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Why are we in STEM? An attempt to define STEM literacy for everyone and with values

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Abstract • STEM education is an emergent approach with a lot of presence in the current educational arena. Further than the need to have an impact in the STEM education field in an innovative way, however, there is not enough agreement among STEM education researchers, teachers, educators and/or designers. As a consequence, there are a lot of different ways to conceive both what to do and how to do it in STEM education. Therefore, our standing point in this paper is to signal the need to agree on the purpose to enrol in the demanding STEM educational approach before discussing its what's and how's. To do so, we start by sharing a first initial attempt to define STEM literacy for all, in which the specific and high-order transversal competences and values of STEM education are highlighted over the technological, aesthetic or interdisciplinary aspects commonly emphasised in STEM education activities.

Keywords • STEM, scientific practice, transversal competences, literacy, equity.

Per a què estem a STEM? Un intent de definir l'alfabetització STEM per a tothom i amb valors

Resum • L'educació STEM és una proposta emergent sobre la que se'n parla molt darrerament. Entre els investigadors/es, docents, educadors/es o dissenyadors/es en educació STEM no hi ha, però, gaire consens més enllà de reconèixer la necessitat d'incidir en aquest àmbit d'una forma innovadora. Així, hom pot trobar moltes maneres diferents d'entendre què ha de ser i com s'ha de fer l'educació STEM. En aquest article reclamen, però, que per començar a parlar del què i el com de l'educació STEM primer hauríem de consensuar per a què o amb quin objectiu ens embarquem en aquesta demandant proposta educativa. Per fer-ho, plan-tegem un primer intent de definició d'alfabetització STEM en la que les competències específiques i transversals d'alt nivell així com els valors agafen protagonisme davant d'aspectes tecnològics, estètics o d'interdisciplinarietat comuns en les activitats STEM habituals.

Paraules clau • STEM, pràctica científica, competències transversals, alfabetització, equitat.

DO WE KNOW WHY ARE WE IN STEM?

The acronym STEM (Science, Technology, Engineering, and Mathematics) is increasingly present in today's educational reality. The launch of the STEMCat Plan in Catalonia this year is just a local example of the international concern for the scientific and technological field in its broadest sense. In Europe, this concern was highlighted with the publication of the report "Europe needs more scientists" at the beginning of the 21st century, while in the USA it has a long tradition, initiated in the post-Sputnik era with the acronym SMET, which has now resurged strongly. "We are the STEM generation" (Zollman, 2012).

Both in the USA and here, the main reason for governmental, business, and social interest in STEM education is the improvement of the quantity - and more recently also the quality and diversity- of STEM professionals, which is considered essential to ensure desirable economic and social progress. Thus, in the diversity of programs, reports, and proposals linked to the STEM movement, similar concerns can be found, which Zollman summarizes as: problems in ensuring the supply of STEM professionals, problems in ensuring knowledge and innovation for all future workers in a technological world, and what schools (and also other non-formal educational agents) "must do" to solve these two problems. Secondly, in these documents and programs, the need for citizen literacy in the scientific-technological field is highlighted.

From our perspective as researchers, trainers, and teachers in Science, Technology and Mathematics education with a critical stance, the interest in STEM education is precisely in promoting literacy in the STEM field for all students as a personal value in itself. As future citizens of a democratic society facing great challenges (e.g., the UN's Sustainable Development Goals), where science and technology play a leading role both in the side of the causes and the solutions, we need all students to develop a minimum competence in the scientific-technological field to have something to say. And this is completely independent of whether they will be part of the future STEM professional world or if they will be professionals in any other field where science and technology play a prominent role. First, because we do not know what the future world will be like, and today we already have proposals on the table such as controlled degrowth that predict and imagine a very different future from the current one. Second, because whatever the future world is like, we are clear that an essential part of it is the democratic will to decide it together, and this includes decisions in the STEM field from a perspective of Responsible Research and Innovation (RRI). Therefore, the importance of being literate in the STEM field has more to do with the empowerment and capacity that allows for active, responsible, and critical participation, with STEM knowledge, in the world we want to build, rather than with preparation to contribute to creating a particular world where science and technology have a predominant role.

However, we do not consider this objective to be opposed to the goal of achieving more, better, or, from a perspective of equity and gender that seems especially appropriate to us, more diverse professsionals in the STEM field. The reason is that education in STEM literacy can, explicitly or implicitly, limit or promote professional aspirations in this field. Today, the lack of professional aspirations in STEM among certain types of students is a reality. In our context, as elsewhere, gender and socio-economic level are related to the perception of low capacity in STEM and identity conflicts with professionals in this field (EVERIS 2012). As a result, our female students and also those from low socio-economic backgrounds have low aspirations for the STEM professional world, particularly in certain branches of it. And they have these low aspirations for the wrong reasons: they do not believe they are capable enough and do not see themselves in it. Literacy in the STEM field with a perspective of gender and equity should enable empowerment and the overcoming of stereotypes that allow these aspirations without necessarily promoting them. It is about all our students being literate citizens in STEM and realising that, if they wish, they could be empowered professionals in this field or related ones. Achieving this would be advantageous for everyone, as it would not only ensure fairer access to the STEM professional world but also a more empowered and engaged citizenry as well as more diverse STEM professionals who would bring social and economic benefits.

To decide which STEM education is most appropriate to achieve this, it is first necessary to clarify what sort of literacy or competence in the STEM field enables citizen participation and professional aspirations in this field for all students. That is, it is necessary to operationalize and define STEM competence in a way that allows decision-making when judging the suitability and quality of available STEM education proposals. The great variety of STEM programs, entities, activities, and projects that can be found online and around us suggests that perhaps not all these proposals, professionals, and entities pursue the same objectives or have the same idea of what it means to be literate in this field. In fact, the few attempts at definition have not achieved a minimum agreement to specify what is STEM literacy.

The educational literature does not offer much help either, beyond recognizing that STEM has become an empty buzzword due to its polysemy. In general, there are many more articles focused on discussing what STEM education is or is not, and how it should be carried out, rather than what the result should be in terms of students' capacities and knowledge with this educational proposal. And in the few documents and articles dedicated to talking about STEM literacy, most definitions are made from a vision that considers social and economic needs but "overlook personal needs" (Zollman 2012). That is, it seems that we are not clear about what we want to achieve, in terms of citizen competence, by opting for STEM education.

In this article, we want to make a first attempt, based on what we already know mainly from science education, but also mathematical and technological education, to define STEM competence and literacy for everyone. In doing so, we want to discuss the implications of this choice, differentiating the non-negotiables (what we should not lose) from other aspects that may vary depending on what other educational sub-objectives beyond literacy are pursued. In doing so, we believe we contribute to the important existing discussion about what STEM education is and how it should be, from the position that to contribute to this discussion we must first agree on why we want STEM education.

STEM COMPETENCE OR LITERACY: WHAT ARE WE TALKING ABOUT?

Although there are not many academic definitions of STEM literacy, one can find various references to this concept among the proposals, entities, and programs promoting STEM education, both formally and informally. Generally, references to STEM literacy highlight two key aspects: the use of concepts from the involved disciplines (science, technology, engineering, and mathematics) and the application of these concepts to understand and solve problems (Zollman 2012). In other words, existing definitions of STEM literacy show a competency-based approach by putting the knowledge of each of the STEM disciplines into use. This orientation is consistent with existing definitions of literacy or competence for each of the STEM disciplinary areas. For example, in our current curriculum or in the PISA assessment framework, scientific-technological competence is written in similar terms.

To this basic definition, some authors add two features that seem distinctive of STEM proposals: the integration of concepts from the different disciplines involved in STEM and the promotion of innovation or creativity. An example is Balka's definition: "STEM literacy is the ability to identify, apply, and integrate concepts from science, technology, and mathematics to understand complex problems and innovate in their solution" (Balka, 2011, p. 7). This definition emphasizes the importance of being able to integrate the concepts or ideas of the STEM disciplinary families to put them to specific use, involving the mastery of 21st-century transversal competencies: solving problems and doing so creatively. This implies adding value to the STEM proposal compared to competency proposals of each disciplinary branch by necessarily adding transversal competencies to the disciplinary ones.

In the definition of STEM literacy that we want to propose, we believe that all these traits are indispensable: the competence-based vision (aspiring to be able to put knowledge to use), the integration of knowledge from the involved disciplines, and especially the explicit incorporation of the most important transversal competencies, such as 21st-century competencies. However, we miss other aspects that we believe should be included in a more complete definition of STEM literacy. These are, in particular: 1) A vision of disciplinary knowledge or content that explicitly refers to both knowledge of and about the disciplines, highlighting the importance of non-conceptual knowledge or content; 2) An inclusion of transversal competencies that also includes other very relevant 21st-century competencies, such as critical thinking, cooperation skills, and communication, as well as the metacognitive vision of learning to learn; and 3) An explicit reference to values, both as content to be mastered by students and as an educational perspective for teaching and learning them. At the same time, we want our definition to make an explicit contribution to clarifying two aspects that are often mistakenly linked to quality in STEM education, which are the degree of interdisciplinarity and the use of cutting-edge, generally creative or programmable technologies. With all this, our concrete proposal for a first attempt at defining STEM literacy that includes these ideas would be:

Being literate in STEM means being able to identify and apply both key knowledge and ways of doing, thinking, speaking, and feeling in science, engineering, and mathematics, in a more or less integrated way, to understand, decide, and/or act on complex problems and to build creative solutions, taking advantage of personal synergies and available technologies, and doing so critically, reflectively, and with values.

Within this proposed definition of STEM literacy, a concrete vision of specific contents or competencies, transversal competencies, as well as the values that we consider necessary to work on in STEM education to ensure literacy, is incorporated. Below, we discuss each of these aspects, with the aim of clarifying a bit more why we believe we should be in STEM.

What Contents? Key Ideas and STEM Practices

In the context of STEM education, there are deep discussions about which disciplinary families it refers to and which specific disciplines are included in each. This discussion encompasses which specific disciplines of science or engineering are included (for example, whether astronomy or palaeontology are considered STEM); whether other related branches are included (for example, whether environmental sciences, medicine, or pharmacy are considered); or even whether areas considered social sciences in our context, such as geography, economics, or psychology, among others, are included. When the chosen educational perspective is STEAM, adding an A for Arts, Humanities (Liberal Arts), or even all disciplines (All), the complexity of establishing a disciplinary boundary that delimits the STEM field increases even more. In fact, what is considered STEM depends on what is considered science, engineering, or school mathematics in each cultural and curricular context. In some contexts, alternative acronyms have been proposed, such as STREAM, which include disciplines as far removed from the scientific-technological field as religion!

Regardless of which disciplines are considered included in STEM in each context, selecting well which contents of these disciplines should be worked on in STEM education is essential. As we have seen, however, in the definitions of STEM literacy, reference is often made to contents ambiguously (as “knowledge”) or only to conceptual contents (i.e. concepts). The analysis of activities commonly found with the STEM label, however, shows an interesting contrast with these definitions, as they generally include very manipulative activities, of an observational, investigative, or construction nature, where procedural or technical contents predominate, and no conceptual content seems to be worked on in depth. So, what are the necessary contents to be literate in STEM?

Today, we consider that conceptual contents alone or the inclusion of procedural ones are not enough to be considered literate in a disciplinary area. First, because literacy requires not so much a mastery of conceptual contents of a discipline as a mastery of certain specific contents of that discipline, which are those key ideas that define its way of looking at the world and have the most potential for understanding and acting in our environment (Couso, 2015; Harlen, 2010; NRC, 2012). Secondly, because the knowledge of a discipline must be epistemic, that is, it must include not only what we have managed to know but also how we know it and why we believe it (Garrido & Simarro, 2014; Grandy & Duschl, 2007; Osborne, 2014). For example, in science, it is as important to know an important product of science such as the theory of evolution as it is to understand how knowledge is generated to propose a theory and why it is supported. Thus, both the practices of the disciplines (the ways of doing, speaking, and reasoning) and their value systems (what they value and promote) are an indissoluble part of their knowledge content: in fact, they are the knowledge that gives them meaning because they allow us to differentiate them and choose which is more relevant for each specific situation or problem.

This way of understanding disciplinary contents not as a list of concepts or techniques, but as a way of doing, thinking, speaking, feeling, and valuing specific to a particular community of practice (for example, the scientific community) is the basis of the new curricular reform in the USA, where the curriculum is organized into key ideas, socio-discursive practices, and meta-disciplinary notions specific to each disciplinary field (NSF 2012). The idea is to shift the focus of scientific and engineering education from the products of science and technology (what we know, such as facts, nomenclature, laws,...) to what are the most important things we know (the key ideas), how we have got to know them and why we value them (the epistemic practices) (NRC, 2007). In science, these practices include formulating researchable questions or drawing conclusions based on evidence. In our context, the proposal of the School Scientific Activity by Izquierdo and followers has been promoting the same ideas for more than two decades (Izquierdo, Espinet, García, Pujol, & Sanmartí, 1999), fostering contextualized and competency-based curricular proposals where students work on key models of science (the most important ideas generated by science) while engaging in the practices of inquiry, argumentation, and especially modelling (see Project Scientific Competence 12-15). Similar references for engineering or mathematics can be found in different curricula and reports worldwide, highlighting that what is crucial in these disciplines is not a specific concept such as a gear or a specific technique such as adding fractions, but the practices specific to these disciplines: for example, optimizing, thinking systemically, or visualizing in the case of engineering, or reasoning abstractly and looking for patterns in mathematics. Although we do not have a consensual list of these practices for the STEM field that can be used directly today, the idea of going beyond conceptual contents and involving the epistemic ones is considered indispensable and should be explicitly added to a definition of STEM literacy.

On the other hand, regarding the capacity for integration or interdisciplinarity that should be expected or not in STEM literacy, the proposal to understand STEM as a field in which to develop the ways of reasoning, doing, speaking, feeling, and valuing of the scientific-technological field helps to position oneself in a non-radical integration stance. While a certain degree of integration is desirable and can be achieved, the practices of science, engineering, and mathematics are ontologically and epistemologically different, and as a result, it is difficult to work on all of them in depth at the same time. In fact, sometimes it is impossible to do so because what is a value in one field can be an anti-value in another. For example, idealizing in science vs. materializing in engineering, or proving in mathematics vs. testing hypotheses in science. In this sense, being literate in STEM should not be understood as being able to participate in the practices of science, engineering, and mathematics simultaneously, but as knowing how to navigate between them comfortably, being able to participate meaningfully and decide which one should be prioritized at each moment to solve a real problem. For example, recognizing that to understand why any ship floats, we need to delve into the scientific practice of modelling flotation, but to build a specific ship or test which ones float better, the most appropriate thing will be to follow the phases of the technological process (engineering practice). And recognizing that, in doing so, I may be applying appropriate scientific, technological, or mathematical concepts (hence the certain degree of integration), but the practice, that is, the discourse and way of doing and looking that it is developed and learned, will generally be from one of these disciplinary branches at each moment.

Which Transversal Competencies? Those Not So Transversal

In the proposals for defining STEM competence, as we have seen, some transversal competencies are explicitly included, such as problem-solving and creativity. However, these are not all the transversal competencies that the literature has highlighted as important today. Therefore, we need to analyse the different proposals for transversal competencies to decide which ones are key to complementing the disciplinary competencies in the STEM field. Moreover, some of these transversal competencies coincide with STEM disciplinary competencies that have different meanings for the different STEM disciplines. In this sense, it is necessary to discuss the role of transversal competencies in STEM literacy.

Since the beginning of the competence-based educational movement, different sets of basic competencies for citizenship have been proposed, differentiating between disciplinary competencies or those associated with specific knowledge areas and those that have a transversal character. These transversal competencies are largely inspired by HOTS or high-order thinking skills, defined as the most advanced levels of thinking in which we can engage. For example, in the current reformulations of the well-known Bloom's taxonomy, they would be critical thinking, analytical capacity, and evaluation. Additionally, in recent years, other horizontal skills and dispositions have also been socially and especially corporately advocated, extending the use of the term "soft skills" to encompass those interpersonal or social skills that, although not cognitively demanding, are essential for the good personal, social, and professional development of the individual and are not always adequately developed. Examples include teamwork or communication skills.

Recent formulations of transversal competencies encompass these classic notions of HOTS and soft skills and add other aspects to take into account the demands of the dynamic, global, and deeply digital current society. In this sense, 21st-century competencies are proposed as a "survival kit" of transversal competencies that citizens must master to survive in the century they live in. These skills include critical thinking and problem-solving, but also collaboration and leadership, agility and adaptability, initiative, effective communication skills, access and analysis of information, and curiosity and imagination (Wagner 2003). Subsequent classifications and reformulations of these 21st-century competencies, particularly the well-known P21 Partnership proposal, have explicitly incorporated digital and media literacy and separated skills for personal and professional life from skills for learning and innovation. The latter, known as the 4Cs for their initials in English, include Critical thinking and problem-solving, Communication, Cooperation and Creativity. These four 21st-century transversal competencies are the most cited ones in STEM proposals.

Regardless of whether only the 4Cs should be considered as necessary transversal competencies for STEM literacy or if some other transversal competencies or skills should be added, what has generated the most controversy in the literature, both in STEM and in general, has been the consideration of these competencies as learning objectives *per se*. That is, whether these transversal competencies can be learned outside the disciplines and transferred directly from one domain to another. Cognitive literature seems to indicate that knowledge and skills are interdependent and that a base of disciplinary knowledge is essential to develop important transversal competencies (NRC, 2007). In problem-solving, for example, a meta-analysis of 40 experiments investigating ways to teach scientific problem-solving found that the most effective strategies were those that worked on the involved knowledge (for example, including activities like concept maps) over others focused exclusively on general problem-solving strategies (Taconis et al, 2001). The same happens with critical thinking, which is considered strongly dependent on the knowledge of the subject being addressed and, although it improves with practice, is not a skill that can be learned and then applied in any other situation (Willingham, 2008). The same applies to creativity, although this topic is more controversial (Plucker, 1998). In fact, it is easy to recognize that being critical in science is not the same as in engineering, nor is solving technological problems the same as mathematical ones, nor is being creative in science the same as in the arts. Despite all STEM disciplines include argumentation among their competencies, what counts as evidence and the rules of good argumentation depend deeply on the disciplinary field (NRC 2012).

This dependence on the content domain for many 21st-century competencies (particularly skills for learning and innovation) should lead us to think that, despite their name, they are not transversal competencies in the universal sense: 1) they do not have a definition and way of being understood completely independent of the context of use or disciplinary perspective undertaken, and 2) they cannot be fully developed without learning the contents (key ideas and practices) of each field. In fact, an interesting way to address this need for new competencies suitable for the 21st century is not to understand them as transversal competencies to be developed in all or even "apart" from the disciplines. Rather, they are part of the disciplinary learning objectives, which have extended beyond their traditional focus and become more sophisticated contents with higher cognitive, discursive, and social demands.

From this perspective that we share, developing 21st-century competencies actually implies increasing the competency demand of each discipline. This has important implications in the classroom. We agree with the report by Pellegrino and colleagues that the range of 21st-century competencies should be developed within the disciplines, and that this requires dedicating additional teaching and learning time and a significant variety of methodological and didactic resources (Pellegrino, Hilton, & Learning, 2012). In other words: we do not need to focus on teaching creativity, problem-solving, or metacognition in addition to, in the context of, or even instead of teaching science and engineering. We need to teach science and engineering by developing creativity, problem-solving, critical thinking, communication, and metacognition, among others.

The previous two points propose considering practices and transversal competencies as inherent contents of the STEM disciplines. This recommendation, although referring to what to teach, partly determines how to do it. As we have argued elsewhere, in fact, the “whats” and “hows” of teaching are not as independent as they seem (Couso 2014). For example, one cannot learn to argue or inquire without actively participating in arguments and inquiries. Moreover, the two types of content are compatible and facilitate joint work. If we manage to get students involved in the practices of school science and engineering, which are analogous to the practices of real science and engineering, it will be easier to develop these 21st-century competencies that necessarily form part of the way "expert" scientists and engineers work. For example, if in the topic of plant germination and growth, students develop researchable questions; design and carry out their experiments and learn to communicate their results in a certain format, this serves them, at the same time: 1) to develop their scientific creativity and communication skills in science; 2) their competency knowledge of science (applying and advancing what they know about plants, germination, etc.) and 3) their competency knowledge about science (applying and advancing what they know about what inquiry is, how we inquire, when an inquiry is trustable, ...). If they do this in the context of creating a vertical garden to welcome people to their school, they will also work on their artistic creativity in the design phase and even the technological process if they explicitly and reflectively follow these steps to solve the task.

What Values? Equity and Sustainability in the What, How, and Why

Developing key ideas and STEM practices in the classroom, and doing so while developing 21stcentury competencies, can be done for many different reasons. At the beginning, we mentioned that the STEM movement was initiated and continues to be led from the perspective of achieving better STEM professionals, and therefore, from a socio-economic motivation. However, there is also the democratic and ethical motivation for STEM education that we have presented and argued for in this article, related to the desire for citizen empowerment in front of scientific-technological challenges in a context of citizen participation in scientific research (RRI). Choosing which of these objectives are at the centre of each STEM educational proposal is obviously not exempt from values.

However, the values in STEM are not only found in the motivation behind the support for this educational proposal. Within the enormous diversity of different activities and programs that we find in STEM, the different types, forms of organization, resources used, target audience, etc., communicate values in themselves and emphasize the work on other values. For example, associating STEM (or even thinking that we can only do STEM) using high-cost creative technologies (such as 3D printers, commercial robots, or sophisticated kits for designing sensors, etc.) makes STEM activities more accessible to certain students. If we associate STEM with extracurricular activities not open to everyone, the same thing happens. A STEM program that includes activities with recycled or homemade materials, low-cost programmable or analogic technologies, that is done by sharing resources with other entities (such as public maker spaces), that is done in the classroom integrating all students, that is concerned with the environmental impact it generates, that is oriented to solving local problems with social impact and/or that is done in extracurricular social programs, etc., communicates and develops very different values. Examples that already exist today include tinkering spaces in public schools, making toys from waste, participating in citizen science projects to investigate local (i.e. air pollution in the school) or global (i.e. improving biodiversity or helping in disease detection) challenges, programming games about disproportionate consumption or how to protect oneself from child abuse, developing programming clubs in socially vulnerable contexts, building musical instruments to play music from different cultures, dramatizing the historical role of women in science, incorporating other mathematics or sciences in multicultural contexts, conducting scientific outreach in neighbourhoods and for other audiences that are not usually reached, etc. Despite the criticisms that I partly share regarding certain STEM proposals that promote irresponsible consumption, technocracy, and elitism, there is a whole range of STEM activities and programs that emphasize the opposite values: producing to reuse and reduce; emphasising ethical science and technology with and for society and valuing everyone's creative contribution. These values, however, must be made explicit to change the collective consciousness about what STEM education is and can be. From my perspective, the values of equity and sustainability should be non-negotiable.

Regarding equity, we have published elsewhere that the STEM positioning of our students (how they see themselves in this field, what role they believe they can have in STEM, and what role they give to STEM in their lives) depends on many variables (see STEAM4U project [1]). The most important are identity concerning the identity associated with people interested or working in STEM, professional aspirations in this field, the capacity we have, and the perception of self-efficacy, that is, how "good" we believe we are at STEM. All these variables develop in context, with a significant influence from society in general, and family and school in particular.

In our context, the identity and image of STEM professions reproduce the patterns identified internationally since the 70s: STEM professions continue to be associated with white, middle/upper class, and exceptionally brilliant men. Also, with geek personalities who are childish, obsessive, uncommunicative or asocial, and deeply vocational. Reconciling one's identity as, for example, a feminine girl or a maghrib boy with the socially shared image of STEM is not easy. Moreover, when STEM is not familiar (when people who enjoy, live, or value the STEM field are not recognized in the immediate environment), STEM aspirations are very low, and therefore the motivation towards this field, perceived as alien, is further reduced. Finally, and most importantly, our students have a significant problem of self-efficacy perception, with more than 45% overall (and over 55% in girls and students from low socio-economic backgrounds) convinced that they would be unable to successfully pursue STEM studies (EVERIS 2012). This is due to the accumulation of negative experiences (getting bad or simply worse grades in STEM than in other disciplines), the assessment of their abilities by their adult references, both parents and teachers or counsellors ("you're not good at it..."), as well as the image of excessive difficulty associated with this field. Working towards normalizing the image of professionals and people interested in STEM, expanding the range of professions and people associated with it (scientific communicator, teacher, technician, entrepreneur, artist, translator, or STEM historian), making STEM more familiar (bringing STEM closer to neighbourhoods, families, etc.), and above all, ensuring that boys and girls have successful experiences in this field would be some of the strategies for an equity and gender perspective in STEM education. Both science and mathematics education research fields have been investigating for years from a multicultural perspective on what scientific and mathematical education is more inclusive. It will be important to take their results into account explicitly if we want to do STEM education with the right values. Assuming that STEM activities, simply because they are innovative, manipulative, creative or colourful already have an equity and gender perspective is too simplistic.

Regarding sustainability, the field of environmental education and sustainability has also been working for many years on different ways to introduce this perspective into all activities, promoting awareness, responsible action, and even activism. STEM agroecology projects (for example, automating school gardens or building containers for urban eco-gardens), reducing energy consumption (for example, conducting energy audits and active campaigns in schools), protecting local biodiversity (conducting field trips linked to species protection organizations, etc.) are activities that in our context have been developed in various schools, generally linked to the Green Schools and Agenda XXI movements, and should not be considered outside of STEM. On the contrary, introducing the STEM perspective into these activities can significantly enrich them. At the same time, introducing the environmental perspective into the STEM field is especially important so that this field does not become what its critics and detractors predict. In fact, STEM education without an environmental perspective would contribute to the problems and challenges we face, such as those behind the Sustainable Development Goals (SDGs), like resource and energy waste or pollution generation, instead of contributing to the solutions.

STEM LITERACY AS A TRUE OBJECTIVE

Although a definition never captures all the ideological richness behind it, nor the important nuances that experts in the field usually give to it, we believe that this first attempt at defining STEM competence can be useful for trainers, teachers, non-formal educators, and STEM education designers. In fact, it should serve to start evaluating and judging the suitability of the different STEM activities, proposals, and programs available today. For us, it helps to put into question STEM activities where students only manipulate scientific-technological objects with a merely aesthetic approach, for example, drawing a picture with polygons or making a rainbow with pigments. In these "beautiful" STE(A)M activities, students generally do not acquire competence in the use of the STEM constructs behind the objects used (polygons, concentration, or capillarity), nor in any STEM practice such as observing, analysing, or optimizing. And probably not in artistic competencies either. It also helps us to show reservations about those activities typically associated with STEM where the values we want to convey or an equity perspective are not clear, such as assembling a commercial robot without any other purpose than the challenge of assembling it.

The definition we offer does not solve all the doubts that may arise about STEM education. We will continue discussing whether an activity is a good example of STEM education or not, or how to make it so. In this discussion, however, it is important to focus not on what we like about the activity, but on what it promotes and allows students to develop. That is, if by doing this activity our students are learning to navigate the scientific-technological field with agility and autonomy, which is our goal. We firmly believe, however, that making explicit and agreeing on why we are in STEM and what is STEM literacy is a good start to the serious, explicit, and unavoidable conversation that, in education, we must have regarding the STEM field (and which, in fact, we are having in the hallways). This article simply aims to take a first step on this path, not with the intention of getting entangled in discussions about versions of definitions, but with the aim of getting appropriately entangled in clarifying the ultimate goal of our efforts in STEM education.

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NOTES

[1] Web of the STEAM4U project: http://steam4u.eu/

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