

Public Abstract

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Title:THE DEVELOPMENT AND VALIDATION OF A THREE-TIER DIAGNOSTIC TEST MEASURING PRE-SERVICE ELEMENTARY EDUCATION AND SECONDARY SCIENCE TEACHERS UNDERSTANDING OF THE WATER CYCLE

The main goal of this research study was to develop and validate a three-tier diagnostic test to determine pre-service teachers' (PSTs) conceptual knowledge of the water cycle. For a three-tier diagnostic test, the first tier assesses content knowledge; in the second tier, a reason is selected for the content answer; and the third tier allows test-takers to select how confident they are in their answers for the first two tiers. The second goal of this study was to diagnose any alternative conceptions PSTs might have about the water cycle.

The Water Cycle Diagnostic Test (WCDDT) was developed using the theoretical framework by Treagust (1986, 1988, and 1995), and in similar studies that developed diagnostic tests (e.g., Calean & Subramaniam, 2010a; Odom & Barrow, 2007; Pesman & Eryilmaz, 2010). The final instrument consisted of 15 items along with a demographic survey that examined PSTs' weather-related experiences that may or may not have affected the PSTs' understanding of the water cycle. The WCDDT was administered to 77 PSTs enrolled in science methods courses during the fall of 2012. Among the 77 participants, 37 of the PSTs were enrolled in elementary education (EPST) and 40 in secondary science (SPST). Using exploratory factor analysis, five categories were factored out for the WCDDT: Phase Change of Water; Condensation and Storage; Clouds; Global Climate Change; and Movement through the Water Cycle. Analysis of the PSTs' responses demonstrated acceptable reliability ($\alpha = 0.62$) for the instrument, and acceptable difficulty indices and discrimination indices for 12 of the items.

Analysis indicated that the majority of the PSTs had a limited understanding of the water cycle. Of the PSTs sampled, SPSTs were significantly more confident in their answers' on the WCDDT than the EPSTs. Completion of an undergraduate atmospheric science and/or meteorology course, as well as a higher interest in listening and/or viewing weather-related programs, resulted in PSTs having greater understanding and confidence in their answers on the WCDDT. The analysis of the PSTs' responses revealed 49 potential alternative conceptions and areas where PSTs' lack of knowledge was revealed from the WCDDT.