Abstract

This study explored the possibilities of using beads and beadwork (cultural artifacts) to create instructional models of simple and complex organic compounds for teaching and learning of life sciences concepts in South African science classrooms. The objective was to find ways of integrating African indigenous knowledge (AIK) through cultural artifacts into westernized science teaching to enhance better learners' understanding of and performance in sciences. I became interested in using materials available in learners' (students') lived-world to spur their interests in learning sciences when I taught high schools life sciences in Iyin-Ekiti, Ekiti State, Nigeria. Classroom resources were very scarce and those manufactured by textbook companies were boring to indigenous learners. They tended to memorize and regurgitate to pass exams and often could not explain the concepts in their own words. Therefore, I had to improvise. I asked learners to bring resources from home that we then use to create paper mache of science concepts as instructional models thereby concretizing abstract life sciences concepts. This hands-on, minds-on, culturally related, approach sparked learners' interests in science that resulted in high performance in science and spurred me to carry on this study. This study has therefore solidified my view that materials found in the learners' lived-world (cultural artifacts) can be used by teachers to enhance the teaching, learning and understanding of westernized science and help improve science performances (the learners ability to produce and reproduce the knowledge of simple and complex organic compounds) and literacy of indigenous learners.

Enhancing indigenous learners' understanding of westernized science concepts by using culturally relevant materials that are significant in learners' lived-world became imperative in South African context. The South African National Curriculum Statements stated categorically that teaching of sciences must "values indigenous knowledge systems and acknowledges the rich history and heritage of the country" (NCS, 2005. p. 5) and the Curriculum and Assessment Policy Statements (CAPS, 2011. p. 2), as policy documents, mandated that "children acquire and apply knowledge and skills in ways that are meaningful to their own lives". In addition, CAPS also instructed teachers to "construct models of simple and more complex molecules using beads" (CAPS, 2011. p. 19). Surprisingly, the teachers, who participated in this study, were unaware of this provision in the CAPS document and it may not be wrong to assume that most science teachers are equally not aware of this provision. More critical is that the curriculum did not state how these models of simple and complex organic molecules would be constructed with beads; and the schools and/or teachers

were not provided with beads, resources, and neither were they trained on how to do this. Without these provisions, the outcomes envisaged by CAPS will continue to be hidden in the curriculum without actualizing them.

This study takes a qualitative approach using a case study paradigm and video-recorded (teachers professional development workshop, teachers interview and teachers and learners classroom interactions) and conversation analyses with the use of questionnaire to collect data on "how" beads and beadwork could be used to create instructional models for teaching and learning of simple and complex organic compounds and more. The study was conducted in two peri-urban (township) schools near a metropolitan city in South Africa. Four (4) grade 10 life sciences teachers and their learners (forty learners on an average) as participants were involved in the study. The four life sciences teachers were interviewed after the professional development and training workshop. In the professional development and training workshop, all sciences teachers indicated their interest to participate and this was not denied, however, only the experiences of four life sciences learners were captured during the interview. In essence, there were four interviews (20 minutes each) with the life sciences teachers. The focus groups were conducted for 20 minutes also. The study was carried out in three phases. In phase one, I as the researcher taught myself how to create simple and complex organic compounds in order to teach the processes to science teachers. In phase two, I engaged science teachers from two schools in a professional development and training workshop where I worked with the teachers on how to create simple and complex organic compounds as instructional models using beads and beadwork. The third phase was where teachers taught learners how to create such instructional models by themselves, which were later used to teach the organic molecules Participants included four teachers and their learners. I also engaged a professional bead maker to help me gain a better understanding of the knowledge of beads and beadwork and the learning processes that are involved in bead making.

Research findings indicated that the aesthetic properties of beads and beadwork and interests of learners in the aesthetic properties endeared the learners to the hands-on, minds-on activities and enhanced their sustained engagement, interests and interactions among learners, learners and their teachers, and both learners and teachers with the culturally-related materials (beads and beadwork). These materials became tools for generating culturally related instructional models (CRIM), as the beads and beadwork became cognitized for teaching and learning of life sciences in the classroom. The professional development and training workshops with the teachers became forum for teachers' heightened awareness of

and interests in the use of not only beads and beadworks but other cultural artifacts in concretizing abstract science concepts. Teachers demonstrated the conviction that the use of the cultural artifacts integration model (CAIM) could be a pedagogical approach to aligning the two worldviews, indigenous knowledge (IK) and westernized science (WS) in indigenous science classrooms. Other areas of indigenous knowledge integration with westernized science in the African sciences classroom/contexts; and how they can be integrated using the CAIM present areas for further research.

Keywords: Culturally Responsive Pedagogy, Culturally Related Pedagogical Resources, Indigenous Knowledge Systems, Nature of Science, Culturally Responsive Resources, Cultural Artifacts Integration Model