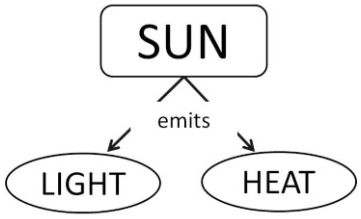
Concept Map is a pictorial representation of the links and the relationship between ideas held by learners regarding particular scientific ideas or phenomenon. These representations may be drawn by students themselves or by teachers while interviewing students (Halford, 1993). Such pictures are useful to learners in expressing what they already know and to teachers in assessment and in developing instruction that builds on knowledge of students' preexisting ideas.

The ability to organize thoughts and illustrate them is a valuable cognitive skill for all learners. Developing this capacity is vital to the students' potential to gain from classroom instruction. For the sciences in particular, a broad range of concepts exist that encompasses a complex web of interrelationships students must comprehend to fully understand the content. Students use concepts to guide the thinking process. When concept mapping, a concept is listed in either a box or a circle. Then each concept is connected to another by a line or arrow. This displays a relationship between concepts and represents a progression in the thought process.

As an example, consider the following concept map developed by young students who were asked to think about what the sun provides to the Earth:



In this very basic concept map, the sun is the main focus with two major effects. The arrows point to light and heat equally showing that the student believes that the sun emits these two types of energy. A concept map can include text written by the student to accompany the arrows and explain the nature of the relationship (Sun *emits* heat). These are known as linking phrases that further develop the visualization of the concept map (Novak & Cañas, 2006).

This simple concept map portrays the foundational understanding that is now illustrated in a clear and concise format both for teachers and students. Of course, many concepts maps are far more complex and have many boxes (concepts) and relationships (linking lines).

Potential applications for concept mapping are endless, but it is best utilized as a complementary strategy for science instruction (Kinchin & Hay, 2000). The broad applicability and visual characteristics make the concept map a vital tool Students who use concept maps for studying have been shown to improve their study skills and in learning science lessons (Kinchin & Hay, 2000). (JK)

Halford, G. S. (1993). *Children's understanding: The development of mental models.* Hillsdale, NJ: Lawrence Erlbaum.

Kinchin, I. M., & Hay, D. B. (2000). How a qualitative approach to concept map analysis can be used to aid learning by illustrating patterns of conceptual development. *Educational Research, 42*(1), 43-57.

Novak, J. D., & Cañas, A. J. (2006). *The theory underlying concept maps and how to use them.* Pensacola, FL: Florida Institute for Human and Machine Cognition.