Reducing Cognitive Load in the Educational Computing Class by Using Scaffolding

Modeling effective teaching strategies is of utmost importance in teacher education courses. One such teaching strategy is reducing cognitive load to produce the greatest amount of learning. Since many skills and activities are required in the educational computing course and many of the students are novices in information technology, this offers a perfect opportunity to utilize and model strategies for reducing cognitive load. Cognitive load theory deals with the way in which cognitive resources are utilized during learning and problem solving. Chandler and Sweller (1991, p. 294) assert, “Many learning and problem-solving procedures encouraged by instructional formats result in students engaging in cognitive activities far removed from the ostensible goals of the task. The cognitive load generated by these irrelevant activities can impede skill acquisition.” Cognitive load theory also deals with acquisition of knowledge by novice learners as compared to expert learners. According to Cooper (1998, p. 10), “The major factor that contributes to cognitive load is the number of elements that need to be attended to.” What constitutes an element is determined by the expertise of the individual who is learning the material (Sweller & Chandler, 1994). Expert learners have an expansive set of schemas on which to draw and are fast and accurate in their performances. Novices, though, have not experienced as much as the experts and so each learning situation must be “solved” instead of calling up past experiences. This problem solving requires concentration and adds to the cognitive load (Cooper, 1998).

The students in the educational computing course (graduate level) were introduced to the concept of cognitive load and several of the instructional techniques that facilitate learning: the goal-free effect, the worked example effect, the split-attention effect, the redundancy effect and the modality effect (Sweller & Chandler, 1991). Intrinsic cognitive load (difficulty of the material) and extraneous cognitive load (how it is presented) were discussed and the students gave examples that had occurred in the course thus far. Students rated the difficulty level of each of the tasks that had been assigned as well as their level of expertise in each of the areas.

After the students were familiarized with the concept of cognitive load, the concept of scaffolding was introduced. Vygotsky referred to the difference between the novice cognitive functioning and the expert cognitive functioning as the zone of proximal development. Good instruction would build on the novice’s knowledge base and provide a structure or a scaffold for the building process. McKenzie (1999) offers eight characteristics of educational scaffolding:

1. Scaffolding provides clear directions.
2. Scaffolding clarifies purposes.
3. Scaffolding keeps students on task.
4. Scaffolding offers assessment to clarify expectations.
5. Scaffolding points students to worthy sources.
7. Scaffolding delivers efficiency.
8. Scaffolding creates momentum.
After a discussion of scaffolding, ideas were solicited from the students about what would have helped them during the first half of the course – How could the cognitive load have been reduced and how could the course, activities and classes have been scaffolded in order to produce the greatest amount of learning with the least perceived difficulty? These ideas were then applied to the second half of the course.

The results of the data collection, discussions and restructuring will be presented, as well as the differences between the novice and the expert learners. Other questions that will be discussed are: How did this experience enhance the course? Will it make a difference in the design of the course for the next semester?


