



## Teaching STEAM Education in Nigerian Private Secondary Schools: Possible Challenges and Remedies

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### ABSTRACT

*The importance of STEAM education cannot be undermined in the 21<sup>st</sup> century as most future jobs will depend on STEAM education. STEAM is the acronym for Science, Technology, Engineering, Arts and Mathematics and hence the need to inculcate the approach to teaching in private secondary schools because student choice of career and independent living commence from it. Despite the importance and usefulness of STEAM education in the 21<sup>st</sup> century, schools still face some challenges with the teaching and implementation. Hence the paper therefore discussed; teaching STEAM education in Nigerian private Secondary Schools, possible Challenges and Remedies.*

### ARTICLE INFO

Article History

Received: December, 2021

Received in revised form: December, 2021

Accepted: January, 2022

Published online: February, 2022

### KEYWORDS

STEAM, STEAM Education, Private Secondary Schools.

### INTRODUCTION

STEAM is an acronym for Science, Technology, Engineering, Arts and Mathematic; it is the integration of all subjects into all field of learning to enhance progress in learning, to develop critical thinking, innovative mindset, and problem-solving skills and to be able to apply classroom teachings to real life situations.

Naveen (2013) argues that the traditional system of standardized, rote learning that teaches to a test is exactly the type of education the 21<sup>st</sup> century learners don't need in a world that is plague by systemic, pervasive and confounding global challenges. According to Naveen, today's education system does not focus enough on teaching learner to solve real world problems and is not interdisciplinary, nor collaborative enough in its approach. Hence the introduction of STEAM to integrate all areas of academic to ensure conducive learning environment and to promote and encourage all students in problem solving skills, hand on investigative laboratory, learning, creativity, critical thinking and this enables the student to explore and use all aspects of the brains in learning all that is needed, as the knowledge gotten will be needed in the 21<sup>st</sup> century working environment; STEAM education can help learners prepare for the challenges ahead of them by making the students to be the active person in class learning, the student will be

able to think creatively and innovatively through the effective integration of STEAM education.

### STEAM Education

STEAM education is a teaching and learning approach that inculcate the Sciences (science as a body of knowledge consisting of Biology, chemistry, physics, medicine, physiology, food science etc.), Technology (Technology as the application of scientific knowledge includes other discipline imbedded in it such as information system, security intelligence, software development, cloud computing etc.), Engineering (Engineering as a branch of science and technology comprises of mechanical, chemical, civil, electrical, building, chemical petroleum engineering) etc. Arts (Arts as the expression of human creative skill and imagination is comprised of several subjects such as history, Social Studies, English, geography, music dancing, photography, painting, government, food and nutrition), and Mathematics (mathematics which have to do with the study of numbers, shapes and patterns comprises of algebra, calculus, statistics and probability, geometry) as a yardstick for guiding student creativity, critical thinking, innovative mind and dialogue. Team XQ (2020) put it thus "STEAM education is an approach to teaching and learning that integrates science, Technology, Engineering, Arts and Mathematic as pathways to guide



student inquiry, discussions and critical thinking". STEAM education helps student develop the capacity to:

1. Take thoughtful risks
2. Engage in meaningful learning activities
3. Become resilient problem solver
4. Embrace and appreciate collaboration and
5. Work through the creative process.

Psycharis as cited in Sadoh and Sidi (2021), said that STEAM education model was means to improve students' inquiry skills, problem solving skills and creative thinking, in order to overcome the economic challenge of 21<sup>st</sup> century and the future. Therefore, STEAM education pushes the learner towards seeking and getting answers to questions and using the answers gotten to solve real life situations thereby making the learner to become a goal getter.

The 21<sup>st</sup> century learner needs to be STEAM educated so as to enable them fit into the ever-developing world and to develop the 21<sup>st</sup> century skills that will make them successful, be effective and to achieve in their future place of work. Hence, STEAM education makes learning worthwhile; it brings fun into learning activities by making learning not just only educational but edutainment. With this approach the learner will always look forward to learning, STEAM education enables the learner to apply the 4Cs areas that is needed to succeed in the 21<sup>st</sup> century, these skill areas are:

1. Critical thinking and problem solving
2. Communication
3. Collaboration
4. Creativity (Stauffer, 2020).

With this knowledge gathered through STEAM education the learner will be prepared for the after school and thereby helping modern student to succeed both in school and work place

#### **Importance of STEAM Education**

The importance of STEAM education cannot be over emphasizing in private secondary schools, home and even the playground as it exposes the learner into self-discovering, problem solving skills, critical thinking and hand on investigative learning, hence Riley (2021), viewed STEAM as an

educational approach to learning that uses Science, Technology, Engineering, The Arts and Mathematics as access points for guiding student inquiry, dialogue, and critical thinking. Below is some of the importance of STEAM education

1. STEAM education teaches students how to be a critical thinker and a problem solver; this skill gotten from STEAM education can be used when they are faced with hard and difficult times or situation and enables them make good use of opportunities whenever it appears
2. STEAM education when taught properly and learnt very well enables the student to probe questions, experiment on their own, create problems and investigate on how to solve them through their own experiment.
3. STEAM education helps to develop in the student the skills and competencies that are necessary for the person of the digital age Olga, Tatyana, Faruza, and Olga (2019).
4. The result analyzed by Gilbin and Unsal (2020) concludes that STEAM education positively affects the students' conceptual understanding and reduced the number of misconceptions.
5. STEAM education allows students to connect their learning with Arts practices. Students can rely less on memorization tactics and more on truly comprehending the materials they are studying when they apply the tools of creation and inquiry. It also allows students to dive deeper into their learning by using Arts as an avenue to create a more meaningful and engaging learning environment Team XQ (2020).
6. STEAM education is important to all learning groups; Burkhard (2020) in her word explained that " STEAM education" is becoming an increasing important part of a modern curriculum with the growing development of Technology , more student are preparing for careers as Engineers, Developers, or Analysts, hence students from all areas benefit from STEAM education as it helps to establish the 4Cs. The 4Cs are
  - a. Communication: Communication is the chief among the 4Cs. Through STEAM education, student daily life

are establish in communication skills like critiquing art, presenting research, collaborating with peers for group projects, and communicating result in research papers.

- b. Critical thinking: STEAM education makes the learner to think critically which mean the learner know how to apply what is being learnt, and understand how to filter information effectively. This critical thinking is a crucial skill that brought us through the ages and it's especially important to the 21<sup>st</sup> century learner.
- c. Creativity: Creativity is not something that can be taught specifically. But STEAM education creates an

environment where students can learn to express themselves. With STEAM education student get the chance to explore more of who they are and allows them to think outside of the box on a variety of subjects.

- d. Collaboration: STEAM education encourages team work, collaborative spirit in the classroom rather than a competitive one e.g. as students work on chemistry reactions together or learn to see value in their classmates artistic expressions, they are able to learn how to cooperate and how to appreciate their peers. Figure 1 shows the conceptual model of the 4Cs



Figure 1. Conceptual Model of the 4Cs developed by the researcher

### Teaching

Teaching is the passing on of instruction to a learner that will cause a relatively permanent change in the behavior as a result of constant interaction with an instructor. Teaching as a concept involves teacher who teaches the student to learn and a place where the teaching and learning takes place (which could be virtual or classroom). Teaching foster easy understanding of concept and makes learning easy and fun. Therefore Smith (2018) reveals that teaching is the process of attending to people's needs, experiences and feelings and intervening so that they learn particular things, and go beyond the given. According to Smith, (2018), he argues that some of the teaching we do can be planned in advance because the people involved know that they will be attending a

session, event or lesson where learning particular skills and topics Some teaching arises as a response to a question, issue or situation. However, both are dependent on our ability to:

1. Recognized and cultivate teachable moments
2. Cultivate relationships for learning
3. Providing people with temporary support so that they can deepen and develop their own understanding and skills and grow as independent learners.
4. Differentiate learning; by adjusting the way we teach and approach subjects so that we meet the needs of diverse learners.
5. Accessing resources for learning and
6. Adopting a growth mindset.

The summary of it all is that all teachings involve recognizing and cultivating “learners’ moment” or “teaching moments”.

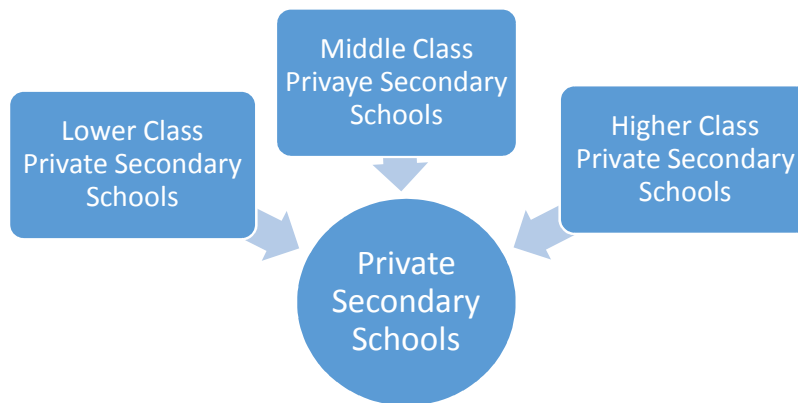
### **Private Secondary Schools in Nigeria**

Private secondary schools in Nigeria are schools own or pioneer by private individuals, religious bodies or co-operate organizations and are grouped into lower class private secondary schools, middle class private secondary school and higher class private secondary schools. In view of this Nwiyi cited in Ogunode (2020) agrees that private secondary schools are owned by private individuals or co-operate bodies and are administered and managed by an administrator. The private owners engaged the services of private professional teachers to teach in the respective institutions across the country. In his view, Ogunode, (2020), opted that private secondary schools are grouped into three namely: The mushroom private secondary schools, Average private secondary schools and international private secondary schools. Figure 2 illustrate the three main groups of private secondary schools in Nigeria

1. The mushroom private secondary schools are owned by private individuals and funded from the school fees charged to the students (school fees). These mushroom private secondary schools are the most popular in Nigeria and are found in every part of the country, teachers in mushroom private secondary schools are less motivated, less paid and not well paid.

2. The average private secondary schools are more organized and coordinate; hence get support loan facilities from the Government to manage the affair of the school. The average private secondary schools have a good academic system and qualified teachers who are motivated to teach as such the academic performance of the student are better compare to the mushroom private secondary schools.
3. The international private secondary schools are mainly owned by international, religious bodies, corporate organizations and highly placed individuals in the society, the international private secondary schools are well placed, organized, registered and more coordinate. They have good academic environment suitable to teaching and learning and good educational facilities. The international private secondary schools are patronized by highly placed people in the society (the rich and famous) their teachers are professionals, well qualified in subject areas and most motivated.

Private secondary schools are more in numbers compare to public secondary schools in Nigeria and they employ a larger fraction of the total workforce of the country which aid to reduce unemployment and develop the country’s economy.



**Figure 2:** Illustration of Private Secondary Schools in Nigeria



### **STEAM Education in Private Secondary Schools**

Both private and public secondary schools are attended by individuals (learners) who are interested in learning in order to further their academic pursuit and be responsible citizen of the country. Secondary education is the education given to a child after passing through primary school (FSLC) with the mindset to go higher. (International Standard of Classification of Education as cited in Iwamoto, 2005). Therefore STEAM education in private secondary schools should not be looked down upon because higher learning and working status commence from secondary school, with the knowledge that private secondary schools are segmented into three broad categories, it is essential that STEAM education teachings be made available and assessable to all segment of the private secondary schools not just the schools of the elites and famous (International and average private secondary schools), but it should be inculcated into the secondary school curriculum where all segments of the private secondary schools can have access it. Educational bodies monitoring progress of schools should be send to all private secondary schools, including the mushroom private secondary schools to ensure implementation and continuation of STEAM teaching.

STEAM education in private secondary schools broadens the learners learning horizon pertaining to career choice, the learner is involve actively in the field of both Science, Technology, Engineering, Arts, and Mathematics. STEAM education is required for advancement in career, for national development and sustainability in the 21<sup>st</sup> century and should be taught in secondary schools and at all spheres of private secondary schools as majority of the learners is found there.

### **Ways to Creating STEAM Teachers in Private Secondary Schools**

1. Create STEAM teams of teachers from different subject areas with different subject expertise; creating this teams of teachers from different educational field enhances the STEAM team in the school
2. Ensure that both student and teacher schedules are adjusted to fit in with

STEAM lessons, including time for planning, refinement and reflection.

3. Staff, department, and faculty should receive professional training and development in STEAM practices, principles and supports
4. STEAM team or educators should be equipped with necessary skill needed for STEAM learning. (Adapted from Team X Q; Rethink high school, 2020).

### **Steps to teaching STEAM education in the classroom**

Teaching STEAM education in the classroom is beyond just adding the subjects into learning, it involves lots of steps integrated together, these step are:

1. Add More Hands-On Projects: STEAM incorporates hands on learning, not just for the sake of doing a project. STEAM projects allow open ended exploring and investigating, problems to solve and solutions to create, making education hands-on projects important. The more senses involved in education, the more it will help students to remember what they are learning. The experiences that come from hands-on projects bring learning to life and make learning interesting.
2. Real-World Problem-Solving Activities: the second stage is including real word problem solving activities, in this stage the learners are asked to find a real world problem e.g. how animals and humans interact and create a solution for that problem. Including activities that will help the learner to focus on the important parts of education, how to apply it to real life. Professionals in different fields can be invited to help learners see things in action; this will boast the learners' interest in academic and school activities.
3. Integrate and Apply the Learning: this third stage have to do with application of the STEAM teachings, connecting the subjects together, intertwine arts and math, making engineering and science work together. Bring technology into all of it through apps, programming, wiring, tools, and more. Incorporate all these processes across all areas of learning.
4. Encourage Questioning and Wondering: learners are naturally curious, therefore allow them question, wonder, experiment

and explore. It is through these methods that new discoveries and intentions are made, this approach helps student understand why things happened the way they do.

5. Give the Learners More Control of Their Learning: at this stage more control should be given to the learner over their learning as this is important in education

and also to the learner, when they have control over their learning they will care more and be more responsible. The learners are allowed to make some decisions about the projects they do and the way they do them (Karyn,2021). Figure 3 describe the cyclical representative steps to teaching STEAM education

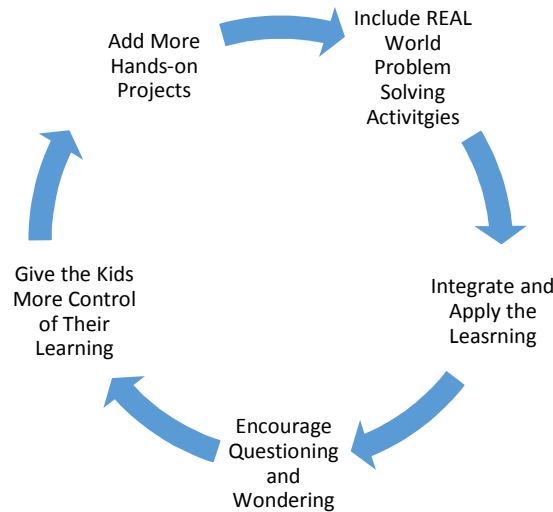


Figure 3: A Cyclical representative steps of teaching STEAM Education

### POSSIBLE CHALLENGES OF TEACHING STEAM EDUCATION IN PRIVATE SECONDARY SCHOOLS

Despite the increasing knowledge on STEAM education and the increasing awareness of its importance, STEAM education still faces lots of challenges especially in private secondary schools. These challenges are both teacher, student, Government and environmental based, the challenges are:

1. Lack of relevant tools or equipment needed by both students and teachers in the teaching and learning of STEAM.
2. Lack of student's interest in science related field or context; most young learners are scared of sciences and any subject relating to it, not knowing that in their individual time or place they have been involve in science e.g. the putting together of blocks (block building) in the playground.

3. Lack of integration with real life situation, as most student does not see the link between science and technology with real life experience.
4. Gender issues is another challenge with STEAM education teaching, as most male go into the lots of science, technology, engineering and mathematics more, and the female are not encourage or motivated in the above mentioned areas.
5. In service teachers currently applying STEAM education in the classes reveals that lack of time for collaboration planning, lack of time for instructions, and inadequate school structure and organization (e.g. scheduling), difficulty to assess STEAM achievement, lack of resources and inadequate teacher education are the main challenges faced. Shernoff, Sinha, Bressler and Ginsburg as cited in Ivan and Cortes, (2020)





6. Herro, Quigley and Cian (2019) claimed that STEAM education challenges include pacing/time, student understanding of content and process, issues relating to planning and concerns about school district policies. According to these researchers, there are two other challenges that include technology integration and issues related to assessment.
7. Multidisciplinary education whereby teachers teaches content outside their comfort area or specialty.
5. STEAM is not a one man's or teachers approach to teaching rather, it is a collaborative approach where team working is vital, a working team is vital, a working team should be made in schools to foster effective STEAM education.
6. Practical tools or and equipment should be made available to all private secondary schools for effective STEAM teaching.
7. One of the challenges of STEAM teaching is lack of interest from the student as such the teacher should start slow, then capture their attention and apply STEAM teaching to real life situations, actively involve the student, allow them "do it yourself", the teacher can come in where needed

### POSSIBLE REMEDIES FOR THE CHALLENGES OF TEACHING STEAM EDUCATION IN PRIVATE SECONDARY SCHOOLS

Teaching STEAM education in private secondary schools will be stress free, but with the application of the following recommendations both teacher and student will have reasons to smile and enjoy STEAM teaching and learning, these remedies are:

1. There should be availability of quality and same STEAM curriculum in all aspect of the private secondary schools (both low, middle and high class private secondary schools), this is to enhance equity in STEAM teaching in all private secondary school sectors.
2. The private secondary schools' teachers should be properly train on how to integrate STEAM education in their everyday teachings in the classroom, STEAM is a multidiscipline approach to teaching and hence needs to be properly educated so as to be able to handle learner misconception in STEAM education.
3. According to Herro, Quigley, and Cian, (2019), one of the challenges of teaching STEAM education is pacing /time, in view of this , quality time should be made available during STEAM classes, both students and teachers should be given quality time to help enhance teaching and learning of STEAM.
4. Adequate school structure should be erected and dedicated for STEAM education teaching because STEAM education multi-disciplinary that involves the integration of Science, Technology, Engineering, Arts, and Mathematics.

### CONCLUSION

This paper concludes that despite the importance and usefulness of STEAM education in schools, private secondary schools will still face some challenges this may also be as a result of the type of the private secondary schools and where the school is situated, therefore the paper presents remedies on how to tackle the challenges that may arise in the course of teaching STEAM education in the 21<sup>st</sup> century.

### RECOMMENDATIONS

Based on the reviews of the study, the researcher recommended that STEAM Education should be emphasized and educational supervision and monitoring by the personnel of ministry of education should be reinforced to ensure quality teaching and learning that is directed towards achieving the objectives of education as enshrine on the national policy on education and adherence to the national curium for better achievements of educational set goals.

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