. (2014). Construindo práticas didático-pedagógicas promotoras da literacia científica e do pensamento crítico [Building didactic-pedagogical practices to promote scientific and critical thinking literacy]. *Documentos de Trabajo de Iberciencia*, 2. Madrid, Spain: Iberciencia.

UNESCO (2015). *Rethinking education – Towards a global common good?* Retrieved June 20, 2018, from http://unesdoc.unesco.org/images/0023/002325/232555e.pdf

United Nations (2017). *The sustainable development goals report 2017*. Retrieved June 18, 2018, from https://unstats.un.org/sdgs/report/2017/

Veiga, E., Costa, H. G., Cardoso, E., & Jácomo, A. (2016). A perspetiva dos alunos sobre um projeto de desenvolvimento do pensamento crítico no ensino superior [Students' perspectives about a critical thinking development project in higher education]. *Revista Lusófona de Educação*, 32, 109-121.

Vieira, R. M., & Tenreiro-Vieira, C. (2005). *Estratégias de ensino/aprendizagem* [Teaching/learning strategies]. Lisbon, Portugal: Instituto Piaget.

Vieira, R. M., & Tenreiro-Vieira, C. (2016). Teaching strategies and critical thinking abilities in science teacher education. In G. Gibson (Ed.), *Critical thinking: Theories, methods and challenges* (pp.77-97). New York, NY: Nova Science Publishers.

Vieira, R. M., Tenreiro-Vieira, C., & Martins, I. P. (2011). Critical thinking: Conceptual clarification and its importance in science education. *Science Education International, 22*(1), 43-54.

Vong, S. A., & Kaewurai, W. (2017). Instructional model development to enhance critical thinking and critical thinking teaching ability of trainee students at regional teaching training center in Takeo province, Cambodia. *Kasetsart Journal of Social Sciences, 38*(1), 88-95.

World Bank (2018). *World development report 2018: Learning to realize education's promise*. Washington, DC: World Bank.

World Economic Forum (2016). *The future of jobs – Employment, skills and workforce strategy for the fourth industrial revolution*. Retrieved March 13, 2018, from http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf