

## **Interventions that Engaged Teachers with Developing Conceptual Maps of Science Content**

**Excerpted from Shymansky, J. A., Woodworth, G., Norman, O., Dunkhase, J., Matthews, C., & Liu, C. (1993). A study of changes in middle school teachers' understanding of selected ideas in science as a function of an in-service program focusing on student perceptions. *Journal of Research in Science Teaching*, 30(7), 727–755.**

“Concept maps generated by individual teachers at three points during the in-service and scored blindly at the completion of the study allowed changes in mean scores for various groups to be monitored using standard statistical procedures....

### *The In-Service Experience*

A unique feature of the in-service experience was that it was advertised to middle school teachers as an opportunity to develop a special instructional unit based on student ideas about a selected science topic. The emphasis from the start was on researching the structure, origin, and evolution of student ideas about specific science topics. As a result, teachers participating in the in-service did not enter or ever view the experience as a science course. Thus, they felt no great pressure to master any particular body of science knowledge and little anxiety related to course evaluations.

The in-service was set up in three distinct segments. There was an initial 2-weekend segment in which teacher topic teams met with a science expert and a science educator to establish the parameters of the science topic around which the unit would be built, to learn how to make concept maps, to establish procedures for interviewing students in their home schools, and to make concept maps of the unit topic. Concept mapping and clinical interviewing were introduced as tools for gathering and monitoring student ideas.

The second segment consisted of a full-week summer workshop in which student ideas gathered by the teachers via concept mapping and clinical interview sessions were analyzed and instructional units including unit tests were prepared to address these specific misconceptions and assess learning. Again, a science expert was involved. At this stage the teacher/expert teams had to tease out and evaluate the science in the student ideas. Laboratory activities, discussions, readings, texts, films, demonstrations, and computer-based materials were among those experiences used to facilitate the analysis. A snapshot of activity taken at this stage of the in-service might look like one of any number of other science courses except that when activities occurred in this context they were driven by the need to evaluate the merit of the student ideas for unit planning, not by the need to learn science as a course requirement.

In the final segment of the in-service each teacher implemented the science unit on which they had worked that previous summer. Prior to, during, and following the implementation, each topic team met with their science expert to continue the analysis of student ideas. To maintain the research emphasis, all the topic teams monitored

student understanding in their classes using concept maps and a set of tests constructed for their units. Along with anecdotal data gathered by the teachers, the concept map and test data served further to focus discussions in the final meetings. The science expert served as a resource person throughout the in-service, not as a lecturer. Prior to the start of the in-service, all the experts were briefed on using student ideas to plan instruction and given suggestions on how to interact with the teachers. For example, they were told that their primary function was to assist the teachers in evaluating the merits of the student ideas and make suggestions for how to probe and challenge those ideas. They were told they could explain, demonstrate, and set up laboratories related to the student ideas brought by the teachers, but were otherwise discouraged from approaching the experience as if it were a short course on the topic. This mode of interaction was new to most of the science experts enlisted, but all seemed to accept and adapt to the challenge very well. Meetings with all the experts were held throughout the in-service and helped to maintain the integrity of the theme.

### *Sample*

Grade 4-9 teachers for the study were drawn from schools in eastern Iowa and western Illinois. Responding to a brochure mailing to all schools in the specified region, 48 teachers were selected from an applicant pool of 175. Teachers were selected on the combined factors of grade-level assignment, science topic interest, and geographic location. Science background and teaching experience were not considered. The selection was done to allow study of the in-service model across multiple topics, to ensure representation of several grade levels within the topic teams, and to facilitate site meetings during the school implementation phase. Based on teacher interest and the project staff's desire to study the model in different content areas, 10 teams were established. Of those 48 beginning the three-stage in-service, 42 completed all three segments. Among the six not completing all phases, three changed teaching assignments and could not participate in the fall implementation activities, two moved from the area and were unavailable, and one left the teaching profession.”