

# Egyptian STEAM International Partnerships for Sustainable Development

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## Abstract

*Actually, the STEM acronym stands for the interdisciplinary teaching and learning approach Science, Technology, Engineering, and Mathematics. In Egypt, the acronym could be transformed to STEAM by adding the Arts and Architecture disciplines. In fact, Egypt has a history that extends for seven thousands years with architectural remains from Coptic and Islamic eras as evidences for such great history. By adding the fifth discipline, this will enrich the STEAM educational approach and makes it available for all students whether gifted or with learning difficulties. Actually, the latter group suffers a lot of problems in the Egyptian schools with inevitable end of school dropout because they don't find a chance to be involved in the mainstream education.*

*One main goal of the international STEAM partnership research project is to change the targeted traditional schools in the community to an active STEAM schools where every individual student can find a chance to learn inside and outside the STEAM school according to his/her abilities, capabilities and needs without regard to any other trait related to gender, socioeconomic status, race--- etc. Actually, the successful, active STEAM school should offer more opportunities for those who are showing greater needs to master their learning. Hence, it ensures equitable access to All students; gifted, average and with learning difficulties. By the end of this action research, The STEAM Active School will be an inclusive approach that is attentive to all diversity of students in the community. There are two main factors that have great implications on the influences of such inclusive approach; the differentiated pedagogical interventions applied inside/outside the Active STEAM school, which should be supportive for each individual student and supported by the needed accommodations and modifications for those who have some type of disability. So that the quality of and equality in education will be attended in the Active STEAM schools. The other factor is the efficiency and stability of the international partnership for development which is a result of effective partnership's governance and coordination that exclusively depends on the involvement and commitment of all partners [1]*

## 1. Introduction

Actually, the idea of establishing a STEM (Science, Technology, Engineering and Mathematics) school in Egypt was unbelievable during that critical stage of real political, economic and social change in Egypt. After the Egyptian revolution, exactly at the end of 2011, The World Learning\* worked with the Egyptian Ministry of Education (MOE) to establish the STEM model schools through a generous \$25 million grant from the United States Agency for International Development (USAID). The first Egyptian STEM School opened the doors to the Egyptian gifted students regardless of their gender, or social and economic background.

In addition to the parties mentioned above, one of the Non-Governmental Organizations (NGO) that cooperates with the MOE is the Egyptian Misr El Kheir that is also greatly involved in supporting the STEM school. This NGO is the current Egyptian sponsor for the project and has a clear vision and commitment to promote and nurture Science, Technology, Engineering and Mathematics education, particularly for gifted students. Within its aims is to provide more employment opportunities for those young youths after graduating from STEM fields [2]. In 2012, Misr El Kheir becomes responsible also about the development of the Vocational STEM school in Suez governorate and transforming it to an advanced STEM vocational school. It is a public vocational school with many internal, technical, mechanical and scientific divisions. The development started with the Petro – chemical division under the academic supervision of Misr El Kheir representative and the school principal. The main goal of this school development is to prepare students to be proficient workers, capable of dealing with the demands of a science-based workforce, and continue the research and development that is central to the economic growth of the country.

In the author's view, the transformation of the community traditional schools to an active STEAM schools where every individual could find a chance to learn effectively on the time being and well-earned later on in the near future, this transformation

should be based on international accreditation and quality STEAM standards, this is if we really would like to increase the college and career readiness of our Egyptian STEAM school students. Actually, the international organization which could be responsible about setting those standards required for quality STEAM education is AdvancED STEM Academy. The standards are already prepared and could be used to manage the success of the Active STEAM initiative in Egypt, but under the usual demands, requirements and policies applied by AdvancED accreditation organization on the schools operated on its quality standards.

## **2. The Role of international Partnerships within STEM education**

Undoubtedly, for a STEM student to be a proficient worker, achieve the requirements of the 21st century workforce skills, and to be able to continue his scientific research and maintain scientific careers according to [3]; students are expected to attend technical training programmes related to specific industries before graduation and acquire the skills and experiences of scientific research in one of the research centres or institutes found in the community. In this way students will relate academic studies to a future career by learning the language of the field and discovering how workers in that field think, troubleshoot and solve problems [4].

In addition, the perfect achievement of that STEM education goal demands professional STEM educators who have feasible access to job – embedded professional development to be able to build their capacity in both STEM content and STEM real world application. Consequently, the immediate collaboration between schools, business, industry, research centres and other private and public sector partners is essential to support the STEM Egyptian education and help it achieve its main goal of having STEM students who successfully compete in the 21st century economy.

Obviously, benefits of developing STEM partnerships with Institutions of Higher Education (IHE), businesses and industries vary. They advance student learning by enhancing educational experiences and create exposure and recognition of STEM professional organizations [5]. The international STEM partnerships improve the impact and overall effectiveness of STEM education [6]. Besides, they prepare the students for the challenges and opportunities in the 21st economy [7]. Above all, they assign a significant role to each active member of the school and promote an attitude of positive change.

## **3. Current Situation of international partnerships within STEM Egyptian schools**

However the STEM Egyptian schools have not yet had any type of international partnerships which could have serious implications on student achievement, progress, success in STEM fields and pursuing a STEM career after graduation since those programs and internships facilitate the students' own learning. This, in turn, may result in higher rates of matriculation for students into the STEM workforce [8]. In addition, those partnerships and internships programs can provide institutions and employers with a unique opportunity to recruit and retain students for a highly skilled and technically proficient workforce and preventing the Egyptian students whether in STEAM private or public schools from participation in such programs might have a deterrent effect on development and progress of the country's economy. On the other hand, extending a partnership with AdvancED STEM academy in order to transfer the STEAM Egyptian schools to internationally accredited STEAM schools will let the school extend more public and private national partnerships with research centres, universities, industries and companies, this is for the STEAM school to be able to meet the AdvancED STEAM indicators related to STEAM students' career readiness and STEAM educators professional development .If the school couldn't achieve at least the average level of performance in those two indicators, the STEAM accreditation license could not be conferred to the school.

## **4. Study Context and rational**

In fact, for this study to achieve its main goal there should be a clear structure for the STEAM Egyptian STEAM international partnership strategy that is based upon standards and indicators that are consistent with the national educational standards of the country. Both the MOE and NAQAAE have developed and announced educational standards. According to this structure, the planning, designing, implementation and evaluation of international STEAM partnership programs and initiatives could be conducted and improved according to the results of the evaluation.

Actually, providing all Egyptian STEAM students with quality education in the STEAM disciplines is an important and competitive national goal. But, there are many challenges to achieve such quality STEAM education in Egypt during the current unrest where the political transformative situation is the hardest. First of all, the limited state resources - as the government budget is already under strain; the 2011–12 budget envisages a deficit of 8.6 per cent of

GDP [9] and the low economic returns to public and private investment in education in Egypt are main reasons that prevent new investments in effective STEAM programs or initiatives. Secondly, there are not clear, identified criteria and standards for quality STEAM Egyptian education including qualified STEAM programs, internships, administrators, educators and students. According to [10] to improve the STEAM learning, the selection, preparation and licensure of elementary school teachers should be strengthened. This couldn't be done without a framework of international STEAM standards that could help us in Egypt to strengthen those factors required to achieve a progress in STEAM learning. As the National Authority for Quality Assurance and Accreditation in Education (NAQAAE) and the Professional Academy for Teachers haven't yet put the required STEAM standards for STEAM school accreditation, STEAM teachers preparation programs and STEAM educators professional development, so there is an urgent need to follow the AdvancED STEAM international standards if we really hope to make a progress in the STEAM education in Egypt.

Moreover, because STEM education is a new educational approach in Egypt as well as the PPPs with Egyptian STEM schools which have not been applied before in Egypt, so increasing STEM literacy for all stakeholders including the members of: MOE, Professional Academy for Teachers (PAT), the NAQAAE and parents is another main goal of such study. If these stakeholders are kept aware with the importance of STEM education for Egypt during such critical period, understood the necessary strategies to implement it, and collaborated together, certainly they could help develop a set of practices that support STEM Egyptian education system to be successful, fruitful and fulfil the goals that the country expects. This is why such model of international STEAM partnership will have a collaborative network structure, so that the collaborated partners can develop mutual goals, structural arrangements, and shared commitments [11].

Actually, in order to make the international partnership truly beneficial, The participants from both institutions must define the mission, needs, and assets and use them to structure a relationship in which the assets are used efficiently and the needs and mission of partnership are identified and fulfilled [12]. This ensures that there should be precise criteria and standards for identifying high quality, effective STEAM international partnerships. According to those standards and measures the evaluation process could be continually conducted in order to define how those international partnerships are functioning and how they could be improved to meet their goals. Practically, the proficient, highly qualified workers who are prepared for careers in the 21st century, and the young scientific researchers

who have the commitments to continue their researches processes in order to develop the modern sciences and innovate through application of technology, both really need the support of the STEAM international and national organizations. To achieve this national goal and to increase the college and career readiness of our Egyptian STEM school students, throughout this study, the author will plan and design international STEAM partnership programs and initiatives with Egyptian public and private/ Academic and Vocational STEAM schools in order to answer the following main question:

### **5. What are the benefits of extending an international partnership with AdvancED STEAM Academy?**

In an effort to answer this question, the author will introduce a proposed structure for international STEAM partnership with Advanced STEAM Academy.

### **6. Theoretical framework for international STEAM partnership with Egyptian STEM schools**

The theory of change is the theoretical framework that guides the process structure of this international partnership, so that it could be able to achieve the goals of quality STEAM education. According to [13] theory of change is a predictive assumption about the relationship between desired changes and the actions that may produce those changes. Regarding the effective changes that sustainable and well-organized partnerships could bring [14] proved that the school engagement in a IHE partnership or research centre training program will scale up STEAM education reform as the participating schools increased their capacity for meeting high standards for learning and for significantly reducing achievement gaps in the mathematics and science performance of diverse student populations. In addition, the well-designed and organized partnerships with businesses will expose students to valuable in-the-field elements of prospective occupations, like hiring, operations, and policy, and project design work [15] which will affect their career readiness positively. In addition, another improvement should be related to teachers' knowledge and understanding of Common Core and Next Generation STEAM standards due to the practical experiences accompanied to such international partnerships, which could have a significant impact on the quality of STEAM learning in and out of the school

## 7. The Model of International STEAM Partnership for development within STEAM schools in Egypt

The suggested model of international STEAM partnership for sustainable development could be represented as in Figure 1. As the main purpose of establishing the AdvancED STEM Certification is to provide institutions and programs within institutions with a research-based framework and criteria for their awareness, continuous improvement, and assessment of the quality, rigor, and substance of the STEM educational program. AdvancED STEM Certification is a mark of STEM distinction and excellence for those institutions and programs that are granted the certification.

In addition to the school's completion of the STEM specific diagnostics, the STEM Certification Reviewer will review evidence, conduct observations, interview stakeholders, and participate in the External Review Team's deliberations during the on-site phase of the process. The STEM Certification Reviewer will rate the 11 STEM Indicators after considering all of data gathered during the review. The total average rating for all Indicators combined must be a minimum of 2.8 and no indicator has a rating of "1." Additionally, the school must receive an Index of Education Quality™ (IEQ™) score that falls within the range of schools that earn accreditation status. A school cannot be STEM certified unless it is accredited.

Such AdvancEd STEAM standards, indicators and benchmarks required for the STEAM school to be certified and accredited as an Active STEAM school require the changes in the learning materials and resources, in the ways of managing and organizing the students, in the methodologies used to offer the STEAM approach, in the activities for the different subjects, in the way the students practice and discuss what they learn, and in the way the student's assessment being held. To put it another way, the Montessori and other visualized teaching aids will be used, the active learning setting will be used in classes; in groups and teams, the Learning By Design (LBD) and Engineering By Design (EBD) methodologies will be used for teaching different subject, the STEAM camps and fieldtrips will be utilized to the cross-curriculum activities, the learn, Apply, Practice approach will be used through the project –based and problem – based techniques, the standard – based assessment and standard -grading system will be used to assess the student learning and understanding. Furthermore, the STEAM educators' professional development and STEAM career readiness programs offered by the STEAM accredited Internal Quality Assurance Unit (IQAU) will support the implementation of those STEAM settings, activities, methodologies,

techniques and assessments. In this context, the aim of the STEAM IQAU is to ensure Education for Sustainable Development (ESD) approach for every Active member in the STEAM Active schools.

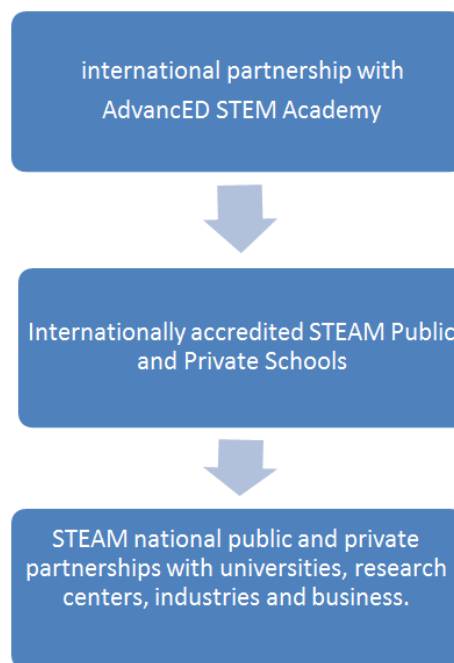


Figure 1. STEAM International partnership for sustainable development

## 8. Conclusion

Accordingly, all STEAM international partnership programs and initiatives will prepare the students to successfully compete in the 21st century global economy. Furthermore, they will prepare, engage and retain effective educators in the STEAM areas. Consequently, for the STEAM international partnership strategy to achieve those goals effectively, all the programs and initiatives included should connect and bolster their efforts towards the collective and sustainable impacts that meet the workforce needs and realize the transformation vision of Egyptian quality STEAM education. As a result, the immediate priorities that guide the STEAM international partnership strategy are: 1) Student college and career readiness, 2) STEM educator professional development & retention, 3) Stakeholders and parents' awareness and engagement, 4) Investments and STEM transformation. In this way, standard-based evaluation will be the guide for the progress of such partnership towards a real quality STEAM education. Afterwards, improvement plans could be considered in order to guarantee the success of this partnership on the long run.

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