Framework for k-12 science education

Education

In 2012, the National Research Council published A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (National Research Council, 2012). It identifies certain key scientific concepts and principles that all students may reasonably be expected to have mastered by the end of high school. This was used to develop the Next Generation Science Standards (NGSS) (National Research Council, 2013), which seeks to engage students in the learning process better and to enable them to actively explore the core scientific ideas and theories. The knowledge that students' gain through this process can be acquired through their participation in the scientific and engineering research practices (Starr & Krajcik, 2013).

Presently, professional development opportunities are being offered with a view to equipping the teachers with the resources required to implement the NGSS in their classrooms. Not all teachers, however, have been able to successfully incorporate NGSS practices in their respective classrooms. It can be said that standards and performance expectations aligned with the framework should consider that students cannot completely comprehend scientific and engineering concepts without being involved in the inquiry practices and the discourses that lead to the development and modification of such ideas (Willard, 2013, p. 16). This is suggestive of the state and significance of science today in the K-12 educational curriculum.

Teachers should have vast knowledge of and expertise in research methodology and must be skilled in scientific research to pave the way for authentic scientific inquiries in the classroom, (Musante, 2006). The National Science Teachers Association recommends the teachers of science to demonstrate their comprehension and understanding of the tenets, process,

and assumptions underlying the different methods of inquiry related to scientific knowledge and also to encourage students' participation in inquiries that are developmentally appropriate and that impart the need for the students to scientifically develop relationships and concepts using data, inferences, and personal observations (NSTA, 2003, p. 18). A potential way in which teachers can acquire such knowledge and understanding is through participation in the Research Experience for Teacher (RET) programs (Ononye et al., 2007).

The purpose of RET programs is to equip the teachers with fundamental knowledge in the conduct of practical research for ongoing application in their daily experiences in the class (Silverstein, et al., 2009). Deep involvement of the teachers in scientific research in the RET programs yields many positive outcomes which motivates the teachers and facilitates them in applying scientific learning in unique ways. Grove, Dixon, and Pop (2009) are of the view that much needs to be done in terms of exploration of the effect of RET practices amongst teachers.

RET programs support realistic scientific practices and exploration aimed at motivating the teachers and invoking a passion in them for new scientific inquiry in their students to improve the learning process. It is unfortunate that the teachers often have trouble implementing the science and engineering practices learned from RET programs in their own classrooms because of constraints that include but are not limited to lack of personnel for support, low motivation for teamwork, few resources, and competition from other coursework (Hemler & Repine, 2006).