Inclusion of STEAM Innovation Spaces: A Critical Issue for Learners with Disabilities

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Abstract –

The fourth industrial revolution has provided a wide range of flexible physical and digital technologies that continue to enhance the teaching and learning of STEAM. Incorporating STEAM and building makerspaces, Fablabs (Fabrication Labs), and STEAM labs as part of the educational curriculum can serve as the right environment to empower learners to transform their ideas into tangible digital or physical solutions. However, the standards way of development of spaces such as FabLabs does not always guarantee accessible learning opportunities for learners with disabilities as they may require additional accommodations to be able to access and use the technology tools. This article confirms that children with disabilities face multiple challenges with inclusivity and accessibility. Creating inclusive innovation spaces that support, promote, and accelerate learning is essential and requires an understanding of the application of user-centered design, universal design, and utilization of local and global networks to create solutions that increase accessibility and create an inclusive environment.

Keywords: STEAM, Innovation, Student with learning difficulties

Introduction

According to a recent UNICEF report, it is estimated that there are 240 million children globally who suffer from a form of disability [1]. This report confirms that children with disabilities face multiple challenges with inclusivity and accessibility. Education is the most imperative subject when it comes to children's development, yet learners with disability are still falling behind as inclusive learning environments are not the norm in modern society.

STEAM is one of the most popular and fast-growing topics in the education industry. This is due to its unique approach and emphasis on innovation, problem-solving, and critical thinking. STEAM education stands out from other learning paths as it is centered around the individual's learning capability and interest which therefore provides an inclusive and accessible learning environment for students with varying abilities. This approach helps students develop 21st-century skills that are necessary to bridge the skills gap for future jobs. Unquestionably, access to STEAM education should be adopted by society, especially to students with disabilities as it possesses the right tools, and environment that empowers the individual to strive in education.

Did you know that the late CEO of Apple, Steve Jobs, and the founder of Virgin Group Richard Branson both had learning disorders growing up? Individuals with disabilities have greatly contributed to our world in STEAM fields. An example would be Kursat Ceylan who is a visually impaired engineer since birth. Kursat invented a smart cane that improves mobility for

visually impaired individuals and is currently the co-founder of the WeWalk Cane as well as being the CEO of the Young Guru Academy which is an international non-profit established to empower volunteers to develop projects that tackle challenges within their communities [2]. This indicates that students with disabilities or different abilities, can all get empowered by STEAM education and therefore contribute to society with products and services that develop different STEAM-driven fields such as Assistive Technologies.

Technology has been identified as the bridge between all the core subjects of science, engineering, arts, and mathematics and is very focused in STEAM learning environments. The fourth industrial revolution has provided a range of flexible physical and digital technologies that continue to enhance the teaching and learning of STEAM. Incorporating STEAM and building makerspaces, Fablabs (Fabrication Labs), and STEAM labs as part of the educational curriculum can serve as the right environment to empower learners to transform their ideas into tangible digital or physical solutions. These kinds of spaces are mainly developed with the purpose of creating accessibility within the community for fields such as manufacturing and makers technologies. Making spaces accessible and accommodating to individuals with different abilities and capabilities is important.

However, the regular development of spaces such as Fablabs in many countries somewhat follows a "One size fit all" approach in terms of design and build which does not guarantee to provide accessible learning opportunities for learners with disabilities as they may require additional accommodations to be able to access and use the technology tools. Hence, there have been recent efforts toward building an awareness of the requirement of building an accessible innovation space. The University of Washington conducted research in 2018 in which individuals with diverse disabilities participated in a series of activities to brainstorm means to make makerspaces more accessible and user friendly. Subsequently, the research concluded with a set of recommendations that can be considered when developing a makerspace that can be accessible to all [3]. Some of these recommendations revolve around the policy planning, space design, equipment, safety, training, and user testing [4] [5].

Simultaneously, Ibtechar Digital Solutions (a Qatari innovation consultancy and management firm) developed a unique approach towards creating the 'world's first' inclusive Fablab "Mada FabLab" which was designed with careful consideration to ensure the lab can be accessed and used by individuals with various abilities. The space layout is easily navigable, the furniture was locally fabricated to be customizable and adjustable to fully accommodate the different users. In addition, the technology equipment stations were designed to be accessed by different individuals while also ensuring that the technologies selected are user friendly. Most importantly, the staff were trained on how to utilize the furniture and the technology equipment to create inclusive learning experiences.

As a result, Ibtechar developed "Mini Fablabs" which is a local, economic, and accessible solution that can be used by any institution that would like to create an innovation space. It consists of a customizable mobile furniture unit that can be equipped with any technology equipment, basic tools, and materials. In the context of education, more institutions are adopting the STEAM education approach which greatly relies on having the right setting or environment. Yet, building a Fablab or a makerspace in an established educational building may require assigning an appropriate space, extensive remodeling of existing infrastructure and many more constraints. Therefore, the Mini Fablab is a turnkey solution that can be utilized to empower the teaching of STEAM and can be easily customized to provide accessibility to all individuals with various abilities creating an environment that is empowering and inclusive.

Conclusion

In summary, research, evidence, and experience clearly prove that inclusivity and accessibility should be considered when it comes to providing quality and inclusive education for children as it gives value to the contributions of all students regardless of their abilities. Creating inclusive innovation spaces that support, promote, and accelerate learning is essential and requires an understanding of the application of user-centered design, universal design, and utilization of local and global networks to create solutions that increase accessibility and create an inclusive environment.

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