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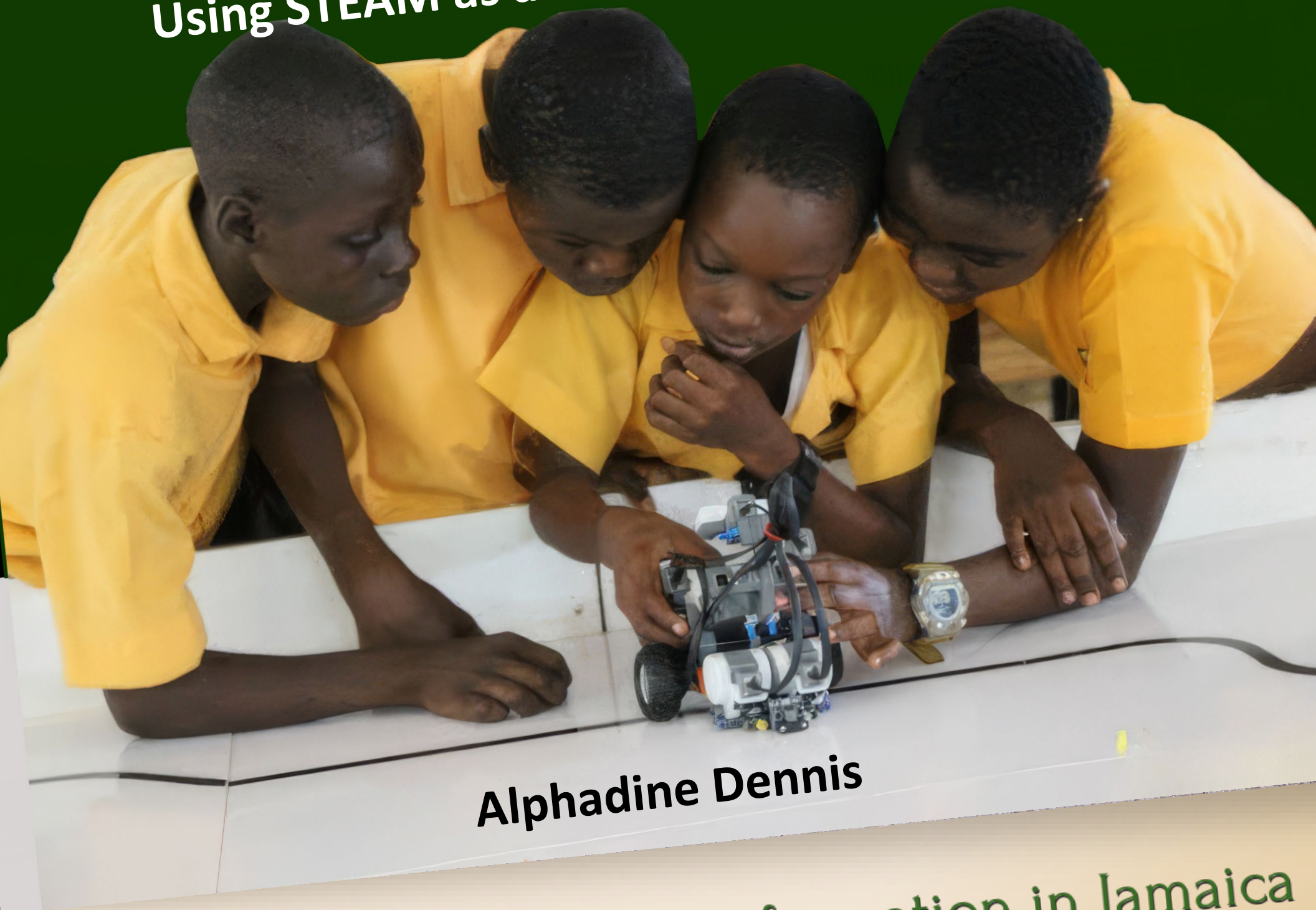
LEGACY



TRANSFORMATION IN ACTION

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**Tackling Bringing Science to Life:
Using STEAM as a Pedagogical Tool in Science**



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Advancing Educational Transformation in Jamaica



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Bringing Science to Life: Using STEAM as a Pedagogical Tool in Science

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What if the key to transforming science education was not found in expensive equipment or imported resources, but in the creativity, compassion, and ingenuity of our own students? Sometimes, the most powerful innovations emerge when educators and learners work together to remove barriers and ensure that every child has an opportunity to succeed. As a science teacher, keeping students engaged can be challenging and that challenge becomes even greater when you must address the diverse learning needs present within a single classroom. While my teacher training introduced me to the concept of differentiated instruction, nothing truly prepared me for the reality of teaching a visually impaired student in my Physics class who I will call Kevin for the purposes of this article. Reflecting on that experience, I realized that traditional approaches alone would not be enough. I needed to find innovative ways to ensure that this student could fully access and engage with the learning process alongside his peers. This student was eager to learn, but he was struggling and understandably so. As a young educator, I felt the need to see how best I could tailor my lessons to assist him. I knew I had to do something.

Before now, I have always believed in the Jamaican ministry of education's mantra, "Every child can learn: every child must". It was the first time I saw this statement for what it really was. In that moment, I truly understood my responsibility as an educator. Kevin was in my care, and regardless of the challenges, it was my duty to ensure that he had every opportunity to learn and succeed. That realization marked a turning point in my teaching journey. It challenged me to rethink my approach to instruction and inspired me to seek innovative ways to make learning accessible to all students. More importantly, it shaped my commitment to creating a meaningful and lasting impact on the lives of every learner I encounter. However, I quickly realized that I could not undertake this mammoth task alone.



Jabari Mannings, Alphadine Dennis (teacher), Brian Clarke, Mr. Neville Bell (host), Darnel Hamilton and Theo Carr in the studios of Television Jamaica (TVJ).

As the teacher-leader of the Robotics club at my school, I shared this challenge with the club members, who were mostly students. They immediately accepted the challenge. This marked the beginning of something spectacular. Soon, we got to work using just about any materials we could find to make science manipulatives that would be appropriate for their visually impaired peer to use in learning science concepts. Of course, we all had to first research how visually impaired students learn, so that was the focus. The club members

thought of creating things that he could manipulate - feel and explore concepts via touch. The end product in the first attempt was a representation of the respiratory system using different types of materials of different textures. For example, cotton, board, or just about any scrap materials that could be found in the immediate environment. After all, they were students, and resources and funds were limited. This was necessary so the student could use the sense of touch to identify each part. The club members decided to keep the momentum and went on to design a tactile graph and a digital meter. These devices became essential in helping to enhance Kevin's learning experience. For instance, the representation of the respiratory system, was not only relevant to biology and integrated science lessons, but also allowed all students to visually see concepts that were many times difficult to understand. Moreover, for Kevin, the tactile model enabled him to explore and identify the various components of the respiratory system through touch. Additionally, the analogue meter, which is applicable in physics and integrated science, is used to measure the amount of electricity consumed in a traditional context. That's exactly what Robotics is all about - students building and testing systems to observe scientific principles in action.



Figure 1 Model of the respiratory system. Representation of the respiratory system made from various materials such as board, threads, pipes, cotton, wires, plastic wraps, tie straps and glue.

Why STEAM as a Pedagogy in Jamaican Classrooms?

According to Rodrigues-Silva and Alsina (2023), STEAM is an educational approach that incorporates the application of science, technology, engineering, arts/humanities and mathematics in everyday lessons to enhance students' creativity, innovation and overall critical thinking skills. STEAM emphasizes hands-on learning, critical thinking, innovation and inquiry-based learning (Niu & Cheng, 2022). This aligns well with Jamaica's national curriculum goals in science and technology. In the twenty-first century and beyond, educators need to move beyond passive traditional methods of disseminating knowledge, especially in physics. Also, learners in this changing world have a direct need to be actively involved in their own learning. Of course, this approach requires more creativity and innovation on the part of both teacher and students and is more time-intensive, but the benefits outweigh the challenges. Learners are to become more self-directed, more willing to make hypotheses, design experiments, and come up with innovative solutions to their everyday problems. This is important, as today's learners need to learn that they are the future problem solvers and innovators of tomorrow, so they need to develop those skills today.



Figure 2 Theo Carr, Jabari Manning, Brian Clarke and Darnel Hamilton at the studios of Television Jamaica displaying a representation of the respiratory and the analogue meter.

These are essential twenty-first-century skills that are essential for thriving in an evolving STEAM society that Jamaica aspires to be. This approach also builds their conceptual understanding of the subject matter and deepens their interest in it. It does not take rocket science to become innovative; it only requires a genuine commitment to doing whatever it takes to support our students and a willingness to involve them as active partners in the learning process. When educators and learners work together, even the simplest resources can be transformed into powerful tools that make learning meaningful, engaging, and accessible to all, including those with special needs or disabilities.

Furthermore, this approach can also be integrated with other models to develop an even richer teaching and learning experience. For example, science educators can integrate robotics into project-based units. This is where creativity and innovativeness are valuable skills in designing these resources.



Hope Coming Alive!

Seeing these learning aids, I was deeply inspired by the compassion, selflessness, and commitment demonstrated by the club members in ensuring that their peer had an equal opportunity to learn and succeed. In Physics, learners are expected to manipulate graphs to analyze relationships between variables and draw meaningful conclusions from experimental data. To support their classmate, the club members surprised the student with the tactile graph. For the first time, I saw hope, a spark of curiosity. It was a whole new world. Kevin was able to use their other senses to visualize and understand concepts that had previously been difficult to grasp. An outstanding teaching-learning moment occurred when the visually impaired student independently used the tactile graph to complete a prescribed task. Without this resource, plotting, interpreting, and analyzing graphs would have been a significant challenge. Watching the student confidently engage with the activity was both rewarding and inspiring, demonstrating the power of innovative, inclusive teaching practices. It was a transformative moment - one that opened up a whole new world of learning possibilities and demonstrated that with the right support, every student can meaningfully engage with scientific concepts. At that moment, I recognized that using STEAM as a teaching methodology in the sciences could be an effective way to enhance learning among diverse learners, making it meaningful and enjoyable for individuals with varying abilities and challenges.

It was at that moment that I truly recognized the transformative value of STEAM education. This realization reinforced my belief that STEAM could be instrumental in moving Jamaican educators closer to achieving our vision of becoming leaders in education within an inclusive learning environment. In an inclusive classroom, that student needed something different-an approach that could transform the learning experience and foster meaningful engagement.

When thoughtfully integrated into science education, STEAM provides an innovative and inclusive approach to teaching and learning that is well suited to the demands of the twenty-first century and beyond. By blending science with technology, engineering, the arts, and mathematics, STEAM creates authentic, hands-on learning experiences that encourage creativity, critical thinking, collaboration, and problem-solving. Among its many benefits is its ability to spark curiosity, engage diverse learners, and cultivate a genuine interest in scientific inquiry. It also enhances student motivation, increases classroom participation, and creates meaningful opportunities for all learners to experience success.

Long-Term Impact

Using STEAM as a pedagogical approach can contribute significantly to Jamaica's broader economic development goals. By nurturing creativity, critical thinking, problem-solving, and innovation. It helps to prepare learners for the demands of an increasingly technology-driven world. As such, science educators have a responsibility to harness students' interests and empower them to become creators, innovators, and solution-oriented thinkers rather than passive consumers of knowledge. When learners are encouraged to design, build, and create using available resources, they develop a greater sense of ownership for their own learning, therefore, embracing the engineering aspect of STEAM education. Furthermore, there are immense benefits such as reducing the dependency on imported resources, lowering the cost of resources and creating a local supply of skills through entrepreneurship. Therefore, embedding STEAM within science education is not merely an instructional innovation but a strategic investment in developing a resilient, globally competitive, and sustainable Jamaica.



References

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Alphadine Dennis is a physics teacher and STEM educator who is passionate about helping students understand science in fun and practical ways. She currently teaches at Old Harbour High School in St. Catherine, where she encourages students to explore subjects like physics, and robotics. She describes herself as an “educational engineer in physics” and is known for supporting her students as they create innovative science projects. She is also a STEM Ambassador for the Scientific Research Council, helping the SRC implement some of their student outreach programmes. Alphadine has a Bachelors of Education in physics from The Mico University College where she was involved in hands-on learning activities such as robotics demonstrations. During this time, she worked as an instructor and helped younger students learn how robots move and function using computer programming. Ever interested in furthering her own education, she recently completed a Masters of Science degree (M.S.) in Sustainable Electricity Generation through the Universidad Isabel I in Spain. 

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