The use of experiential learning and manipulations to understand STEAM concepts : Transcript

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Hi, my name is Manon de Schryver, and I am a Project Coordinator at Logopsycom in Belgium. Our company is a pedagogical innovation center that specialises in the creation of inclusive and innovative pedagogical resources, especially in the field of STEM.

My talk today will be about the use of experiential learning and manipulations to understand STEAM concepts.

During the last few years, we could observe a persistent issue of underachievement in STEAM subjects that pushed us to explore innovative pedagogical solutions.

Indeed, the 2018 PISA studies have shown that 1 out of 5 youngsters in Europe is underachieving in STEM, and thus not equipped with the basic skills necessary for jobs in critical fields such as engineering, medicine, or scientific research for example. This indicates a need for alternative solutions and support systems in education.

The first step was to ask ourselves what the potential causes for underachievement in STEM could be. Our research revealed that there is a rise in underachievement in STEM generally occurring in secondary school when we go from contextualised concepts to abstract ones where the students are unable to link what their lessons are with a concrete life situation. As traditional education mainly relies on theory-based ex-cathedra lessons, we end up with a portion of students who cannot see the point in learning these subjects, as they are not contextualized. In fact, recent studies revealed that the older a pupil gets, the less their interest is stirred and the more their attitude towards school in general, and especially in subjects such as Math and Science tends to deteriorate.

Thus we endeavoured to find a way to root abstract STEM theory into concrete life situations and this is how we came to design the european project STEAMbuilders in collaboration with 7 different European organizations.

The idea of the project is to introduce pupils to STEAM through the recreation of historical techniques with the help of makerspace technology for materials. The approach is hands-on, inclusive, and has the benefit of promoting History and Cultural Heritage while also interesting pupils into current school materials.

This method is mainly based on Experiential Learning Theory, or ELT. According to one of it's founding fathers, David Kolb, it can be summarised by:

" Learning is the process whereby knowledge is created through the transformation of experience".

ELT encourages trial and errors, improves retention of information, orients learning towards problem-solving, promotes a mindset of progress and boosts students' interest and motivation.

The main idea is that Learning is based on experience, in a cycle that alternates 4 phases: Experiencing, Reflecting, Thinking and finally Acting, before starting all over again.

Instead of visualizing learning like pouring knowledge into an empty mind, it is more akin to molding a way of thinking by renewing, adapting, adding and linking information through experience over time.

Knowledge is not a fixed thing, nor is it "dead". We reassess what we know continually and we are evolving in our knowledge and the brain is more akin to a muscle being continuously formed through exercice than to a box being filled with fixed information.

This all led to the creation of the pedagogical materials of STEAMbuilders in which we use History and heritage techniques and manipulations to contextualize present-day STEAM theory.

The pupils are first presented with a technique, a small-scale machine, or a building of some kind. They experience or observe the manipulation working. Then they try to reflect and try to figure out it's mechanism and it's use if relevant. The manipulation is then presented a little in terms of historical origin: where it comes from, what is it's purpose, etc. Then, the pupils receive the blueprints to build it or recreate it

themselves under supervision. And this will allow them to integrate the mechanism better, to visualize it's components and how they articulate or interact together. They use it in class, with the teacher explaining the theory behind it. The pupils are then asked in what other instances of everyday life this concept can be applied or found. This will in turn trigger more observations of their surroundings and more reflection on how the world works around them.

They will be able to link the abstract concepts to both recent and ancient concrete manipulations and this will fix the information more deeply in their memory.

Especially given that, as more senses are activated during the session, and as they are actively taking part in their learning, more brain zones are active during learning and this will help with the retention of information long-term.

Of course, the end goal is not to replace formal education with this method, as unfortunately it is problematic in terms of assessment of knowledge and it is more time-consumming, but rather it is to enrich the traditional teaching method with these contextualisations in some lessons in order to improve the memory of the students, to boost their engagement in lessons and to peak their curiosity about the world and its STEAM mechanisms.

A motivated student will always achieve much more than an unmotivated one. This method is also beneficial for pupils with Specific Learning Disorders as the sequences and concrete materials will help them visualize, interact and understand the theory that they are learning. They need clear steps and to be able to link things to concrete situations in order to integrate the materials more easily.

So to conclude, the use of experiential learning is not only very useful to boost the learning efficiency and engagement of pupils in STEAM subjects more, but also beneficial for pupils with SLDs, and can, and should, be used more often in the context of the classroom to boost students' interest, engagement and understanding of the STEAM subjects.

Thank you very much for your attention.