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FIRST YEAR PHYSICS STUDENTS' ALTERNATIVE CONCEPTIONS ON BERNOULLI'S PRINCIPLE

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Part of a larger project, first year students' alternative conceptions relating to Bernoulli's principle were investigated. In order to develop teaching interventions using constructivist principles, students' prior understanding is important as new knowledge is linked to their prior knowledge. In most of the secondary schools, flow dynamics is not part of the curriculum and therefore very little research regarding alternative conceptions concerning Bernoulli principle has been conducted. An explanatory case study design was followed, by identifying the most prevalent alternative conceptions relating to the Bernoulli principle, which describes pressure of fluids in motion. The study was done amongst 71 first year physics students at a University of Technology in South Africa. Both qualitative and quantitative research methods were used to determine these students' alternative conceptions. Three instruments were used to collect the required data: (i) a questionnaire with structured multiple choice questions before the intervention, (ii) a tutorial where students had to solve applicable problems using the continuity equation and Bernoulli's principle during the intervention and (iii) a test with multiple choice questions, followed by a motivation for each choice, as well as two open-ended questions, after the intervention. The motivations and open-ended questions sought to elicit the students' views regarding flow dynamics, and to gain more original responses than would have been the case had the students been asked to respond to already pre-conceived statements regarding flow dynamics. Although quantitative data were collected, the main thrust of data analysis for this study was on the qualitative data.. The analysis of the students' responses did not focus on the knowledge, per se, but the underlying conceptions behind the respondents' answers. The results showed that the students held many alternative conceptions concerning the equations of continuity and Bernoulli's principle in a dynamic fluid system, which include the following notions: pressures are equal when flow speeds are equal, without taking different altitudes in consideration; pressures are equal where cross-sectional areas are equal, without taking different altitudes in consideration; pressure in a fluid is the same throughout the fluid (a misconception from Pascal's Principle); in a pipe with different altitudes the speed increases due to gravitational acceleration; the depth in static fluids and the height due to potential energy cause confusion. These answers were further categorised into six themes namely naïve physics; lateral alternative conceptions, ontological alternative conceptions, Ohm's p-prims; mixed conceptions and loose ideas. Even fundamental concepts of static liquids were not mastered and recommendations are made. Due to the multiple alternative conceptions in these different categories, the importance of the larger project to design an instructional intervention with constructivist principles which focuses on teaching sequences to address the alternative conceptions relating to Bernoulli's' principle, is clear.

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