How to teach energy efficiency in houses by using STEAM approach?- ComfyHouse Innovative Pedagogy Guideline
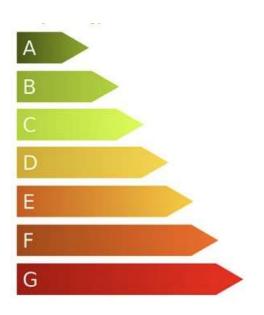
About the project

The European Green Deal is at the heart of the new EU agenda. Its aim is to make Europe climate neutral in 2050. Buildings are responsible for about 40% of the EU energy consumption and 36% of energy-related greenhouse gas emissions. Buildings are therefore the largest single consumer of energy in Europe. Heating, cooling and domestic hot water account for 80% of the energy consumed by us citizens. Currently, about 35 % of buildings in the EU are over 50 years old, and nearly 75 % of buildings are energy inefficient. At the same time, only about 1 % of the building stock is renovated each year. [1]

Several educational initiatives have been undertaken locally in order to respond to the ambitious aims of the EU, as well as to support the societal change in terms of the climate change. This publication is a part of a bigger educational project, which was aimed at creating innovative educational curricula for schools based on the STEAM approach to support energy efficiency in houses.

The innovative and interesting educational materials have been produced, which you can find on our website. They were used in primary schools in Lithuania and Romania as a project-based learning activities using STEAM during classes with pupils. These materials are open-sourced, i.e. everyone can have access to it and are aimed to be used by other primary schools in all EU countries.

The aim of this publication is to complement the existing classes and to provide teachers with guidelines on effective use of STEAM in their workplace.

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[1] Energy performance of buildings directive (europa.eu)

What is a pedagogy for teaching?

The term "pedagogy" describes the method by which teachers instruct students in both theory and practice. The teaching philosophy of a teacher shapes pedagogy, which describes how culture and various instructional modalities interact.

The study of teaching methods, especially STEAM methods, and how they affect pupils is referred to as STEAM pedagogy. For students to learn more effectively and for them to develop STEAM skills, an effective and well-considered pedagogy is essential. A robust pedagogy, introducing math, science, engineering and art, is necessary to guarantee that students can learn well, which poses certain problems and opportunities for instructors. This might entail employing teaching methods and resources that are suitable for the students' ages as well as having an awareness of the many stages of a child's development and how they can impact learning. This learning method is also very good for the environmental learning, since both green skills and digital skills, are strongly and directly related to the STEAM approaches being used in the past.

Strong pedagogy in STEAM education should also take into account the demands and learning preferences of students who are taking classes. The adoption of individualized learning plans and other strategies that let students study at their own speed and with their own abilities is one of the main good assumptions of STEAM. They might be quicker in art, while performing worse in math exercises, or they might have more scientific skills, which will allow them to do math exercise quicker and give them more time to perform art activities.

This is the value added of STEAM pedagogy and teachers should be aware that the multidisciplinary approach to the lesson give students more freedom, enjoyment and allows them to find fields, where they feel fulfilled.

This document is aimed at investigating the learning process and how it can be advanced using evidence-informed teaching strategies.

Constructivist pedagogy for STEAM

One popular pedagogy for absorbing STEAM into the classes is Constructivist pedagogy, which emphasizes the importance of active learning and student engagement in the learning process. The focus of this method is on the notion that knowledge is constructed by the student rather than merely being imparted by the teacher.

The goal of constructivist pedagogy is to help students develop their own understanding of the subject matter by encouraging them to ask questions, explore ideas, and work with others. By employing this strategy, educators can assist students in becoming as independent thinkers and critical thinkers.

How does STEAM pedagogy affect the learning process?

The most effective pedagogies incorporate a variety of teaching methods, including a thorough teacher's manual, organized group work for the entire class, guided learning, assessment practice, and individual activity. All these methods are included in our educational materials of ComfyHouse. Our pedagogies make appropriate use of questioning and dialogue in order to improve STEAM thinking and the improvement of digital skills.

In line with that for the scope of the creation of innovative educational materials, we utilize the research that is easily accessible and verifiable, in case other stakeholders want to deepen one of the topics covered. Our shared objective is to improve kids' learning opportunities by using the ease access to digital materials online. We aimed at guidling kids where to look for reliable information. This entails dissecting the learning process and developing efficient teaching methods that genuinely engage students.

The results of pupils' learning are greatly influenced by pedagogy. Students can develop their critical thinking, problem-solving, and creative abilities with the help of a well-designed pedagogical strategy in STEAM. On the other hand, a worse level teaching strategy may cause students to become disinterested, bored, and unmotivated. To guarantee that their students achieve successful learning outcomes, educators must be aware of how pedagogy affects the learning process and continually improve their teaching strategies.

Perhaps there are occasions when the learning environment makes it difficult for us to use the finest teaching strategies. Schools are always pressed for time, and hectic schedules call for organized classrooms that can't always veer off course or behave impulsively. We produce educational materials that encourage in-class active learning.

Teachers can carefully craft learning techniques that scaffold challenging classroom tasks by using the universal thinking framework to dissect learning tasks. Such a pedagogical strategy reaches the core of students' thinking. Deep thinking leads to deep learning. The likelihood is that a student will not be able to comprehend the lesson material if they are not mentally engaged. The educational curricula based on STEAM and including project based learning helps students to stay focused and to catch up with some deconcentrating issues, since it is build around the same topic, which is presented from different angles of science, engineering, art, and math.

A pedagogical approach to education places a strong emphasis on the need to establish a welcoming and stimulating learning environment that promotes student achievement and as it has been proved in our ComfyHouse project, STEAM approach is the best examples to that.

How do we advance the pedagogy of STEAM teaching?

The worldwide nature of the structural learning is well-established over years and around the Europe. Different pedagogical methods, such as project-based learning, STEAM, or direct instruction, are used in various school systems. While some institutions have abandoned collaborative learning, others still view it as a vital component of the educational process. No matter the type of educational setting you work in, it is crucial to invest in the creation of effective classroom pedagogy.

The old, well-established Rosenshine principles of education gave schools a list of current, all-evidence-based teaching strategies. These facets of instruction gave classroom teachers sound advice. Because they weren't prescriptive, his teaching methods were favorably appreciated by other educators. These effective methods of education delivery could be used in every classroom setting. With the publication of this research, conventional educational methods were rightfully called into question. STEAM approach should be also considered within these principles in a more structured manner.

Teachers can now choose their teaching strategies more carefully thanks to many educational options available to them. Numerous academics have been striving for a productive method that produces long-lasting change. STEAM approach is one of the methods being very much encouraged and promoted. Teachers should be better informed about their availability. The fact that they are significantly busy with daily work with students, language limitations, as well as the lack of easy access to information, makes the implementation very complicated. With the aid of public authorities, teachers may put the knowledge they are learning together. The inclusion of formative assessments into the learning process by setting their concepts is one of the ways to advance the pedagogy of STEAM teaching. With this teaching approach, students have more control over their education. There needs to be a balance between these contemporary teaching techniques and teacher explanations. Giving people room and opportunity to engage in critical thought is a good idea.

Demagogy for the Modern Classroom based on STEAM

The goal of STEAM pedagogy in the contemporary classroom should be to foster a safe, interesting, and successful learning environment for all students. This may involve encouraging students to cooperate and support one another's academic growth through the use of cooperative learning techniques and instructional activities, such as group projects and team-based assignments.

The use of innovative learning, in which traditional instructional methods are reversed and students acquire basic knowledge outside of class and then apply STEAM approaches, is another important component of pedagogy for the modern classroom. With the use of this strategy, learning may be made more engaging and applicable to students' daily lives.

Additionally, rather than just having students memorize facts and information, the STEAM pedagogy for the modern classroom is aimed to emphasize encouraging deep learning, in which students gain a thorough comprehension of important concepts and ideas. This can be achieved through the use of discussion and questioning, as well as practical, experiential learning activities that promote reflection and critical thinking. When creating the ComfyHouse educational materials, we based our approach on the abovementioned assumptions.

Social Pedagogy

Social pedagogy offers a comprehensive approach to working with kids and their families in a way that promotes their development, well-being, and education. This is another way of including STEAM effectively in the educational curricula in a more systemic manner. According to social pedagogy, education is essential for students' development and well-being. Since they support social learning and development in one's life, these kinds of pedagogical practices are viewed as forms of practice in the broadest sense. Students are by nature sociable beings. Including STEAM into this way of thinking might seem challenging in the first place, but then, when analysing the educational curricula into detail, it comes out that actually project-based learning is very beneficial for social learning. Groups

classes, common assignments, games and competitions around one topic, increases social skills among students, supporting social pedagogy effectiveness.

They also require the education necessary for efficient communication. Providing different cultural and social contexts can have an impact on how public education is delivered in different nations, which is also extremely relevant in the globalised world. In general, pedagogues use social education to emphasize the importance of things like compassion and empathy is an example of social pedagogy. Using the appropriate materials for kids to explore at the appropriate stage of their development depends greatly on the understanding of practitioners. STEAM, by using art, might also contribute to that a lot.

Critical Pedagogy

Paulo Freire, a philosopher and educator from Brazil, is recognized as one of the pioneers creating critical pedagogy. Liberation and social transformation, according to Freire, begin with the development of oppressed people's critical thinking of the existing situation. He stated that learners are mostly focused on receiving, memorizing, and repeating information rather than actively participating in their learning, solving problems, or interacting.

Therefore, critical pedagogy is also viewed as progressive and even radical by certain policy makers since it challenges commonly assumed systems. Critical teaching tries to inspire students to question their behaviours, beliefs, and ideas in order to develop a deeper understanding and critical thinking skills. This brand of pedagogy is also open to use STEAM in their daily usage. STEAM can highlight student ability to critical analysis and question the research assumptions. Nevertheless, not many examples of such an approach can be found in the literature. STEAM is more objective concept admitting common challenges of global changes, rather than contradicting its existence. Therefore, although theoretically possible, its combination might be challenging.

Cultural Responsive Pedagogy

Culture-responsive education takes into account cultural settings. When using culturally responsive education, teachers adapt their pedagogical strategies after observing children to meet the needs of a child from any particular cultural background. The educational institution occasionally modifies its policies and practices to encourage greater community involvement.

A culturally responsive teaching strategy encourages and takes into account the various racial, religious, and ethnic backgrounds of students. A culinary lesson's cultural responsiveness would be demonstrated by giving students access to video pedagogy that would teach them about the many cultural cuisines being studied. Political studies that are culturally sensitive engage in discussions and analysis of a wide range of political issues in many cultural contexts. In the field of law, this entails keeping in mind varied cultural and religious perspectives, such as how various groups may perceive analogous legal issues. STEAM approaches in this type of pedagogy should fit very well. Built around project-based learning, STEAM can fit effectively with the fight against the discrimination, equal rights, or different backgrounds. By using art, as an element of STEAM, it can increase pupils' sensitivity to the disfavoured groups.

Socratic Pedagogy

The Socratic pedagogy was developed by the Greek philosopher Socrates and focuses primarily on relation between the teacher and the students, as a boost to increase educational effectiveness. The instructor would probe students' opinions and uncover the underlying assumptions that influenced their perceptions and worldviews. The Socratic Method has three steps: The teacher first gives a description or viewpoint, and then ask a question to bring out an exception to that description or opinion. Lastly, he will upgrade your judgment or description.

A strategy for helping students improve their psychological and social abilities so they can participate actively in a democratic society is a part of socratic pedagogy. Students are encouraged to question conventional notions of knowledge,

investigate alternatives, and produce new types of knowledge through meaningful interactions with others, experiential learning, and ideas. In order to help students open their minds and gain a deeper comprehension of subjects, the Socratic pedagogy curriculum will primarily feature the anonymous peer review process, collaborative instructions, comparative context, and thinking. STEAM approaches promoted nowadays are very well suited form this type of pedagogy. Not only they encourage students to reason, but also it encourage the experimental thinking approach. Both approaches are strongly related to maths and science.

When students examine a scientific or mathematical process in depth to determine what it is, why it exists, and how it is used in society, they are demonstrating socratic pedagogy in science or mathematics. This kind of conversation does not always result in a solution, but it does prompt fresh inquiries for the conversation. This is exactly the STEAM approach we observe in our daily educational systems and in our ComfyHouse approaches.

The three elements of personal, pedagogical, and work-institutional learning are employed in concert in multicultural societies to recognise and address the cultural differences among various learners as well as to celebrate various learning modalities. In order to implement such a strategy, the teacher must be prepared to accept the diversity of multicultural educational practice and create an environment that is fair and welcoming for all pupils.

Constructivist demagogy

An educational approach called constructivist pedagogy places a strong emphasis on the value of student-centered instruction. It emphasizes getting students involved in learning activities that let them create their own knowledge and motivates them to do so. STEAM approach can benefit from this demagogy as well, but to a limited extent. Materials being created within ComfyHouse were aimed at work in groups, work with digital tool, building interest in science.

Constructivist education is founded on the notion that learning occurs most effectively when students actively construct their own knowledge of ideas and subjects. In order to promote higher levels of learning, it also places a strong emphasis on student and teacher collaboration. The foundation of constructivist education is the idea that every learner has a distinct set of skills and talents that may be developed via meaningful activities and reflective discussion.

Moving teacher's pedagogy forward

The aim of this Innovative pedagogy guideline was to shed some light on the interrelation between STEAM and different pedagogical approaches. By using ComfyHouse experience, we tried to answer which of the educational approaches should be developed in order to support STEAM in a more regular systemic basis. We tried to prove that different educational pedagogues can easily implement STEAM approach and disseminate it and promote further, while other pedagogues, are too traditional to absorb such an innovative way of working with students.

To wrap up, we might conclude that STEAM approach is the right and the only effective path for today's rapidly changing world. Green transition, digital transition, increasing need of the social skills, empathy and art, might bring pupils closer to the real world challenges. Project-based learning allows the to solve challenges based on different multi-facets methods and ComfyHouse project proves that.