opinion

The role of STEM in education

Students' perception that STEM areas are more complicated than other areas needs to be reversed.

by Pepe Menéndez

BACKGROUND AND CURRENT PERCEPTION OF STEM

Seymour Papert (1928-2016) is the mathematician considered the promoter of a playful methodology for learning programming, primarily aimed at children and young people, and felt a precursor of the STEM (Science, Technology, Engineering and Mathematics) initiative. Papert was a strong advocate of learning through artificial intelligence to develop children's thinking. For this reason, from the 1980s onwards, he promoted numerous initiatives using LOGO language, of which he was the creator.

We mustn't lose sight of the basis of Papert's reasoning, based on the link between play, technological gears and the development of the brain in early stages.

STEM aims to stimulate interest in knowledge areas traditionally seen as complex and unattractive for students, for girls in particular. The acronym itself evolved in several variants: the most widely accepted is the one that adds the A for Arts and it is recognised as STEAM, or the acceptance of ST2REAM (T2 for teaching or thematic instruction, and R for reading).

According to UPC data, only 29% of new enrolments were girls. Two more facts should be taken into account: they have increased by 5% in five years, and the Polytechnic University concentrates around 80% of the studies related to STEAM subjects. The Department of Education, in its publication of the STEMcat Plan in 2017, pointed out, among other reasons for promoting it, the gender stereotypes in society, and cited a study by Everis in which it states that only 26% of girls opt for the STEM-specific bachelor's degree compared to 40% of boys. This situation is even worse if we look at the family's socio-cultural level, which shows that only 24% of those with a low level of education choose them, compared to 44% of those with a high education level.

The contrast between the usual way of starting an argument in the field of science by asking questions, and the way schools approach their knowledge.

The difficulties of teaching mathematics and science at school are a classic debate in many countries of western culture, in the broadest sense, which contrasts with the great acceptance and apparent ease of teaching in Asian countries such as India, China and Singapore.

At the root of all initiatives linked to STEM -or any of its variants- is the evidence that students themselves have a poor perception of their opportunities and genuine ability to learn in these areas of knowledge. And this insecurity

is even more common in the case of girls than in the case of boys. Melina Furman, an Argentinean teacher who is well known for her work in science education, has told me more than once her surprise by the contrast between the usual way of starting an argument in the field of science by asking questions, and the way schools approach their knowledge, in which the initial questions are often absent.

ASKING GOOD QUESTIONS

Asking oneself the why of things, their origin, meaning, evolution, learning by making mistakes and experimenting are habitual scientific thinking attitudes. The truth is what it is until proven otherwise. It seems to be radically opposed to learning based on procedures without alternatives and which have to lead to a single result.

It is important to note that the very evolution of the drive for STEM (or STEAM) has been linked to methodologies that start challenging questions: they require inquiry, experimentation and selection, are based on teamwork, oriented towards the creation of an actual product that promotes learning without fear of error; and that focuses on relevant issues. They have prioritised using technologies for 3D manufacturing, *Fablabs, maker spaces*, the use of LEGO-LOGO and other artificial intelligence technologies. This is a kind of synthesis between the conviction to disseminate scientific and technological thinking and adopting methodologies that many innovative schools are also carrying out in other curriculum subjects.

Providing additional ways for children and young people to connect their learning areas could lead to better results.

STEM AND THE LABOUR MARKET

We have often seen the importance of STEM studies underlined by European labour market forecasts, showing a need for seven million skilled jobs in these disciplines by 2025 (Encouraging STEM Studies for the Labour Market). From my point of view, focusing on the future of work to try to convince young people to take these studies is not a very wise strategy: if anything characterises young people's vision of the future of work, it is the lack of a link between their training and the behaviour of the labour market. The figures are stark: 18% school failure rate, endemic unemployment and job insecurity. On the other hand, providing additional ways for children and young people to connect their learning areas could lead to better results. If, as Cristòbal Cobo considers, the programming language is approaching the concept of basic literacy, we need to look at other learning strategies that reach all pupils.

In this sense, there are some proposals for interdisciplinary knowledge, apparently very far apart, to bring STEM closer to humanities (literature, history, philosophy...), also at low moments, and which are generally chosen for their apparent ease.

The key question we have to answer is what we want young people to know when they finish school and what we want them to have experienced, bearing in mind that we are already entirely in a world in which we will be lifelong learners.

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