International Journal of Education & the Arts

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http://ijea.asu.edu **ISBN 1529-8094**

Volume 7 Review 4 **September 2, 2006**

A Nordic Model of Technology Education: An Essay Review

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Lindstrom, Lars. (Ed.). (2005). *Technology education in new perspectives: Research, assessment, and curriculum development.* Stockholm: Stockholm Institute of Education Press.

210 pp.
ISBN 91-7656-429-0

Citation: Stokrocki, Mary. (2006, September 2). A Nordic model of technology education: An essay review. *International Journal of Education & the Arts, 7*(Review 4). Retrieved [date] from http://ijea.asu.edu/v7r4/.

Abstract
This anthology offers multiple perspectives on assessment, curriculum development, and research on technology education, presented in 14 chapters. Each chapter contains a rich array of historical developments, theoretical background or conceptual explanations, methods, new approaches and examples, conclusions and references, as well as various charts, illustrations, and photographs to illuminate the topics. The book has a heavy engineering perspective with some explanation of advancements in computer technology. Future technology education should incorporate multiple tools for learning, interdisciplinary content, real life problem solving skills, and assessment practices.

Technology Education

Based on papers presented at the "Technology and Environment Conference" in Germany 10 years ago, this anthology presents a Nordic interactive educational model that features "a multi-perspective approach of dialogue and reflection" (p. 9). The approach is sound and significant because of its open, ongoing, and all encompassing dialogical approach to learning. The authors conceive of technology as "***techne,"*** tools for learning skills in handling a wide range of problems to be solved.

The papers fall into three major sections, including assessment, curriculum development, and research. The book lacks a good definition and discussion of assessment in general and differences between assessment and evaluation. The assessment section is really about technological education; and, Chapter Two and Three, for example, contain few assessment ideas. However, the first and last chapters offer several clever assessment models or approaches.

The first section of the book covers **new modes of assessment**. In Chapter 1, Kimbell (Goldsmith College, London) responds to criticisms of design programs as formalistic and conventional, stating that a focus on risk-taking rather than hard work in design innovation is equally problematic. His research contains three parts that include preliminary exploration of design innovation qualities, investigation of resulting classroom practices, and development of evidence-based assessment. The assessment he describes is presented in the form of a structured worksheet, which includes a collaborative element and digital photographs, in story format. Such a device encourages stimulating ideas, but does not recognize students as design innovators. The assessment sheet includes holistic impressions as well as details about "having, growing, and proving" ideas. Colloquial judgments are evident in terms such as "wow" and "yawn" and reward the quality and quantity of ideas with the term, "sparkiness" (p. 28), which fittingly is a pun as the model project was to design light bulb packaging. In addition, the assessment focuses on the process of optimizing or complexity control as well as proving ideas with thoughtful criticism and not just generation of novel ideas. The definitions for qualities such as "technical" and "aesthetic" pertaining to users, are too narrow and ill-defined. The author provides examples of the project, its features and structures, students' notes and judgments, and their sketches and photographs of finished light bulb packages, in the Appendix.

In Chapter 2, Graube and Theurerkauf (TU Braunschweig, Germany) maintain that the traditions in technology education include manual skills, polytechnics, work orientation, science, general technology, and systems theory. They believe that design and technology study should be playful at the primary level for life-long learning. In Chapter 3, Graube proposes a competent technological education model consisting of three dimensions of technology action (e.g., developing goals and ideas, prototyping, producing, distributing, and disposing), technological systems (materials, energy, and info), and relationships (among humans, nature and society). Lost in translation, his level of explanation is abstract with few models for actions/activities. For example, he refers to technological action as "step by step acquisition of nature in order to satisfy social and personality needs" (p. 54). Under *Examples*, he stipulates that "Building" and "Dwelling" are the action fields primary school students should develop, as in making ideal rooms. It seems evident that the writer has not taught young children because the language and tasks are too general and vague. For instance, the objectives "to realize and formulate own needs, to analyze the room, develop size notion (from original to the paper), 3D and 2D illustration of simple solids (e.g. furniture) . . . and transfer them in a model like way" seems difficult for children to understand. For assessment, the author uses the term "valuation of the results," which is also quite vague. If this is a competence model, to whom is the language aimed? The model described certainly fails to convey a sense of playfulness at the primary level as promised in Chapter 2.

An explanation of technology by Lindstrom (Stockholm Institute of Education) in Chapter 4 is much more concrete and understandable, as the author concentrates on generating competency criteria in the area of metalwork. He explains the term **competence** by describing the difference between the "in process" problem-solving of experts and the "makeshift" troubleshooting of novices. **Craftsmanship,** which is assessed in terms of competence, involves differences in skills and which abilities are emphasized. Based on teacher and student practice in design and technology, Lindstrom promotes an inductive approach to formulating criteria through the use of a quantitative hierarchical **repertory grid.** This is "a technique for charting individuals' constructs of phenomena in the world around them, based on a set of 'examples or elements' " (p. 62) found in their portfolios that provide a rich picture of products and processes (sketches, notes, drafts of working habits). The grid is constructed with a Macintosh computer program that randomly presents three portfolios [triads] at a time for subject experts [professional artisan or college professor] to indicate how they are both similar and different. The **laddering** grid (ratings from high to low) uses such bipolar constructs as novice/expert, experimental/fixity of purpose, and free/strict task interpretation. The judging process continues until respondents or triads are exhausted. After **cluster analysis,** which is not adequately explained, grids reveal percentages that stipulate how the bipolar qualities agree with the novice/expert. Resulting process criteria include idea and design, **realization** (planning, problem-solving, and executing), and evaluation. The differences are a matter of degree between experts who are absorbed and detailed in their work and novices who are detached and incomplete. In addition, five students and two experts describe their goals and the evolution of their finished product using photographs and notes in their own everyday portfolio language.

Such models are helpful for teachers to develop their own portfolio guidelines. This qualitative evidence also reveals different evaluation approaches between experts and novices. One such example is the extreme focus on process by teachers as opposed to the product orientation of artisans. In conclusion, Lindstrom notes that experts solve problems "in process," while novices may be distracted by external conditions, which may result in less desirable projects. This reveals differences in the **learning cultures** of school and workplace and further indicates a lengthy history of disagreement between the aims of social and personal development in design. In school, the main aim is learning and the object can remain unfinished. The educational purpose is no longer the making of useful things but exploring craft processes. The latter practice increases risk-taking, self expression, and evaluation, but divorces learning from the reality of craft cultures outside of school and the need to develop higher levels of competence. In contrast, too much emphasis on authentic schooling and accountability leaves little room for freedom to experiment and fail.

The next section incorporates the state of **contemporary curriculum development** in Nordic lands. In Chapter 5, Schlagennhauf (Freiburg, Germany) finds that secondary educators regard technological education as applied natural science with disregard for social perspectives. He argues that without a broader notion of technology beyond manual labor, technology education will become extinct. Similarly in the Ukraine, technology education is in dire straits due to workshop and equipment deterioration cause by a lack of funds. In Chapter 6, Sidorenko (Pedagogical University of Kiev, Russia) calls for an innovative techno-cultural discipline that stresses transformation of modern society in daily life, recreation, and business. In Chapter 7, Eva Blomdahl (Institute of Education in Stockholm) regards technology education not as an isolated activity, but as "re-presenting" technology—as in Heidegger's idea of a complex socio-technical system. She also argues against training. She favors gaining understanding, as in Dewey's idea of reflection on the technological consequences on people and environment—the techno-culture.

In Chapter 8, Lindgren (Halmstad University College, Sweden) relates his experiences in teaching technology to college students from various occupations and backgrounds. He emphasizes the fact that we are surrounded by technology in everyday life and the result is some form of human activity. This activity, for instance, includes an artifact (product-hammer), a method (technique-to hammer), and a theory/science (the systemic explanation of its material strength). Technologists organize artifacts to function together, resulting in innovations that include developing and spreading new mechanisms that function for useful purposes (wind, gas, electric propelled vehicles) or irrational intentions and negative effects (guns for killing, pollution, and global warming). As a multidisciplinary example, he shows how religion and technology intertwined in great buildings, namely the medieval cathedral. In addition, he offers such educational techniques as case studies, study trips to industries, and role-playing and storytelling, to name a few of his strategies, which are not well-defined. He also interrelates technological concerns with other disciplines in order to provide relevance to students' lives. Finally, Lindgren points out that the goal of educating citizens is to make good philanthropic choices for sustaining the future.

In Chapter 9, Jan Granath (Chalmers University of Technology in Gothenburg, Sweden) points out the importance of context for structural knowledge (e.g., the construction of a concrete beam) in engineering education. Rather than stressing artistic creativity alone and well-defined problems and facts, Granath presents an architectural case study and problem that is unclear and without optimal conditions. She points out that **problem solving** is using logic intuitively, thereby questioning, bending, breaking, and designing new rules. She thereby underlines the uncertainty principle and the dynamics of reality. I conclude that this approach is quite similar to action research in which teachers document/analyze how they conduct a lesson and its results, concerns, and implications. In research, everything is context, whether historical, geographical, and/or conceptual.

At the end of this section, Bjorklund (Linkoping University, Sweden) stresses the need to study the functions rather than the structures of modern technological artifacts in Chapter 10. He writes that technology has developed beyond the lever, the wedge, pulley, and the winch. Whereas it may be important to explain the inner structure of a microchip, understanding technology in everyday life is more relevant to students. At the high school level, the discipline called *Teknik* "incorporates such functions as transforming, storing, transporting, and controlling" with areas of action: materials, energy, and information" (p. 165). It is unclear as to how these latter subjects qualify as action, which may be the wrong term. Perhaps, his claim that electronics can be the foundation for all modern technology could be explained better if applied to computers. I can see that technological artifacts, such as the simple pencil, are transforming tools. Furthermore, I applaud his remedies for gender issues, such as action research with a female instructor. In addition, a case study about females who were introduced to the functional approach of playing with electricity and appropriate measuring devices, showed that they felt engaged in the activity and were open to making mistakes when males were not allowed to dominate.

A final section called "What Research Adds Up To" summarizes the state of educational affairs, discusses issues, and offers suggestions for the future of technological education. Although Swedish international publications on technology are sparse, in Chapter 11 Hagberg (Linkoping University, Sweden) insists that **research** on learning and teaching in Swedish technology education is "differentiated [at various levels] and dynamic" (p. 198). Some research studies focus on technological programs at the institutional level; other examples delve into such social concerns as gender studies; and, still others explore children's technological interests and learning abilities (pp. 13-14). Technology education research has no home of its own and evolves from many disciplines. He hints at the political problems in determining educational content in textbooks at the compulsory school level, using social studies as an example. Hagberg further suggests the need for "more solid grounds for the choice of content and methods and better understanding of how general knowledge in technology can be acquired, as well as to clarify values-based attitudes" (p. 204). His clever metaphor from Heidegger suggests that the essence of technology is similar to the carpenter's hammer, which may reinforce highly valued abilities.

The book has a heavy engineering perspective with some explanation of computer technology advancements. The Greeks referred to ***"techne"*** as a rational ability or form of human condition that makes a product. Hannah Arendt (1998/1958), a student of Heidegger, warns that technology also needs ethical and aesthetic dimensions, so that when makers adhere to the guidelines of their art, the products will be good and useful. Finally, I will add that good making requires "good reflecting and care" as well.

Reference

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About the Reviewer

Mary Stokrocki is Professor of Art, Arizona State University. She is the World Counselor and former Vice-President of The International Society for Education Through Art (InSEA). She has won the National Art Education Association (NAEA) 2005 Lowenfeld Award for significant contributions; the 2002 USSEA Ziegfeld Award; the 2002 NAEA Distinguished Fellow; the 2000 NAEA Pacific Region Higher Education Award; the 1995 NAEA Manual Barkan Award for Outstanding Research Article; and, the 1992 NAEA Women's Caucus Mary Rouse Award. She recently edited *Interdisciplinary Art Education: Building Bridges to Connect Disciplines and Cultures* (2005), published by NAEA. She has taught and conducted research in inner-city Cleveland; Rotterdam, Holland; Ankara, Turkey; Sao Paulo, Brazil; Warsaw, Poland; Barcelona, Spain; Evora, Portugal; and the Yaqui, Pima/Maricopa, Ak-Chin, Apache, and Navajo Reservations in Arizona. Email: Mary.Stokrocki@asu.edu.

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