Teaching Through Technology Concepts

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Abstract
Teaching technology concepts helps students organize their thinking about technology. By understanding these concepts and using them students will learn to see the broad patterns that are across all technology fields.

There is wide consensus about the necessity of teaching technology concepts, Yet, technology concepts are not consistently defined in the literature (Jones, 1997) and There is still much confusion in the technology education community with regard to what are technology concepts and how to teach technology concepts. Although various technology concepts such as design and systems are presented in different curricula and are taught at k-12, often the nature of technology concepts as big ideas are missing or get lost in the teaching of craft skills, knowledge and problem solving (design and make activities).

This paper will offer evidence that the technology concepts are still inconsistent and confusing. It than goes on by suggesting that in spite of the inconsistency, technology concepts as big ideas should play a central roll as part of technology literacy. Such concepts helps understanding broad patterns that cut across all technology fields.

Keywords: Technology concepts, Big ideas, Technology education
1. Introduction
Teaching technology concepts helps students organize their thinking about technology. By understanding these concepts and using them as they design and make, students will learn to see the broad patterns that cut across all technology fields.

The importance of teaching technology concepts was addressed throughout the last 20 years (Householder, 1991; De Vries, 1997; Jones, 1997; Compton, 2004;). However, there are different approaches to the issue of Technology Concepts and Technology Concepts are not consistently defined in the literature.

"Although, there are different approaches to the issue of concepts, there is wide consensus about the necessity of teaching technology concepts, "...not only skill, but also concepts of technology need to be taught" (De Vries, 1997).

The different views to the issue of technology concepts are inconsistent and confusing. Concepts of technology (De Vries, 1997), Concepts in technology (Banks, 1994; De Vries, 1997), universal attributes (Savage & Sterry 1990), principle (Compton, 2004; Engineering by Design™ Program).

Although technology concepts presented in different curricula and are taught at k-12, (In spite of the inconsistency), often the nature of technology concepts as big ideas gets lost in the teaching of skills and design activities.

This paper will offer evidence that the technology concepts are still inconsistent and confusing. It will suggest that in spite of this inconsistency, technology concepts as big ideas should play a central roll in the curriculum as part of technology literacy. Such concepts helps understanding broad patterns that cut across all technology fields.

2. Inconsistency and Confusion about the Term “Technology concepts”
De Vries & Tamir (1997) distinguished between two types of Technology Concepts:
(a) Concepts of technology - The overall concepts of the nature of technology.
   Technology as processes, technology as knowledge, technology as artifacts and technology as volitions (Mitcham, 1994)
(b) Concepts in technology – the theoretical concepts that are used in technological activities, such as system approach and design processes.

Savage & Sterry (1990) identify universal attributes. They are:
   o People create technology
   o Technology responds to human wants and needs
   o People use technology
   o Technology involves action and extend human potential
   o The application of technology involves creating, implementing, assessing and managing
   o Technology is implemented through the interaction of resources and systems
   o Technology exist in a social/cultural setting
   o Technology affects and is affected by the environment
   o Technology affects and is affected by people, society and culture
   o Technology shapes and is shaped by values
The Engineering by Design™ Program (ITEA) is organized around seven principles. These principles are very large concepts that identify major content organizers for the program. In order of importance, the seven organizing principles are:

1. Engineering through design improves life.
2. Technology has and continues to affect everyday life.
3. Technology drives invention and innovation and is a thinking and doing process.
4. Technologies are combined to make technological systems.
5. Technology creates issues that change the way people live and interact.
6. Technology impacts society and must be assessed to determine if it is good or bad.
7. Technology is the basis for improving on the past and creating the future.

Banks (1994, p.114) refers to concepts in design and technology in three dimensions: Design and technology knowledge, Design and technology skills and Values/Attitudes.

Ann Marie Hill (1997) has defined technology concepts as framed by three areas of study: physical products, human processes and environmental systems which include concepts such as: structures, materials, fabrication, mechanisms, power and energy, control, systems, functions, aesthetics and ergonomics.

'Technology for all American – Rational and Structure' (1990) and 'Standards for technology literacy' (ITEA, 2000) describes standard no. 2 as: "Students will develop an understanding of the core concepts of technology" (STL, p. 32), and refers to technology concepts as: trade-offs, resources, systems, processes, optimization, control and requirements.

In New Zealand's curriculum for technology education, the second objective introduces the notion of technological principles, the list of which includes modification, adaptation, user-friendliness, fail-safe features, flexibility of use, reliability, fitness for purpose, efficiency, ergonomics, aesthetics, and optimisation (Compton, 2004).

As we can see, technology concepts are not consistently defined in the literature. The first point is that technology concepts are defined or described in two level: The first level refers to the overall concepts of nature of technology as big ideas: Concepts of technology (De Vries, 1997), universal attributes (Savage & Sterry, 1990), principle (Engineering by Design™ Program, ITEA). The second level refers (mainly) to factors or features that should be considered through design activities in class (ITEA, 2000; Compton, 2004; Hill, 1997; Banks, 1994).

The second point is that there is inconsistency and confusion even within each level. For example, on the level of technology as big ideas the concepts of technology as processes, knowledge, artifacts and volitions (Mitcham, 1994), are more on a philosophical level than the universal attributes (Savage & Sterry, 1990) or the principles that are expressed by The Engineering by Design™ Program (ITEA).

Inconsistency and confusion is also at the second level which refers to theoretical concepts that are used in technological activities. While there are concepts like systems and control that cut across all the different views (ITEA, 2000; Compton, 2004; Hill, 1997; Banks, 1994), there are some concepts which are unique to each view: Values (Banks, 1994), fitness for purpose, efficiency (Compton, 2004), requirements (ITEA, 2000).
3. The importance of teaching concepts
Teaching technology can have several aims. Beyond specific knowledge and skills, people should have a balance perceptions of what technology is (De Vries, 2005). The general findings of PATT questionnaire indicate that student have a limited concept of technology (Jones, 1997).

Core concepts are the ‘big ideas’ of the field. Such 'big ideas' are the universal attributes (Savage & Sterry, 1990) or the principles that are expressed by The Engineering by Design™ Program (ITEA).

Core concepts:
- Help learners understand a variety of ideas about the field.
- Provide insight into the development of the field or have a key influence on explaining the major ideas in the domain.
- Provide models to explain a range of phenomena.
- Allow learners to intellectually make individual, social, and political decisions regarding science and technology.

Although technology concepts such as design and systems are presented in different curricula and are taught at k-12, technology concepts as big ideas are missing or get lost in the teaching of craft skills, knowledge and problem solving (design and make activities).

The power and promise of technology can be further enhanced through Teaching technology concepts.

"Greater emphasis should be placed on the development of the knowledge base for the technology education field of study. The need to further identify the working theories and concepts of technology education must be addressed in order for the field to move forward as a legitimate academic discipline" (Wicklein 1993).

We should redefine those technology core concepts(big ideas) and place a greater emphasize on it by Teaching Through Technology Concepts.

References:


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