

INVESTIGATING THE DEVELOPMENT AND USE OF PHYLOGENETIC
REPRESENTATIONS BY COLLEGE UNDERGRADUATES
IN A PLANT SYSTEMATICS COURSE

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ABSTRACT

Representations are critical tools for visualizing complex scientific knowledge. However, there is limited research investigating how students gain representational competence in biology, specifically in evolution. In evolutionary biology, phylogenetic trees are generated to represent evolutionary relationships among taxa. Unfortunately, these trees are not well understood by students. In this study, I used open-ended student responses from pre/posttests, interviews, reflective journal entries, field notes, and course assessments to learn how 27 upper-level undergraduate students enrolled in a plant systematics course used phylogenetic trees and developed tree thinking skills. I identified a) 10 approaches students used to interpret phylogenetic trees and 5 criteria used to compare representations; b) 8 alternative student generated representations and that some students were not able to generate any representation to illustrate a given phylogenetic scenario; and c) improvements in students' overall tree thinking, with greater improvement in tree reading than tree building. During the course, students were exposed to 3 instructional interventions to improve their tree thinking skills. I identified 16 core skills necessary for students to develop competence in tree reading and tree building. I proposed 7 levels of representational competence (Levels 0-6) based on these core skills. This empirical framework for representational competence in tree thinking will inform the design of evolution curriculum and maximize the instructional potential of using phylogenetic representations.