# Work package n°2 - Framing: M-STEM Pedagogical Strategy

## *Book 2*

## Incorporating hands-on and experiential learning opportunities in the Metaverse

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# Introduction

Every great educator is also a student. They never stop learning and growing, nor do they stop finding the best ways to enhance their students' learning. That's why many educators often re-evaluate their teaching methods. By blending experiential learning experiences with traditional teaching methods, educators and higher education institutions have found that they are able to expand their offerings and enhance student learning outcomes.

A Chinese proverb says: *I hear and I forget, I see and I remember, I do and I learn, I share and I understand, I reflect and I improve*. Aristotle, the famous philosopher, also quoted that "for the things we have to learn before we can do them, we learn by doing them". This resource provides an overview of experiential learning, a process where students learn through hands-on experiences and reflection. It explains how experiential learning works, highlighting the integration of knowledge, activity, and reflection.

**Experiential learning** is an engaged learning process whereby students "learn by doing" and by reflecting on the experience. Experiential learning activities can include, but are not limited to, hands-on laboratory experiments, field exercises, study abroad or undergraduate research. Experiential learning is a philosophy and methodology in which educators purposefully engage with students in direct experience and focused reflection, in order to increase knowledge, develop skills, and clarify values.

The chapter also focuses on **hands-on learning**, which provides a supportive environment for students to experiment, make mistakes, and learn from their failures. This helps encourage their growth mindset. Rather than being discouraged by a failure, they have a mindset of growth where failures are opportunities for growth and learning. Overcoming the fear of failure helps increase students' confidence and motivation in STEM subjects.

The last part of the chapter is dedicated to immersive learning and considerations are made regarding the impact that the Metaverse will have on it. We have also pointed out that vast opportunities within the space are opening, allowing educators to create exciting and engaging learning experiences. The metaverse will add another element to immersive learning, where classes can easily be delivered and accessed in a virtual setting. By using avatars, these environments will allow for interactivity between students, educators, and 3D objects, encouraging student to learn with others at a time and place convenient to them.

Furthermore, the Metaverse will create a more inclusive and accessible learning experience, catering for multiple learner preferences, due to its interactive content.

### ⬥ Learning practices – in need for a significant change

When we hear the phrase "learning environment", what will most likely come to our minds is a classroom full of desks and chairs, with a chalkboard or dry erase board at the front. Or maybe we envision a huge lecture hall where the instructor stands at the front, using PowerPoint presentations displayed on a screen to help students better understand the day's lesson. Both of these environments depict a traditional learning scenario.

According to most scholars, *Traditional Instruction* represents those teaching practices where the maximum control on the learning experiences lies in the hands of the teacher, which makes educators feel more comfortable, as it allows them to maintain the tradition of the authoritative figure in the classroom. The traditional teaching methodology is, therefore, teacher-centered, with virtually all activities and decision-making done by the teacher, while the student input is reduced to the minimum. The lesson typically follows a format of "introduction, input, modelling, guided practice, periodic checking for understanding and concluding with independent practice" (Kierstead, 1985, p. 25).

Although traditional learning models excel in building a foundational understanding for students, there are certain limitations, some of the most common ones being listed below:

- **passive learning** - the consistent flow of information is mostly directed from educator to student, there is no or limited interaction between the learner and the teacher, students focus on memorizing data in order to do well in tests or pass exams: however, it is widely acknowledged that we all have different learning styles which requires for a personalised, interactive teaching approach;

- **slight gaps between education and employability** - one of the main objectives of education is to prepare students for their future careers; yet, the traditional learning model can sometimes fall short in bridging the gap between theoretical knowledge and its practical application in the real world; it is not, therefore, not surprising that sometimes students score well in exams, but feel unprepared when faced with actual workplace challenges;

- **little career clarity** - traditional learning prepares students with a wide range of skills and theoretical knowledge that will benefit them in whatever career they choose;

however, many times the path to identifying a fulfilling and suitable career is not straightforward.

Consequently, it seemed vital that the educational system should make a shift in pedagogical practice, from direct instruction to graduated opportunities for group learning, practice, and reflection. These expectations are congruent with Experiential Learning, that provides students with opportunities to learn and acquire content through well-designed, purposeful activities and tasks.

### ⬇ Experiential Learning – a meaningful and relevant process

As teachers, we understand the importance of engaging students in their learning and helping them retain information in a meaningful way. One way to do this is through hands-on and experiential learning activities. But what exactly are these types of learning, and how can we incorporate them into our lessons?

The original Experiential Learning Theory was conceived by psychologist David Kolb in 1984 and is used in all levels of education, as well as in business applications. According to him, experiential learning is a process in which the following are integrated:

- Knowledge - the concepts, facts, and information acquired through formal learning and past experience;
- Activity - the application of knowledge to a "real world" setting; and
- Reflection - the analysis and synthesis of knowledge and activity to create new knowledge".



([https://www.simplypsychology.org](https://www.simplypsychology.org))
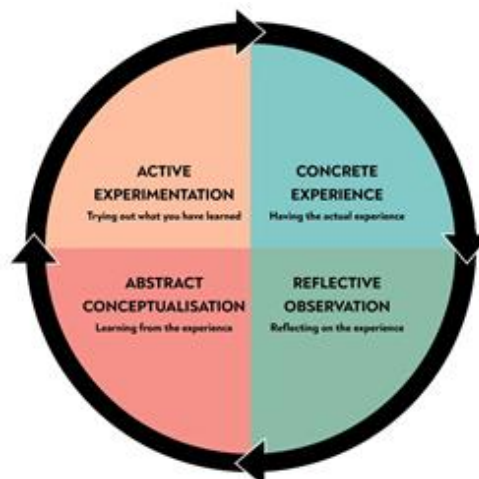
Kolb's model provides a practical framework for experiential learning, whilst Dewey's work provides the philosophical foundation. John Dewey (1859-1952) was a renowned American

philosopher, psychologist and educational reformer. The central tenets of his learning theory are:

- Learning happens through **experience**, or by getting 'hands-on'.
- Learning requires active **engagement**.
- Learning should take place within a **social context**.
- Learning should be a **democratic process**.
- **Reflecting** on our experiences drives more meaningful learning outcomes.

As we can see, they both place experience at the core of the learning process. Dewey denounced passive learning. He believed that genuine learning only occurs when we actively engage with an experience, interact with our environment or work through a scenario (in other words, learning requires a 'hands-on' approach). However, the process does not end there. According to Dewey, once an experience leads us to a new idea or concept, we then test and refine it. This results in another new experience. Therefore, experience helps us to gather information, build our knowledge and develop new skills. And this can only happen when we are playing an active and engaged role in a learning process.

### ⬩ Principles of Experiential learning

In traditional classroom situations, students may compete with one another or remain uninvolved or unmotivated since the instruction is highly structured; in experiential learning situations, however, students cooperate and learn from one another in a more semi-structured approach. Instruction is designed to engage students in direct experiences which are tied to real world problems and situations in which the instructor facilitates rather than directs student progress.

Experiential learning has the following elements, which were listed in *Association for Experiential Education* (2007-2014):

- experiences are carefully chosen for their learning potential (they should provide opportunities for students to practice and deepen emergent skills, encounter novel and unpredictable situations that support new learning, or learn from natural consequences, mistakes, and successes);
- throughout the experiential learning process, the learner is actively engaged in posing questions, investigating, experimenting, being curious, solving problems, assuming responsibility, being creative, and constructing meaning, and is challenged to take initiative, make decisions and be accountable for results;

- reflection on learning during and after one's experiences is an integral component of the learning process. This reflection leads to analysis, critical thinking, and synthesis;

- learners are engaged intellectually, emotionally, socially, and/or physically, which produces a perception that the learning task is authentic;

- relationships are developed and nurtured: learner to self, learner to others, and learner to the world at large;

- the instructor and student may experience success, failure, adventure, risk-taking and uncertainty, because the outcomes of the experience cannot totally be predicted;

- the instructor recognizes and encourages spontaneous opportunities for learning;

- instructors strive to be aware of their biases, judgments and pre-conceptions, and how these influence the student;

- the instructor helps the learner notice the connections between one context and another, between theory and the experience.

### What does an experiential learning experience look like?

Experiential learning involves a number of steps that offer students a hands-on, collaborative and reflective learning experience; this will help them fully learn new skills and knowledge. Although learning content is important, learning from the process is at the heart of experiential learning. During each step of the experience, students will engage with the content, the instructor, each other as well as self–reflect and apply what they have learned in another situation.



([https://21stcented.com/](https://21stcented.com/))

In experiential learning, students perform or do a hands-on experience with little or no help from the instructor (some examples could be: making products or models, role-playing, giving a presentation, problem-solving, playing a game). Apart from learning from the experience rather than the quantity or quality of the experience, students will also share the results, reactions and observations with their peers. This provides the opportunity to reflect on what they discovered and relate it to past experiences which can be used for future use.

The next steps require that students discuss how specific problems or issues were addressed and identify recurring themes. More importantly, students will connect the experience with real world examples, find trends or common truths in the experience, and identify "real life" principles that emerged. Finally, students will apply what they learned in the experience (and what they learned from past experiences and practice) to a similar or different situation.

As far as the instructors are concerned, in experiential learning, their role is to offer guidance rather than direct the learning process. Therefore, educators who are willing to offer a full learning experience to their students, should accept a less teacher-centric role in the classroom, allowing their students to experiment and discover solutions on their own. Educators will not only identify an experience in which students will find interest and be personally committed, but they will also explain the purpose of the experiential learning situation to the students and will approach the learning experience in a positive, non-dominating way. Moreover, they will provide relevant and meaningful resources to help students succeed.

In a nutshell**, experiential learning is learning through experience**. It involves students applying what they have learned in a real-world setting or situation. Experiential learning helps students make connections between their learning and the outside world, which can make the material more relevant and meaningful.

### Hands-on learning and its benefits

Hands-on learning is learning by doing. It involves students actively participating in an activity or project, using their hands and bodies to learn and understand a concept. This could be building a model, conducting an experiment, or creating a project. Hands-on learning is particularly effective for kinesthetic learners, who learn best through physical movement and hands-on experiences.

By definition, hands-on learning requires students to engage in the education process using multiple senses, including sight, hearing and touch. Known as multisensory learning, the hands-on teaching strategy engages the senses in a way that promotes learning comprehension on multiple levels. Moreover, when activities that require movement, talking, and listening are combined, multiple areas of the brain are activated.
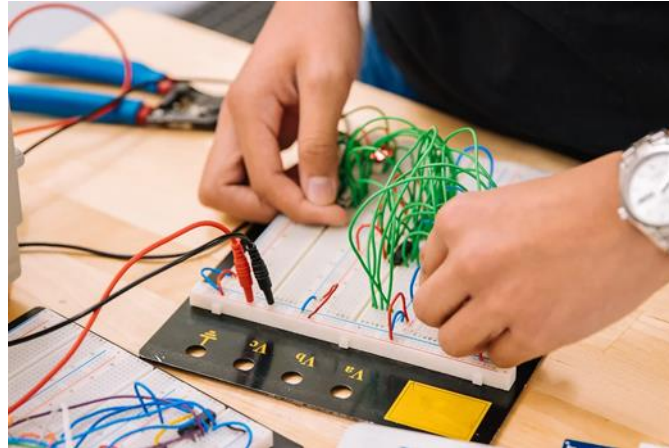


(https://www.steampoweredkids.com.au/)

Hands-on learning is often lots of fun, and having fun increases engagement and motivation. Learning by doing allows students to become personally invested in their own learning process. Becoming actively engaged in their education builds confidence, as the lessons require students to rely on their own abilities to obtain knowledge. That confidence and self-reliance inspires students to embrace the learning process and enthusiastically seek out additional knowledge.

Another element of hands-on learning that must be mentioned is the fact that it addresses a lot of social-emotional skills, such as: goal-setting, tolerance for frustration, persistence, asking for help or working with others. Additionally, there is a huge increase in the amount of information that is retained by students who are given the opportunity to practice what they are learning in the form of hands-on training. According to statistics, students who sit and listen passively in a lecture-style environment remember 20% of the information, whereas those who are given the chance to practice what they have just learned, retain up to 75% of the newly acquired knowledge/skills.

Hands-on learning allows students to experience a problem or task and make adjustments to improve outcomes. This "trial and error" exploration develops critical thinking and improves an understanding of abstract concepts that can be applied to real-life experience.

Experiential learning involves trial by error. As students engage in hands-on tasks, they find that some approaches work better than others. They discard the methods that were not the most successful ones, but the act of trying something and then abandoning it — ordinarily considered a "mistake" — actually becomes a valuable part of the learning process.

One of the drawbacks of traditional learning was its limited preoccupation to prepare students for life. By contrast, many hands-on learning activities are career-oriented, being, by nature, grounded in the "real-world". Through these activities, students start to discover and develop their own skills, aptitudes and passions. Hands-on learning often involves group work. This type of learning helps students develop collaboration and communication skills, such as active listening, compromise, and teamwork. Each of these skills is essential for success both inside the classroom and outside as they move into more professional settings. Therefore, hands-on learning sets students on a more defined path to college and careers.

### ⬥ Connecting the Metaverse, an immersive learning experience, to experiential and hands-on learning

Immersive learning involves creating an environment that actively engages learners in their learning experience, typically through virtual reality, augmented reality, or simulations. The concept of immersive learning has been around for many years, but it has only recently become more widely adopted due to advances in technology.

As mentioned in previous chapters, immersive learning uses technology to create an artificial environment that replicates real-life situations. By placing learners in these virtual environments, they are given the opportunity to experience situations that would be difficult, expensive, or dangerous to experience in real life. This kind of learning provides learners with a safe space to experiment with new concepts and encourages them to explore, learn, and make mistakes in a completely risk-free environment.

It must be stressed, one more time, that immersive learning is more than just a visual experience. It involves creating an environment that stimulates all of the senses, including touch, smell, and sound. Additionally, learning objectives are baked into the experience, making sure that the learner is guided towards specific learning outcomes.

As proven before, the benefits of immersive learning are numerous: learners are fully engaged in the learning process and are more likely to retain what they have learned; moreover, they experience a higher level of motivation, leading to a more meaningful and satisfying learning experience; additionally, students have the chance to learn by doing, making the learning experience more practical and applicable.

It can therefore be easily noticed that there are certain similarities between the three types of learning presented in this chapter. Both immersive and experiential learning approaches promote active, hands-on learning experiences that involve the whole learner. Additionally, they prioritize learning through doing and provide learners with a safe space to experiment and make mistakes. What is more, they put an emphasis on guided learning experiences that are contextualized and relevant to the learners' goals and motivations.

At the same time, though, there are some differences between these approaches. Immersive learning is designed to maximize learner engagement and motivation through simulations and virtual environments. As a result, it is particularly effective in developing skills and knowledge that are otherwise difficult or dangerous to acquire in real life. Experiential learning, on the other hand, emphasizes the development of learners' critical thinking, problem-solving, and reflective skills through practical, real-life experiences. As a result, it is

particularly effective in developing skills and knowledge that are relevant and applicable to specific situations and contexts.



([https://www.talespin.com/](https://www.talespin.com/))

We have seen, so far, that immersive and experiential learning can be effective on their own; however, combining the two approaches can lead to even deeper and more comprehensive learning experiences. One way to combine them is by using immersive simulations as a way to provide learners with a controlled environment to experiment with new concepts. Then, we could involve students in experiential learning activities that will allow them to apply their newly acquired knowledge in real-world situations. Additionally, we can encourage collaboration, reflection, and creativity through group work and role-playing activities.

There are many tools and resources available that can help teachers incorporate immersive and experiential learning approaches in their classes. Some examples include virtual reality headsets, simulations, outdoor education programs, community service initiatives, and role-playing activities.

Educational use of VR has been shown to support context-specific and situated learning through immersive experiences, visualisation of invisible or abstract concepts, exploration of content in multiple dimensions and from multiple perspectives, provision of in-context real-time formative feedback, collaborative learning, and the negotiation of barriers including time, physical accessibility, safety, and ethical concerns.

The evolution of VR technology is increasingly enabling high fidelity and motivating experiential learning activities to be offered at a relatively low cost, particularly when the logistical, resourcing, and ethical issues of alternative approaches are considered. However, we must not forget that the ability to explore an environment with a holistic representation of a range of important features including spatial relationships, visual appearance and a rich

soundscape is clearly useful when seeking to create a cognitive space that supports a range of learning preferences as well as the achievement of a variety of learning outcomes. This can be achieved only by using high-performance devices, which may not be so easy to purchase for some schools.

Regarding the role of serious games as virtual reality for enhancing students' experiential learning, it must be mentioned that video games enable learners to study by role-playing. Players may take on the part of some other human or entity and see the world from different eyes and test their skill and innovation. Also, experiential learning requires active exploration in order to acquire experience. As a result, virtual reality can be an effective didactic medium by putting the student at the forefront of practical learning interactions.

Without doubt, the ability to create immersive and interactive learning environments that simulate real-life experiences could significantly enhance student engagement and comprehension. Students are likely to find the idea of learning in the metaverse compelling, providing access to educational resources and experiences that may not be feasible in traditional classroom settings. Meeting in the metaverse may change the future of instruction, and these interactions can benefit students in the real world.

### 🔅 Conclusion

The Power of Experience in Learning is a topic that has been debated for years, with many experts weighing in on the importance of practical experience versus a formal education. While some argue that a degree or certification is necessary for success in many fields, others believe that hands-on experience is a more valuable asset in today's job market.

Despite the vast amount of information available on this topic, there is no definitive answer to which form of learning is superior. It's a complex and multifaceted issue that depends on a variety of factors, including the individual's goals and ambitions, and even personal preferences.

However, the one thing that is clear is that practical experience cannot be ignored in any discussion about the best way to acquire knowledge and skills. While formal education can provide a solid foundation, it is often real-world experience that brings the most significant lessons and insights.

At the same time, a computer-generated simulation and animation in which a human may communicate within an artificial world is considered a helpful, up-to-date, pedagogical tool the in teaching-learning process. Although, in some countries, virtual reality intervention was brief and isolated, with no accompanying content, many studies have shown that immersive virtual reality has a distinct advantage over non-immersive learning methods. This is particularly valid when the subject matter is abstract or when procedural skills are the focus.

Games and artificial environments are also essential in enhancing attainment and retention in education. It now allows for another learning process that better aligns with the demands of the 21st-century and digital learners who seek entertainment, collaboration, connectivity, and manipulation of objects. Regardless of whether learning occurs due to experiencing a virtually generated environment, learning is ensured by the educational methodology found in virtual reality demonstration. As a result, the new generation of educators and researchers is tasked with bridging the digital gap and equipping students with the knowledge and competencies they will need to excel in a globalized digital environment.

Virtual reality in education can improve students' academic success by offering rich qualitative and need-based virtual exposure to the physical world. Virtual reality was discovered to be effective in changing the traditional approach to teaching. It boosts students' morale, curiosity, and talents, challenging to attain in a typical classroom. It lets students improve social skills such as teamwork by involving them in shared and multiple user virtual worlds.

Moreover, simulations and interactive virtual reality can be applied in educational settings for teaching coping skills relating to life and what they need in a specific circumstance or disaster, potentially saving lives. Virtual reality has a profound influence on creative design practices, especially during planning and design stages, evaluating and upgrading, and contemplation and appreciation.

Whether through VR or other experiential learning tools, educational technology is at a turning point for leaders, educators, regulators and other stakeholders to take a proactive approach to invest in future generations and ride the wave of change.

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