What Are the Relative Effects of Reasoning Ability and Prior Knowledge on Biology Achievement in Expository and Inquiry Classes?

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Abstract: What factor(s) influence the likelihood a student will succeed in college biology? Some researchers have found the primary determinant to be the student's prior knowledge of biology, while others have found it to be reasoning ability. Perhaps the ability of these factors to predict achievement depends on the instructional method employed. Expository instruction focuses primarily on facts and concepts. Therefore, perhaps the best predictor of achievement in expository classes is domain-specific prior knowledge. Inquiry instruction focuses more on how science is done, i.e., on scientific processes; therefore, perhaps the best predictor in inquiry classes is reasoning ability. This study was designed to test these hypotheses. Students enrolled in a nonmajors community college biology course were pretested to determine reasoning ability and prior knowledge. The number of previous biology courses was also recorded as an indicator of prior knowledge. After a semester of either expository or inquiry (learning-cycle) instruction, students took a comprehensive final examination. Reasoning ability but not prior knowledge or number of previous biology courses accounted for a significant amount of variance in final examination score in both instructional methods and with semester examination and quiz scores in inquiry classes. This suggests that reasoning ability limits achievement more than prior knowledge among these biology students, whether they are enrolled in expository or inquiry classes. Reasoning ability explained more of the variance in final examination scores for students enrolled in expository classes (18.8%) than in inquiry classes (7.2%). The reason for this is not clear, but significant improvements in reasoning were found in the inquiry but not in the expository classes. These improvements were accompanied by significant differences in achievement in the inquiry classes. Perhaps the reasoning improvement facilitated the better and more equal achievement for students in the inquiry classes, thus reducing the correlation between initial reasoning ability and final achievement. © 1998 John Wiley & Sons, Inc. J Res Sci Teach 35: 89-103, 1998.