Science and Technology for Future Education

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Abstract. In this article, the five imminent trends of science and technology were proposed. Each presents some of the boundless exciting possibilities for future education. For each trend, the characteristics of the specific new technology and the benefited pedagogy of learning were discussed. The article also introduces the related on-going projects conducted in Taiwan. These projects describe how we prepared for future education in Taiwan.

1. Introduction
Technology has rapidly changed every facet of our society, including the education industry. Today students grow up with internet-connected devices at home and in the classroom, which changes the way they learn. Future education technology will transform learning by giving teachers and students a variety of new tools to work with.

While the future of education will be driven in large part by technology, ensuring the new teaching tools are put to use most effectively requires a new generation of educators who appreciate the importance of human interaction in educational settings.

In this article, I propose the five imminent trends of science and technology, each presenting some of the boundless exciting possibilities for future education.

2. Interdisciplinary Learning- STEAM Education
Interdisciplinarity has become increasingly important as a means of attempting to address complex, real-world problems and grand challenges. Interdisciplinary learning is the way we cultivate our students to possess the competency of interdisciplinarity. Interdisciplinary learning requires learners from two or more disciplines to bring their approaches and adapt them to form a solution to a new problem. Due to the complexity of the situation and the multiple disciplines involved, technology focuses on facilitating the need for interdisciplinary approaches is fundamental. STEAM education is a remarkable attempt of interdisciplinary teaching approach, emphasizes integrating knowledge and skills associated with science, technology, engineering, art and mathematics. On the other hand, interdisciplinary teaching involves exploring content or solving a problem by integrating more than one academic subject. It is a holistic approach to education and requires the close collaboration of multiple teachers to create a more integrated, enhanced learning experience for students across multiple classes.

Advanced Interdisciplinary is a project initiated by Taiwan’s Ministry of Education starting from 2017 to promote interdisciplinary teaching and learning with innovation technology, such 3D printer, Robot, etc. In this project, school teachers, working with university professors, develop integrated (STEAM) curricula to design PBL projects with students, synthesizing their learning by integrating knowledge and concepts from multiple disciplines. Students not only gain a deeper conceptual
understanding of the material, but also have authentic opportunities to apply their learning to solve real world issues through their direct action.

3. Smart Learning- Smart Learning Classroom

Smart learning is a broad term for education in today's digital age. It reflects how advanced technologies are enabling learners to digest knowledge and skills more effectively, efficiently and conveniently. Smart Learning Classroom is a classroom infrastructure to facilitate smart learning. It includes wireless technologies, remotely accessible switches and routers, and collaboration tools to create an “intelligent” environment for the invention of real-world Internet of Things (IoT) products, services, and experiences by students. Students in the smart learning classroom usually equipped with mobile devices, such as tablets, allowing them to work individually or in groups. Creation takes place in different venues. The next generation of instructors would be wise to consider ways to take advantage of the smart learning classroom in their curriculum to create a variety of learning opportunities for their students.

In Taiwan, the Forward-Looking Infrastructure Plan is a project funded by Taiwan government to build up the essential infrastructure environment to support smart learning and teaching in elementary and secondary schools. It enables teachers to easily use cloud-based teaching tools in classrooms or participating the community to the co-creation of novel pedagogies.

4. Real-time Distant Learning- Live Streaming for Education

The world needs online education now more than ever before. In the meantime, communicating in real-time from a distance has never been easier. There are numerous new platforms and applications (apps) available free-of-charge that are easy-to-use and facilitate seamless communication between geographically distant people with access to a smart phone or laptop. Live streaming is the technology to realize real-time distant learning. It refers to online streaming media simultaneously recorded and broadcast in real time. Live streaming has made education more accessible to people around the world. As live streaming teaching becoming a main trend for the future education, the instructors not only have to find their new normal getting creative with minimal equipment to teach in front of a camera, but also have to create a classroom-like atmosphere and allow for real-time interaction and participation.

One remarkable live streaming project funded by Taiwan’s Ministry of Education is especially designed for rural education, the Digital Learning Partner Program. It allows college students to be one-on-one after-school on-line tutors for students in rural area. Another interesting live streaming project launched by Taiwan Institute for Information Industry, Learning Beyond School Alliance, is designed for the young second generation of new immigrants from southeast Asia to learn their parents’ mother language. A platform was created to provide live-streaming classes by professional teachers for children at different schools with the same language learning need.

5. Adaptive Learning- AI in Education

Adaptive learning comes from the idea of personalized learning that may be difficult for teachers to provide but may be necessary to fully engage each student. With the advent of artificial intelligence (AI) in education, teachers and schools can take advantage of tools that are highly data-driven and adaptive to individual students’ needs. Adaptive learning is the delivery of custom learning experiences that address the unique needs of an individual through just-in-time feedback, pathways, and resources. It is in fact the ability to provide personalized services with AI in educational and corporate settings. The learning platforms uses computer algorithms, such as artificial intelligence and are trained to understand the strengths, weaknesses, learning styles, and proficiency of the student before providing them with the necessary learning material and resources. Adaptive learning technology aims to emulate and support the talents of great educators to provide the best possible learning experience for every single student. It helps scale the benefits of adaptive learning to tens, hundreds, or thousands of students at a time.

Taiwan’s Ministry of Education have developed an adaptive learning platform to facilitate adaptive teaching and learning since 2018. Among the basic subjects, the Mathematics is the most well established one. A knowledge-structure-based concept map is constructed based on the Mathematics
Curriculum Guidelines of 12-Year Basic Education. For each concept node on the map, diagnostic items for adaptive dynamic assessment and instructional video for adaptive learning were designed.

6. Authentic Learning- AR and VR in Education

Authentic learning is generally considered the most effective way to learn. It is an instructional approach that allows students to explore, discuss, and meaningfully construct concepts and relationships in contexts that involve real-world problems and projects that are relevant to the learner. Two of the major areas of next-wave technology, augmented reality and virtual reality (AR/VR), now make it possible to offer students authentic learning experiences ranging from experimentation to real-world problem solving. Augmented reality devices enhance real-world materials, such as making a map jump off a page, while virtual reality products create an immersive digital world in which students interact in virtual 3D worlds that enhance learning experiences.

In Taiwan, a recent research project adopts AR technology to facilitate concept understanding in lab experiments of Chemistry and Physics. It allows students to interact with augmented reality and physical objects and explore the related science principles. Another interesting educational practice is to adopt VR technology to create a virtual practice factory for auto maintenance training. It simulates the situation and tasks that a technician might encounter in a real practice.

Talking about science and technology for future education, it is important to recognize the role that a human teacher will always play in the classroom. They have a unique and personal insight into each learner’s progress, serving as a role model and local expert, and providing inspiration in a way technology itself cannot.

Combining the learning science and innovation technology, we can leverage the best of what digitally enhanced and human-driven education have to offer, creating learning experiences that keep pace with the digital skills demanded by the market. In turn, affecting individual lives, supporting business and transforming global communities.

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