

Cross-disciplinarity in Engineering Education

Making Tacit Knowledge Explicit:

How Novices and Experts Assess Creative work and Problem solving skills.

Abstract: By using a not so known method of interview, Repertory Grid, the author shows underlying, often tacit criteria's that professional teachers use when they assess creative work. It seems plausible that these criteria's can be used to enhance the student's development from a novice to an expert. Some of these criteria may have universal value for the development of skill and creativity in school subjects other than Technology, Art and Craft. The results of these studies also indicates a development of teachers assessing skills.

Body:

Most subjects in modern school have an element of creative work, there is a sub goal of many curricula to enhance skill and to foster the ability to design and innovate. In Art and Craft Education this goal plays a major role but it is important in other subjects as well. In Mathematics problem solving is important, in Language class the ability to write papers, in Science the abilities to use the "Scientific Method" to design experiments and solve problem are important. During the last two decades a new comprehensive subject, "Technology" or "Design and Technology", has been introduced in many countries. In these curricula creative design is a core activity. But, what is creativity? Can it be defined in words? Can it be evaluated? Does any development occur? Can creativity really be taught? In the curriculum for the Swedish subject "Teknik" this seems to be taken for granted. The description of the design process is vague:

"A practical and inquiry based work will illustrate the design process—Defining the problem, forming a hypothesis, planning, prototyping, testing and modification . "(Education 2000)

This is a criticized, simplified, prescriptive and linear description of the design process. Studying professional designers in action shows that the processes are not linear, they are reiterative and very individual.(Petroski 1996; Williams 2000)

Traditionally, creative work have been assessed by assessing the product; the painting, the model of a bridge, the answer of a scientific problem or the written paper in a language class. This will grade the students but will not give any useful clues or feedback to the student as it is focusing on the end result and ignores the process of making.

To be able to assess process we need to know more about the strategies, the skills, the abilities, the habits of mind of an expert in the designing task. What behaviour is to be promoted and which signs of progression are to be identified?

At first it seems as every design task is unique but studies of experts in different areas show that there are common properties and behaviour to be seen. When you study novices becoming experts you will recognize a development and even a change in behaviour during problem solving activities.(Dreyfus and Dreyfus 1986) The expert seem to be able to concentrate on the salient features of the task, they act fast and proficient and they share some important habits of mind controlling their design process.(Middleton 2002)

In a large study about assessing creative development in Art education the following four process criteria were found to be important: .(Lindström 2003)

Investigative work

Inventiveness

Ability to use models

Capacity for self-assessment, knowing one's strengths/weaknesses."

Interviews with professional artists and Art teachers were the source of this analysis. A problem was to make these experts talk, a large portions of their knowledge was Tacit (Polanyi 1966) and a

special method, Repertory Grid, (Kelly 1955) was used to elicit their knowledge. The criteria's were made into an instrument for assessment built on rubrics.

The reliability was proven in a large field study where more than 3000 assessments were made.

The presentation will describe some of Lindströms work and argue for the existence of "metacognitive" skills as those just mentioned. Skills or habits of mind that promotes a development of skills in any creative area. It will show more recent examples made by the author of teachers assessing creative work in different subjects; Web design, essay writing, technology design, model building and others. Primary results also show a development of the teachers assessment ability where experts are more able to assess the qualitative values in the process.

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