

## Conceptual Knowledge Structure Updates after Instructor Provided Structural Feedback: An Exploratory Study Applied with Undergraduate Architectural Engineering Students

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**Abstract :** Structural feedback is any form of feedback that aims to improve the quality of students' domain-normative conceptual interrelationships. Research with structural feedback points to the potential mediating role of network graphs as feedback for tuning students' conceptual understanding; for example, improved content knowledge and motivation were observed for undergraduate students who accessed the instructor's networks of course content. This exploratory study uses a one-group pretest-posttest design to examine the effects of instructor-provided network feedback during lectures on students' knowledge structure measured using a concept sorting task at the pretest and posttest. Undergraduate students in an architectural engineering course ( $n = 32$ ) completed a lesson module and then an end-of-unit quiz on building with wood and wood framing. Three weeks later, as a review, students completed a sorting task that used 26 terms from that lesson, then a week later, the sorting task data were used to create a group-average network, this network along with the instructor's expert network were added to that week's lecture slides and were compared and discussed during class time. A week later, students completed the sorting task again. The pre and post-sorting data were rendered into pathfinder networks, and then these students' networks were compared to five referent networks, specifically the textbook chapter network, the lecture slides network, a network of the end-of-unit quiz, the actual expert network that served as the feedback intervention, and the group-average network. Inspection of means shows that knowledge structure measures improved for all five measures from pre-to-post, becoming more like the lesson content and like the expert. Repeated measures analysis with follow-up paired samples t-tests showed pre-to-post significant increases for both the end-of-unit quiz and the expert network referents. The findings show that instructor presentation of structural feedback as networks improved or 'tuned' students' knowledge structure of the lesson content. This approach only takes a few extra minutes of class time and is fairly simple to implement in ordinary classrooms, and so it has wide potential to support classroom instruction and student learning. Further research is needed to determine how critical it is to present both the group-average network along with the expert network for comparison in order to highlight group-level misconceptions, or is presenting only the expert network sufficient? If a group-level network is necessary, then a simple clicker-like classroom tool could be developed to collect sorting task data during lectures that could then immediately provide the group-average network for class discussion and reflection.

**Keywords :** classroom instruction, engineering education, knowledge structure, pathfinder networks, structural feedback

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