# Engaging learners in non-formal Science Technology Engineering and Mathematics education: ESKOM EXPO for Young Scientists

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**Abstract:** In the global arena, citizens should have the necessary knowledge and skills to be constructively engaged in the development of their country. Their experiences with science, technology, engineering and mathematics, (STEM) education is viewed as providing the skills for the professions of the future. In the non-formal education sector learners are engaged with science expos, which focusses on inquiry and project-based learning, in authentic science experiences and independent research to solve real-life problems by asking questions, collecting, evaluating, interpreting data, engaging and communicating argument with evidence from findings. The nature of the engagements varies across the grades and disciplines, even though there is consistency in the assessment formats and expectations of all learners re the planning and submission of projects.

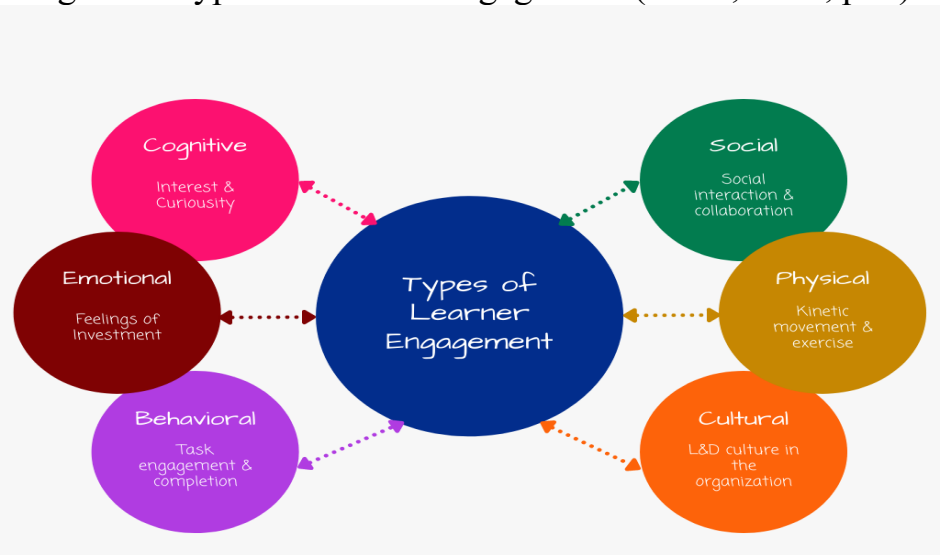
**Keywords:** STEM education, learners, science expo, nature of engagement.

In the complex, dynamic world with all the technological and Artificial Intelligence developments, learners are to be constructively educated to engage and also lead the changes taking place. The Department of Basic Education is engaged in the enhancement of the teaching and acquisition of crucial core skills, as well as raising the caliber of instruction in Mathematics, Science, and Technology (Department of Education, 2021). The National Curriculum and Assessment Policy Statement (CAPS), the curriculum for grades R- 12 was introduced by the department in 2012, in an effort to redress issues of inequalities and imbalances from the past (Jojo, 2019, Mavuru & Ramnarain, 2020). The curriculum comes with the mandate that learners should be given the opportunity to acquire and apply information and skills, in meaningful ways, in order to strive and attain excellence and fairness in scientific education (Mavuru & Ramnarain, 2020). The department and other Science organisations are engaged with building a culture of science in the education system, through Olympiads and competitions in Science, Technology, Engineering, and Mathematics (STEM). Olympiads and competitions, which includes science fairs, are crucial to this effort, because they expose learners from various backgrounds and contexts to the investigative and practical nature of STEM subjects, while also helping to promote the various ways that they can be taught (Zulu, Juan & Luescher, 2018). In South Africa, science fairs are referred to as Science Expos and fall under the auspices of the Eskom Expo for Young Scientists, a non-profit organization (which will be simply referred to as the Expo). The Expo coordinates South

Africa's largest science fair which includes all STEM fields, not only science.

The exploratory research question: What are the levels of engagement of learners in the Science Expos and how do learners experience these levels of engagement? The meaning of engagement used in this article: engagement is, "the act and state of involvement" (Davies, *et al.*, 2018, p. 170). Engagement is distinguished from motivation, which is, "the stimulus for that involvement." (Davies, et al., 2018, p. 170). Learner engagement may be categorized into types: cognitive, emotional, behavioural, social, physical and cultural.

Figure 1. Types of Learner Engagement (Lentz, 2024, p. 1)




Eskom Expo for Young Scientists is a grass root level science foundation hosting South Africa's largest science fair for school learners where they have an opportunity to exhibit their own scientific investigations and engineering research projects.

It is a Non-Profit Organisation (NPO) funded by Eskom to promote STEM engagement amongst learners from grades 4 to grade 12, thereby building a culture of innovation through research-based projects. At the annual prestigious Eskom Expo for Young Scientists International Science Fair (ISF), selected students from 35 Expo Regions in South Africa compete against the best young scientists from around the country and around the world." There are four types of projects - 1. Mathematics/Theoretical, 2. Social Sciences, 3. Engineering/Computer Science and 4. Science Investigation/ Experimental. There are 13 categories linked to this, for example, Earth Sciences, Plant Sciences, Energy. The learners register for the expo, decide on a topic, engage with a research question or engineering challenge, plan and conduct research, collect data, and draw conclusions. They present their

findings effectively in a well-structured display board with a comprehensive report, at the district expo and if selected at the regional expo, then national, if successful.

Figure 2. The Expo process – plan for 2025


Figure 3. Learners with their display boards at a Regional Science Expo


In 2024, South Africa's Eskom Expo for Young Scientists hosted the 44th International Science Fair (ISF). The ISF featured 308 local young scientists and 18 international participants from countries like Lesotho, India, Russia, and Mexico

In 2025, an additional element is added to the learner engagement – Stem Holiday Programme at local Libraries. An important aspect is that the pre-service teachers are engaged in mentoring the learners in the Holiday and now weekly programme in the libraries.

Figure 4. Library programme with pre-service teacher mentors


The levels of engagement are varied across these two initiatives and so are the experiences of the learners and further research to be undertaken to inform this.

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