

Exploring how grade 12 Physical Sciences learners make sense of the concepts of work and energy

Physical Sciences is one of the subjects in which students perform most poorly in the National Senior Certificate examinations. For example, in the Eastern Cape in 2013, a mere 29.9% of the candidates who sat for the Physical Sciences National Senior Certificate examination managed to achieve a mark of 40% or above (Department of Basic Education, 2014). According to the Chief Markers' reports (ibid), questions on the topic of Work, Energy and Power are amongst the most poorly answered in the National Senior Certificate examinations. This fact triggered my interest to explore how grade 12 Physical Sciences learners make sense of the concepts of Work and Energy with particular emphasis on the work-energy theorem and its application in problem solving. I carried out the study in a village school in the Queenstown district. The study adopted an interpretive paradigm in which the case study approach was used. Data were generated using a diagnostic test, focus group interviews, video-recorded lessons, analysis of learner journals and a summative test. Analysis of the qualitative data involved identifying themes from the data and using analytical statements that answered the research questions. The study was informed by Vygotsky's (1978) social constructivism theory, and in particular, the notions of the mediation of learning and the Zone of Proximal Development (ZPD). Learners were given tasks on the work-energy theorem and related concepts and these were designed in such a way that they were situated in the learners' ZPD, since this is where most powerful learning takes place (Thompson, 2013). The findings of the study revealed that grade 12 Physical Sciences learners do not have sufficient prior knowledge on concepts related to the work-energy theory to successfully make sense of the work-energy theorem. The other finding is that learners construct knowledge of the work-energy theorem and its application collaboratively through group work. In the group discussions learners used isiXhosa and this enhanced their sense making. A number of challenges that make it difficult for learners to solve problems using the work-energy theorem were identified.