

This study was concerned with the investigation of various aspects of concept formation and their representation in science as demonstrated by Kenyan secondary school pupils. Specifically, the researcher was concerned with establishing modes of concept representation; detailing variety, quality and status of concepts held; determining utilization of concepts across different contextual situations; and investigation origins as well as development of concepts held. The underlying theoretical framework was constructivism, which put the learner at the centre of all efforts of making sense of the physical world through the construction of personal tentative knowledge.

The investigation was done by administering written task battery, written Tests About Incidents on selected Themes (WTIST) to 849 pupils, and subsequently interviewing a sub-sample of 105 pupils. The pupils involved were form 1 and form 4 chosen from 10 schools selected from 5 provinces. The sample was chosen from 4 girls, 3 boys, and co-educational average ability schools. The follow-up group interview was done to clarify the issues that had emerged from the written questionnaire. The responses from WTAIST and the support interview were analyzed in accordance to a developed concept formation criteria set.

The analysis revealed the ability of the pupils to depict their concepts in two main representational forms namely: prepositional and diagrammatical forms. Various levels of conception were identified. They were generalized as true concepts, alternative conceptions and misconceptions, and none concepts. It was found that for every task, the misconceptions outnumbered any other shade of concepts held. The least held type was the true concepts. The patterns that emerged indicated that the concepts were tenaciously held. They were resistant to change through instruction. Class level was found to have minimal influence on the concepts held. Gender had a small but distinctive effect on the type of concepts formed and represented.

The profiling of the individual major categories of misconceptions and alternative conceptions revealed pupil thinking difficulties with tasks involving boiling, air pressure in an inflatable enclosure, particle diffusion, and potential energy involving a wood block. Pupils' concepts were fairly uniformly applied across different task situations. The main sources of pupils' conceptions were identified as authority (teacher, books, parents, peers) as well as the pupils' personal observation and experience of natural phenomena.

Implications of these findings for curriculum and instructional purposes were discussed. Re-organization of curricula courses and revamping of teacher education programmes were suggested. Suggestions for further research work in concept formation and representation in physics topics and indeed other science subjects in Kenya were made.