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Diagnosing 10th grade students' misconceptions on plant transport and human circulatory systems using a two-tier diagnostic test

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Students bring with them their own misconceptions to the science class and they continue to possess such misconceptions even after instructions. Thus, identifying misconceptions is an essential component of teaching science. It is needed to eliminate the misconceptions of students, as what students would learn otherwise become alien to them and they are unable to assimilate new knowledge into existing knowledge. The aim of this study was to develop and apply a two-tier diagnostic test to identify the misconceptions of students' in Sri Lanka on plant transport and human circulatory systems.

The development procedure of the two-tier diagnostic test had three steps, as, a) defining the content boundaries of the test, b) collecting information on student misconceptions and, c) instrument development. Alternative conceptions of students were collected by interviewing 25 students and administering multiple questions with free responses to 25 students. Sixteen two-tier multiple test items were developed based on the data collected. The first tier of each item examined content knowledge and the second tier examined the reasons for the content. Concepts examined in the test items were: Water absorption; mineral salt absorption; transportation of water; transpiration; organic food transportation, blood pathway; structure of circulatory system; gas exchange, and functions of blood cells. The diagnostic test was administered to 180, 10th grade students from six selected schools in the Kandy and Kegalle districts. Responses to each item were analyzed to identify student misconceptions.

The split-half reliability of the test was 0.75. Difficulty indices of the items ranged from 0.15 to 0.69 and discrimination indices ranged from 0.10 to 0.89. It was revealed that students had thirty misconceptions about plant transport and human circulatory systems. The two most common misconceptions identified were, "The function of red blood cells is to transport only the oxygen"(43.8%) and "Plants obtain organic food through root hairs and transport it to all parts of plants"(35.5%). The research concludes that the two-tier test can be used in Sri Lanka as an effective measuring instrument to identify students' misconceptions.

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