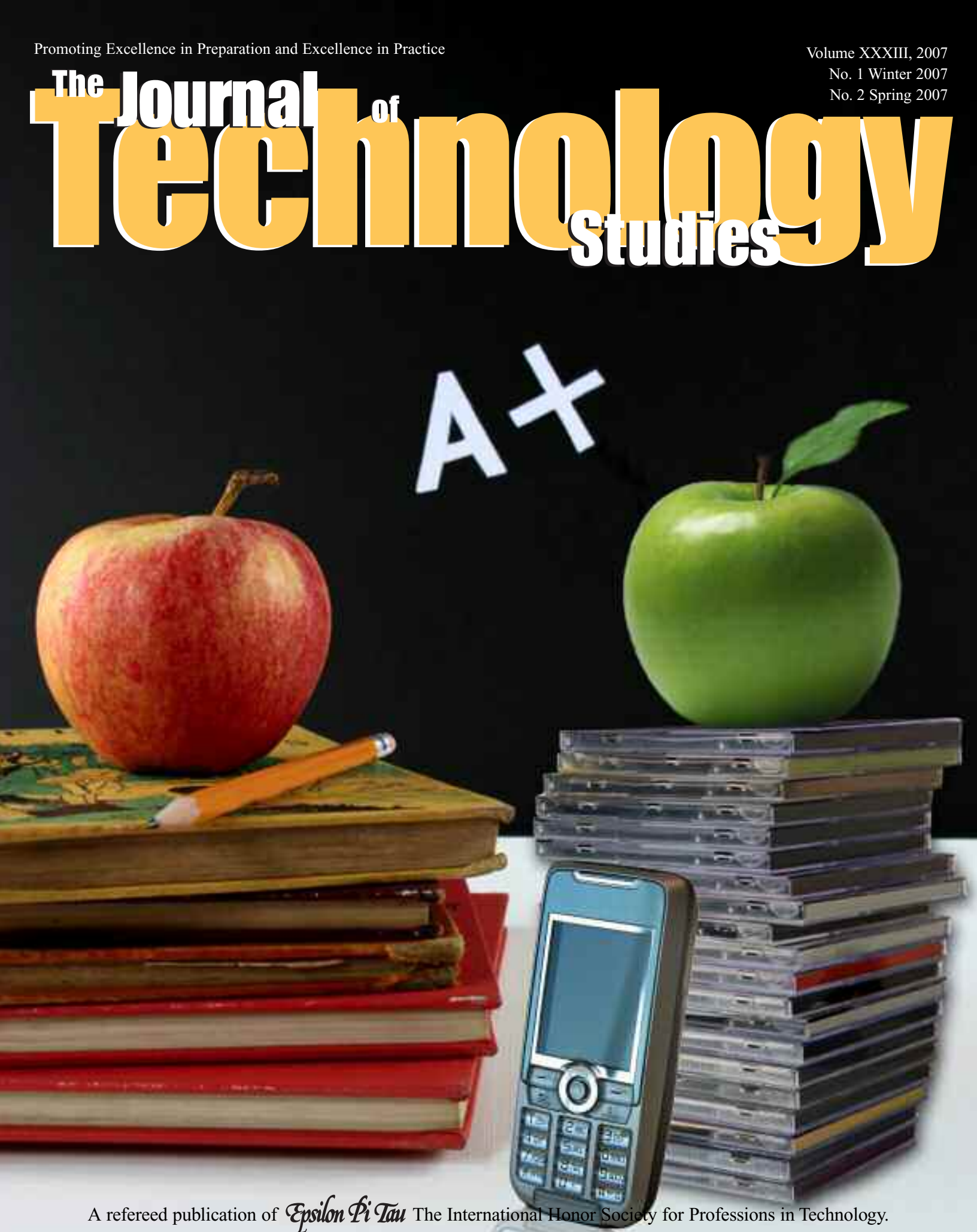
Promoting Excellence in Preparation and Excellence in Practice

The Journal of Technology Studies

Volume XXXIII, 2007
No. 1 Winter 2007
No. 2 Spring 2007



A refereed publication of Epsilon Pi Tau The International Honor Society for Professions in Technology.

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Two print issues per year are mailed to all members of the society upon request and to academic and general libraries around the globe. Issues that are published online only, the aforementioned printed issues, and past issues are available online at scholar.lib.vt.edu/ejournals/JTS.

The journal is currently indexed in Current Index to Journals of Education (USA), International Bibliography of the Social Sciences (IBSS) (UK) and the International Vocational Education and Training and Research Database at http://www.ncver.edu.au (Australia).

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Printed in the United States of America by Kennedy Printing Company, Findlay, Ohio.

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Volume XXXIII, Number 1, Winter 2007

Who are the stakeholders?

Kerry Lee

The New Zealand technology curriculum requires children to solve problems to meet people's needs. So who are these people? Are they the users of the product, people who are affected by the product or someone else? This article investigates the confusion that exists in the New Zealand curriculum about the terms society, community, consumer, user, and people and justifies the replacement of some of these designations with the term stakeholder.

Introduction

Terms such as "society" and "community" are all encompassing. As these terms are used in the New Zealand curriculum this creates problems for teachers and students. It would be difficult if not impossible to consider or consult with every member of a community or society. Using the term stakeholder narrows the focus from the whole community to those people in the community who have an interest in what is occurring. This allows students to consider the appropriate groups and individuals that should become involved in the process. This ensures students question those affected rather than a few people they know will answer a survey.

In the current technology curriculum (Ministry of Education, 1995) the term stakeholder is never used but rather numerous alternatives are used interchangeably. In 2006 the Ministry of Education published a new national curriculum statement as a draft for trial and consultation (Ministry of Education, 2006b). This is a draft document, which asks for and expects feedback from practitioners and those involved in education in order to develop the final curriculum document. In this document the term stakeholder is used to replace the multitude of terms previously used. This will be the first time many teachers will have seen the term stakeholder used in education and yet at no time does this new curriculum define or explain the term.

This paper will outline the importance of considering others in all technological activities. It will highlight the confusion and limitations of current terms such as community, society, people, consumer, client and end-user. It will present a strong argument to ensure the multiple terms used in the earlier curriculum are now replaced with the word 'stakeholders' and a justification given as to why a clear explanation needs to be included within or alongside this new curriculum.

The New Zealand Curriculum (1995 version)

Technology involves people. It operates within, and has an effect on, society. "The technology curriculum aims to develop technological literacy… to enable students to participate fully in the technological society and economy in which they will live and work" (Ministry of Education, 1995 p.5). The curriculum leaves no doubt that technology should operate within the context of society as a whole "understanding the nature of the relationship between technology and society is vital to technological practice" (Ministry of Education, 1995 p.41).

While teachers are aware of this requirement of the curriculum it appears to be common practice to attempt to satisfy this by superficial attempts to use a survey, to be seen to be involving the community. Often children survey 'someone at home', possibly because this is easy but also perhaps because students and teachers are unaware of who the stakeholders actually are. Rarely does this consultation actually consider all the groups that may have an interest in the exercise. The curriculum document recognizes that a wide range of groups are affected by technological processes. Each of these groups has its own views about an issue or design. "Decisions about technological innovation are governed by this complex balance of factors, and groups or individuals may have markedly different attitudes towards technological practice" (Ministry of Education, 1995 p.41).

The curriculum also acknowledges that there needs to be a strong focus on understanding people and their needs. The importance of people is easy to ignore as "the characteristics of the people and the social and physical environment that gave rise to the developments are sometimes overlooked" (Ministry of Education, 1995 p.41).

Values

The curriculum also highlights the importance for students to "become aware of the diversity of valid ways in which different groups of people respond to technology and to innovation, and appreciate the impacts that technological changes have on different peoples" (Ministry of Education, 1995 p.7). Students need to be encouraged to identify the groups who will be affected and to find out how, and to what degree, this will occur. Students need to take this information into consideration when designing an appropriate solution. Students need to evaluate their product by considering its impact on society, both positive and negative from the perspectives of everyone involved (Burns, 1991). "Technological outcomes are judged in terms of their effectiveness, from different points of view" (Burns, 1991, p.23). It is important that students gain an understanding of the differing needs and values in humans (Mulberg, 1992). Technology is driven by values because of human needs and wants. People are different and therefore have diverse needs, causing cases where some groups may see a technological solution as good, and others may see it as an environmental or societal catastrophe (Stables, 1997). Students need to be aware that not every group will feel positive about the solution. Prime (1997), believes that it is critical for students to be equipped with the ability to recognize and handle these underlying values.

Confusion and subsequent questions

The curriculum often uses the words community, society and people interchangeably. Yet at no point are the terms explained. Did the writers wish to differentiate among these terms and if so do teachers possess the same understanding? Throughout the curriculum reference is also made to the needs of the consumers, markets, groups, individuals and users (Ministry of Education, 1995 p.9, 16, 36). Again these terms are not defined. The achievement objectives refer to the 'local community', 'wider community,' and singularly the term 'community', the distinction among these are also never given (Ministry of Education, 1995 p.88-90). Who are these communities and how do they differ from each other? When does a local community convert into a wider community?

An example of this ambiguity is when the curriculum states students "should recognize the importance of meeting consumer needs and being responsive to the community" (Ministry of Education, 1995 p.36). At no point is the reader able to determine to whom the student needs to be responsive. Is it acceptable for a child who is making a personal alarm to consider himself or herself the consumer and therefore only meet their needs as long as they are responsive to the community? In this case could the community be the babysitter? What about others who have to see and hear the product? What about the parent/s who probably helped fund the product? Are the public who are slowly becoming de-sensitized to alarms seen in the guise of consumer or community?

Numerous people will be affected by the design, placement and use of the product but will they be considered? It must therefore be necessary to consider a wide range of views, rather than just consumers (Burns, 1997). The question of what and whose interests and purposes technology is intended to serve is a vital question at the heart of technological literacy (Jenkins, 1998). Students and teachers need to be encouraged to look broader than personal or family needs when devising solutions.

Strand C focuses on the inter-relationship between technology and society. Students focus on views, values, ethics, feelings, beliefs and factors which promote or constrain technological developments and which influence attitudes towards these technological developments. The achievement objectives are worded in such a way that any development can be investigated, not necessarily their own. For example, level 3 requires students to " identify and consider different views and feelings of people in relation to some specific technological developments or effects, such as fitness equipment, noise pollution" (Ministry of Education, 1995 p.88). It is only at level 5 that students are asked to concentrate on the implications of "their own technological activities" (Ministry of Education, 1995 p.43).

Children at present are therefore able to design and make a product with minimal consultation. If the term 'stakeholder' was used when referring to those involved with the product, the teacher and student would be encouraged to consider multiple views and perspectives.

The term stakeholder was not used in the 1995 New Zealand curriculum document (Ministry of Education, 1995). It is however a requirement of New Zealand's tertiary

standardized qualification, National Certificate of Educational Achievement (NCEA), that a year 11 student's design brief should include acknowledgment of all stakeholders, with the use of stakeholder statements, expressing beliefs, ethics, social position, concerns and needs. It is expected that students identify and consult with stakeholders who are directly or indirectly affected by their product. Students need to identify all legal and regulatory aspects of their design, such as, legislation, standards, codes of practice, codes of ethics and global and future technological trends. Students need to develop knowledge bases associated with their products or solutions (Douglas & McGregor, 2001). If the term is accepted as suitable and appropriate for senior students surely it is also appropriate for younger students. If teachers encouraged children to think more specifically of those who are affected rather than those who they can easily survey, students would achieve a product which clearly demonstrates fitness for purpose.

The New Zealand Curriculum (Draft for consultation 2006)

The "revision of the New Zealand Curriculum, currently in its draft form, had its beginnings with the Curriculum Stocktake, a comprehensive review of the current curriculum that was completed in 2002" (Fancy, 2006 p.1). The new curriculum is intended to emphasize "the importance of making stronger connections between what goes on in schools and the wider communities, society, and employers" (Fancy, 2006 p.1). The aim of technology in the new curriculum document is the same as the original document, that being for the "students to develop a broad technological literacy" (Ministry of Education, 2006b p.23). As stated previously the earlier document expected students to identify and consider the needs and views of the community, society, groups, individuals and an assortment of other terms. These generic terms have been eliminated in the new curriculum document, which refers to these people as 'stakeholders'. In the strand of Technological Practice students are required to identify, access and take into account stakeholder feedback. As this is now a critical part of the new technology curriculum it is vital that teachers and their students understand who this group includes.

Stakeholder

One could think the reason for the term stakeholder not being used in the 1995 curriculum, may have been because it is a modern term. The term stakeholder however, has been used widely in business journals since the 1960's. At least seven articles which mention stakeholders in technology education are used in discussions prior to the publication of the New Zealand curriculum (1995). All of these articles however refer to the people who must be consulted when developing the technology curriculum rather than those people the children should consult when developing their solutions. If the term was being used at the curriculum development stage to identify those who should be consulted why was the term not used in the curriculum document?

The reason for this oversight may be due to the fact there currently is no single clear definition of who a stakeholder is, in fact 'there is a deep divide in definitions of what it is to be a stakeholder' (Kaler, 2002 p.92). Many people confuse the term stakeholder and shareholder. Although there may be only a difference of two letters between the terms, there is a considerable difference in who is being consulted and considered. In a survey of 28 definitions over a period of 1963 to 1995, it was found that there was more or less an even split between definitions which see stakeholders as people for whom businesses have to take responsibility and definitions which see them as people who have to be taken account of but not necessarily because of any responsibility for them (Mitchell, Agle, & Wood, 1997).

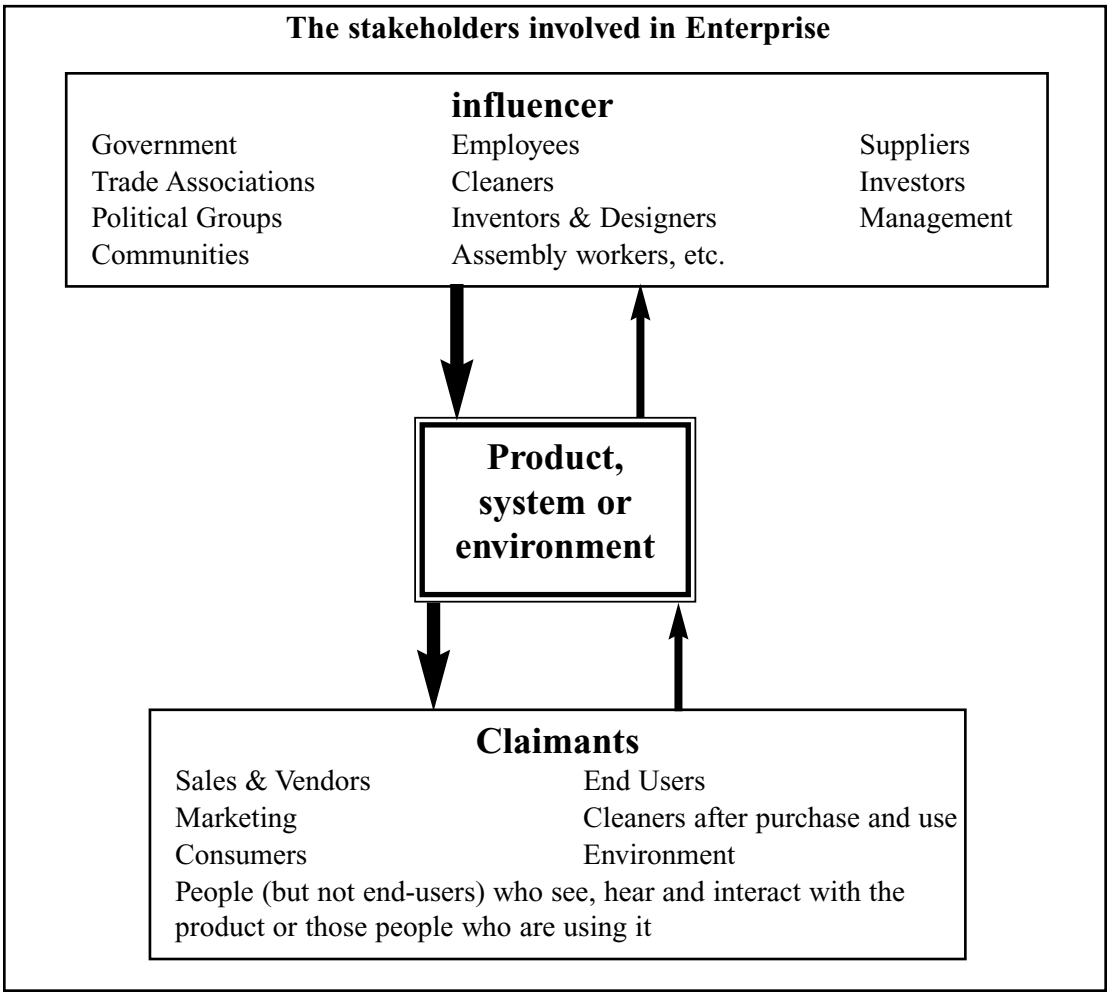
Volumes have been written about the definition and the importance of stakeholders (Henry, 2001, 2002; Kaler, 2003; Mongoven, 2003). Kaler states a starting point would be to assume that all stakeholders have something at stake in relation to the activities of the business (Kaler, 2002 p.93). If the reason for not continuing with the term was because of this plethora of terms maybe the student could identify which definition was appropriate for their project.

The articles and quotes citing stakeholder usually refer to businesses, firms and entrepreneurs. If it is important for businesses and entrepreneurs to consider others and the possible impact of these decisions (stakeholders and stakeholder theory), it could be argued that it is equally important to develop these skills in our current innovators and future entrepreneurs, thus preparing the students to be "the technological innovators of the future" (Ministry of Education, 1995 p.5).

Stakeholders include those who have some kind of claim on the services of the organization ("claimants") or those who can influence the workings of the business in some way, i.e., "influencer" (Mitchell, Agle, & Wood, 1997 p.859). Some stakeholders can be "affected by" as well as "affect" organizations (Kaler, 2002 p.93). The new curriculum expects children to "understand how society impacts on and is influenced by technology" (Ministry of Education, 2006a p.3).

Figure 1 demonstrates the numerous stakeholders, which may be involved in a classroom or school technological enterprise. Some of these stakeholders may be influencer who affect the development of the enterprise. Governments, trade associations and political groups all restrict worker practices and product designs. This is usually to ensure safety for the user or producer of the product, system or environment. These can form limitations or specifications for designs or the production process. The new technology curriculum acknowledges the importance of "understanding and taking into account ethical considerations, legal requirements, protocols, the needs of and potential impacts on stakeholders, the development site, and where the outcome will be used" (Ministry of Education, 2006b p.23). If the students work as a company they may have designated roles or 'jobs' similar to an actual enterprise. People in these roles will influence the design of the process of manufacturing or the design of the product itself. The people making and assembling the product will have a large influence on the quality and hence success of the product. Pacey (1983) identifies many of these roles as part of the organizational and cultural aspects of technological practice. Communities' values and needs will influence the design of the product. The new curriculum requires children to develop an understanding of the "ways which individual and group beliefs, values and ethics can constrain or encourage technological development" (Ministry of

Figure 1. Stakeholders which may be involved in a school technological enterprise.



Education, 2006b, p.23). The inventors and designers have invested a great deal of time and energy into the conceptual stage of the product. They often have an idea of how the finished product is to look and function. This at times can be at odds with those producing and selling the product. Suppliers of materials, tools, equipment and services can affect the product. In a classroom, the manufacturing process may need to be altered to take account of cleaners' and school timetabling requirements. The management (principal and governing body) of a school will have set ideas about how a product, system or environment, which represents their school, should look and behave. Lastly parents or those paying for the product to be developed will often have expectations of and for the product. If these people do not understand that the philosophy of the curriculum is no longer based on creating identical technically correct products, in order to gain set skills, but rather to learn through a process which encourages diversity and risk taking, then conflict can arise. These influencer have a large impact on the design and manufacture of the product, system or environment but may also be influenced themselves (usually to a lesser extent) by its success or failure.

Other stakeholders involved in a school enterprise may be claimants who are affected by the product or its use. The design of the product will affect those who sell and buy the product but also those who have to promote it. Those people who have to see, hear or interact with the product will also be affected. For example a child who designs an alarm for their bedroom will affect the whole household even though they are not the persons directly using the alarm, or the child who designs a T-shirt is not the person who has to read or look at it. These people are affected by the product, even though they have not purchased it nor are they the direct users of it. The environment may be affected by the packaging and use of the product. Designs where packaging or part of the product is discarded after use, e.g., ice-block sticks can greatly alter the environment and may add considerably to a cleaner's job. These claimant stakeholders are affected by the product or its use and they in turn may affect the product or its manufacturing process in some way but this is usually to a lesser extent.

Students need to critically reflect on their own practice. In order to develop 'technological integrity' (Pretzer, 1997), students must gain a deeper understanding of the nature of technology when they consider beliefs, ethics and values of all stakeholders as well as social, cultural and environmental implications (Compton & Harwood, 2003).

The Stakeholder Theory

Most articles using the term 'stakeholder' appear in business or ethics journals. So who are these stakeholders and "what is the appropriate balance between shareholders and other stakeholders?" (Elkington, 2004 p. 6). Unfortunately the stakeholder theory has had its greatest influence on theorists and academics rather than practitioners, yet the challenges of the current environment are making the stakeholder perspective more relevant than ever for the practicing entrepreneur (McVea & Freeman, 2005, p.59). Stakeholder theory offers a "unique and neglected contribution to decision-making processes, particularly in innovative and entrepreneurial fields" (McVea & Freeman, 2005, p.59).

Mitchell, et al. (1997) believe it is important to identify issues of "legitimacy" and "power" of the stakeholders (claimants and or influencer) but also the urgency of their claim and/or influence (p. 865-868). If claimants who are recognized stakeholders influence those affected by and those who affect the organization, then there will be times when their views are conflicting. "We should make students aware that conflicts of interests exist" (Hodson & Farmer, 1992) and that conflict in what is considered the best solution will most likely occur in every technological context (Mulberg, 1992). It is important that stakeholders are consulted throughout the whole of the technological process.

The managerial stakeholder theory, ethical managerial stakeholder theory and stakeholder-agency theory are just a few versions of the debate over who has the right to have a say in the decision making and whose rights take precedence (Freeman, 1984). This is a debate that could and should be taken up by children. Who do they have to consider when they design a new product? Do they have to consider the people influenced during the manufacturing process (cleaners, classmates, teachers, etc.), those who pay for the product (investors/parents), those who use the product (end-users), those who have to see, hear and deal with the consequences of the product although they may not directly use it themselves, to name a few examples. We need to consider who is

benefiting and at whose expense (Prime, 1997). If we do not consider negative consequences "we make the value statement that progress must be made at any cost and that financial gain is the major factor to be considered in technological advancement" (Prime, 1997, p.31).

Part of a technological activity should be to determine who is going to be affected and how the views of these people are going to be obtained. It may not always be possible to obtain these views, but being aware that all actions affect others is an important part of being a valued member of society.

Conclusion

The term stakeholder should be used in the new New Zealand technology curriculum. Teachers and/or students will need to determine who the stakeholders are and whether it is feasible or appropriate to canvas their views. In effect they would need to develop their own stakeholder theory. This process could be as simple or as complex as the teacher feels appropriate. It should be seen as a vital part of the technological process. The term 'stakeholder' eliminates confusion over the multitude of terms currently in use such as consumer, community, society, user, client, and people and helps to ensure consultation isn't trivialized but rather is a key part of the process. There appears to be a lot at stake if this term isn't understood or included in classroom practice.

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A Discussion of Past, Present, and Future Articulation Models at Postsecondary Institutions

Ron O'Meara, Teresa Hall, and Mindy Carmichael

Abstract

This article provides a synopsis of how articulation agreements serve postsecondary education institutions and their constituents, provides an overview on the types of agreements, and discusses some of the issues associated with development of these agreements. The following questions frame the narrative: As community colleges grew in number and format, what prompted the development of articulation agreements? What types of articulation agreements have been and are currently being developed? What are the incentives for either administrators or faculty to pursue development of articulation agreements?

Introduction

The growth in the number and type of articulation agreements and transfer arrangements between two- and four-year institutions during the past 100 years could be described as a work in progress. Procedures to move students progressively along the education continuum have become increasingly formal, yet the overriding objective has been to give students expanded access to learning opportunities at a reasonable cost. As a result, students, faculty, and administrators at community colleges and four-year institutions have usually experienced positive outcomes. Students, the key benefactor of these agreements, are offered new avenues of academic opportunity to pursue upon completion of their studies at the community college. Administrators at four-year institutions have access to a broader student population, thus experiencing growth in enrolled student numbers. Administrators at community colleges gain the opportunity to promote the articulated programs as pathways to bachelor degrees for students with the desire to transfer after graduation. Faculty are afforded insight into curricular content and trends at partnering institutions, giving impetus to integration of emerging issues or affirming the relevance of existing curricula.

The Need for Establishing Formal Articulation Agreements

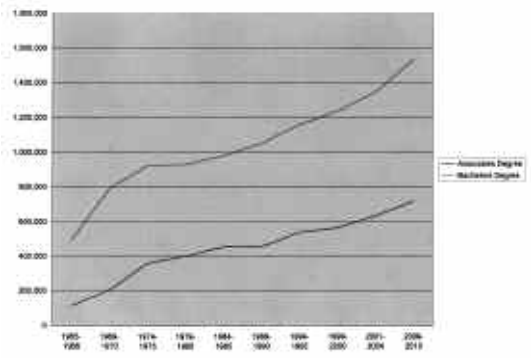
Transfer programs have been part of the academic landscape at the postsecondary level since the inception of the junior college in the 1900s. These early institutions were usually an extension of the local high school curriculum offering freshman- and sophomore-level college courses as well as advanced instruction in occupational and life skills, such as industrial arts or family and consumer sciences (Wattenbarger & Witt, 1995). In 1947, President Harry Truman's Commission report "Higher Education for American Democracy" concluded that community colleges could offer cost-effective alternatives for lower and middle class populations enabling completion of the first two years of college or university education and, additionally, providing occupational training for American workforce needs of the post - World War II economy (Young, 1996). The number of community colleges rapidly expanded as a result of state or local funding rather than federal initiatives and as a result, the number of associate's degrees conferred from community colleges grew rapidly, surpassing 100,000 per year in the mid - 1960s, and the trend is expected to continue as noted in Figure 1 (U.S. Department of Education, 2005).

Most community college students during the 1950s and 1960s sought lower-level college arts and science general education courses with the intent to transfer to a senior institution (Bryant, 2001; Cohen, 2001; Young, 1996). Student transfers to four-year institutions peaked in the 1960s, accounting for nearly two-thirds of community college students enrolled at that time (Kintzer & Wattenbarger, 1985). After this period of growth, transfer rates of students to four-year institutions steadily declined and bottomed out at 22 percent in 1984 and remain at this level today (Bryant, 2001).

Much of the reason for the decline in transfer rates was that the constitution of the student population at two-year degree granting institutions had evolved to follow the non-academic occupational training track rather than being the more traditional student seeking the bachelor's degree at another higher education institution after two years at the community college. Thus, while the number of associate degrees awarded in the United States consistently increased, within this data the percentage of

occupational/technical program enrollees surpassed academic program enrollees in the mid 1970s.

Figure 1. Earned Associate and Bachelor's degrees, 1965–2004 with projections for 2010. Source: U.S. Dept. of Education, National Center for Education Statistics, Table 286 (2005).



An additional problem was that transfer arrangements were usually informal, often developed as a courtesy between regional institutions or as a cooperative endeavor between administrators. This exacerbated the transfer rate decline because students often lacked guidance on how to transfer courses, appropriate senior institutions for their skills/academic preparation, or career path selection (Menacker, 1975). The need for more formal arrangements, articulation agreements, was evident.

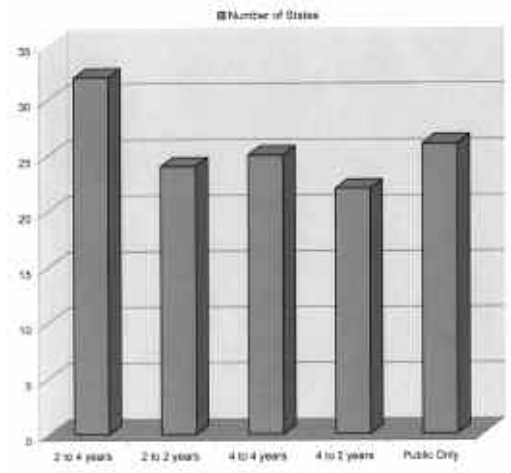
Articulation agreements have had a rather short history within the context of the two-year college movement. In 1971, four states simultaneously developed similar approaches to articulation; Florida launched the Florida Formal Agreement Plan, the Illinois Board of Higher Education approved an articulation/transfer plan, and Texas and Georgia adopted core curricula for their respective state colleges (Kintzer & Wattenbarger, 1985). By the end of the decade, a large number of states had endorsed some form of articulation or transfer agreement for students in two-year programs.

Current Articulation Models

Today, every state has some form of articulation or transfer program in place and, likewise, there are many ways to characterize these mechanisms for movement of students between academic programs (Ignash & Townsend, 2000, 2001; Kintzer & Wattenbarger, 1985). To distinguish between articulation and transfer programs, *articulation* is described as a formal collaborative agreement between education institutions that enables a student to complete a program of study at one institution and, using accumulated credits, attain a degree at another institution in a shorter period of time. There are those who further differentiate articulation as being vertical (progress to higher levels of academic achievement) or horizontal (internal transfer of credits within a system or at the same level at another institution), each having its place under the articulation heading (DeMott, 1999; Menacker, 1975). Transfer programs, which are more informal, acknowledge credits taken at one institution, not necessarily as part of a completed program or degree, that are subsequently accepted by another institution.

In a study evaluating the extent and strength of state-level articulation agreements, Ignash and Townsend (2001) found that 97 percent of the states responding to the survey had policies in place that supported the traditional two- to four-year transfer arrangement. Articulation between two-year colleges, between four-year colleges or universities, reverse transfers (four to two year programs), and agreements between public institutions were variations on this theme (see Figure 2). The researchers also found that 67 percent of responding states accepted associate degrees in the articulation agreements and 70 percent had distribution requirements for general education core courses within the state (p. 184).

Figure 2. Numbers of statewide articulation agreements. Adapted from Ignash & Townsend (2001).



Emerging trends in articulation indicate that the Tech Prep movement is having an impact in reshaping traditional agreement structures due,

in part, to the requirements put forth by the Perkins Act of 1991 (Reese, 2002). The Act served to push states without firm articulation plans to develop plans to serve Tech Prep programs or risk losing federal funding. As an example of articulation across secondary and postsecondary systems, the 2 + 2 + 2 Tech Prep option's goal is to provide a seamless transition from high school to the community college technical degree, adding a twist with the last +2 component, which culminates in the conferral of a bachelor's degree from a college or university (Suba, 1997).

Bringing these diverse interests together to make the 2 + 2 + 2 alternative or any career-to-work program succeed is a challenge. In order to successfully develop agreements between secondary and postsecondary programs, a champion at one or more institutions involved in the process may be required. DeMott (1999) suggested that an individual coordinator serve as go-between or primary contact for the articulation process bringing administrative leaders, faculty, and curriculum planners together.

A typical 2 + 2 program consists of a student taking two years of courses at a community college and transferring them to a 4-year institution into a specific degree program. In theory, after transferring the student would have 2 years of coursework to complete to earn a bachelor's degree; however, in reality the length of time at the 4-year institution is closer to 2 + years. In comparison, a 2 + 2 + 2 program consists of approving specific courses taken in high school for coursework at the community college, reducing the time and courses needed to complete. The courses would then be articulated into a 4-year program for the completion of the final two years of study.

Other ways that articulation agreements have been constructed include block transfer of courses, experiential learning credits, dual credit programs and prorated audit systems. Instead of the traditional progression of students from two- to four-year institutions, reverse articulation (four-year to two-year), swirling (dual enrollment or taking courses at a community college and at a university concurrently or in an alternating fashion), public to private institutional articulation, and between four-year institutions are some examples. These are innovative ways to move students within the domain of postsecondary learning experiences.

At present, there appears to be a paradigm shift in the method and philosophy for student learning in the postsecondary education environment. This paradigm shift in higher education is occurring from an instructional paradigm to a learning paradigm (Barr & Tagg, 1995). The instructional paradigm can be described as the "sage on stage," and learning is dispensed or delivered solely by an instructor. The learning paradigm, on the other hand, is characterized by the "guide on the side." Learning is holistic and is focused on learning environments, experiences, and is student centered. To truly provide a broad array of formal education opportunities for students, education is being restructured with innovation, flexibility, and cooperative learning environments. Redefining what constitutes an articulation agreement is essential for change and progress to occur. In the end, the need for more effective use of increasingly limited resources such as faculty, classroom space, and laboratory equipment will drive the change process. Faculty and administrators with the foresight to take advantage of this dynamic situation in postsecondary education will reap the benefits early and have a voice in the shape of future agreements.

At the University of Northern Iowa (UNI), there have been over 330 articulation agreements written with all 15 community colleges within the state of Iowa. The two types of articulation agreements used at UNI are block transfer of courses from the community college to the university, or a program that is assessed on a course-by-course basis. The total combined transfer credit in college parallel education and equivalent UNI credit for technical-level work may not exceed 65 semester hours. All of the articulation agreements written at UNI are four pages in length. The first page of the agreement includes general information stipulating that the agreements are based on an analysis of program requirements as stated in the community college and university catalogs. In addition, the first page of the agreement states the names of the representatives that developed the articulation agreement and has signatures of approval for both cooperating institutions. Page two of the agreement contains the specific course-by-course outline of the agreement for the remaining requirements to complete a bachelor's of science degree as outlined in Figure 3.

Articulation Agreement
XYZ Community College: A.A.S. Program – Manufacturing Technology
UNI: B.S. Manufacturing Technology - Automation and Production, Design, or Metal Casting

The remaining requirements for students completing the A.A.S. Program in Manufacturing Technology seeking to complete a B.S. in Manufacturing Technology are stated below. All courses in the Manufacturing Technology major are listed except for the Liberal Arts Core and University Elective requirements. Transferring students must select one or more emphasis areas in the Manufacturing Technology program. Courses marked with an "X" are remaining requirements in the major.

Math/ Science.....15 hours Block Transfer _____ Course by Course __X__

__X__ (4 SH) 800:046 Elementary Analysis or 800:048 Condensed Calculus or 800:060 Calculus I

__X__ (3 SH) 800:072 Intro. to Statistical Methods

__X__ (4 SH) 860:044 General Chemistry I

__X__ (4 SH) 880:054 Physics I or 880:130 Physics I for Science and Engineering

See Recommendations (4th page) for Math/Science courses that could be taken at XYZ Community College to count towards the program.

Technical Core.....38 hours Block Transfer _____ Course by Course __X__

__X__ (2 SH) 330:008 Manufacturing Materials & Processes – Metals

__X__ (2 SH) 330:009 Manufacturing Materials & Processes – Non-metals

_____ (3 SH) 330:017 Computer Aided Design & Drafting

_____ (4 SH) 330:024 Technical Drawing & Design I

_____ (3 SH) 330:060 Fundamentals of Automated Mfg.

__X__ (1 SH) 330:112 Industrial Projects I

__X__ (3 SH) 330:132 Applied Metallurgy

__X__ (3 SH) 330:142 Statistical Quality Control

__X__ (3 SH) 330:143 Managing Manufacturing Systems

__X__ (3 SH) 330:170 Statics and Strengths of Materials

__X__ (3 SH) 330:172 Industrial Materials

__X__ (1 SH) 330:179 Cooperative Education

__X__ (3 SH) 330:187 Applied Industrial Supervision & Management

__X__ (3 SH) 330:196 Industrial Safety

__X__ (2 SH) 330:197 Industrial Projects II

Emphasis Areas.....22 hours Block Transfer _____ Course by Course __X__

Automation & Production

_____ (3 SH) 330:014 Machining Principles

_____ (3 SH) 330:113 Manufacturing Tooling

__X__ (3 SH) 330:145 Work Measurement & Improvement

_____ (3 SH) 330:146 Advanced Numerical Control Systems

_____ (3 SH) 330:147 Computer-Aided Manufacturing

_____ (3 SH) 330:177 Advanced Manufacturing Processes

_____ (4 SH) 100 - level electives **(see next page)**

Design

_____ (2 SH) 330:106 Geometric Dimensioning & Tolerancing
_____ (3 SH) 330:113 Manufacturing Tooling
__X__ (3 SH) 330:122 Advanced Modeling & CAD
__X__ (3 SH) 330 :135g Design for Manufacturing
__X__ (3 SH) 330:148 Machine Design
__X__ (3 SH) 330:155g Finite Element Analysis
_____ (5 SH) 100 - level electives **(see below)**

Metal Casting

__X__ (2 SH) 330:040 Fundamentals of Metal Casting Engineering Technology
__X__ (3 SH) 330:134 Molding Practices in Metal Casting
__X__ (3 SH) 330:136 Melting Practices in Metal Casting
__X__ (3 SH) 330:137 Tooling Practices in Metal Casting
__X__ (3 SH) 330:141 Foundry Research Practicum
__X__ (3 SH) 330:192 Non-Destructive Evaluation of Materials/Scanning Electron Microscopy
_____ (5 SH) 100 - level electives **(see below)**

Choose electives from any 100-level course in the Industrial Technology Department or 150:113; 150:119; 48C:141; 48C:173; 620:105; 650:142; 800:043; 980:102

Figure 3. Sample block transfer agreement.

Page three of three of the articulation agreement shows the breakdown of hours required for the major at the university, explains the hours accepted from the community college, and outlines the remaining hours for the degree program for the different emphases. It also includes some general recommendations for specific courses students could take at the community college to further reduce the remaining hours at the university as outlined in Figure 4:

Articulation Agreement
XYZ Community College: A.A.S. Program – Manufacturing Technology
UNI: B.S. Manufacturing Technology - Automation and Production, Design, or Metal Casting

Total Semester Hours (SH) for a B.S. in Manufacturing Technology

Total for Major	75 SH
Liberal Arts Core	38 SH
Total University Electives	13 SH
Total Hours, Bachelor of Science	126 SH

Semester Hours Accepted from ICCC

Math / Science	0 SH
Technical Core	11 SH
Liberal Arts Core	0 SH
Emphasis Area:	
Automation & Production	19 SH
Design	10 SH
Metal Casting	5 SH
University Electives	13 SH
Total	43 (AP), 34 (D), 29 (MC) SH *depending on selected emphasis area*

Remaining Hours at UNI – select one of the following emphasis areas:

Automation & Production (AP)	45 SH
Liberal Arts Core	38 SH
University Electives	0 SH
	83 SH
Design (D)	54 SH
Liberal Arts Core	38 SH
University Electives	0 SH
	92 SH
Metal Casting (MC)	59 SH
Liberal Arts Core	38 SH
University Electives	0 SH
	97 SH

Recommendations:

The following courses will reduce the number of hours needed to graduate:

1. If the student takes MAT-125 Principles of Statistics 1 as an elective, this will substitute for 800:072 in Category 1C in the LAC. MAT-166 Calculus and Analytic Geometry 1 will substitute for 800:060 in Category 1C in the LAC as well.
2. Taking the following optional courses in the A.A.S: ENG-101 & ENG-102 English 1 and 2 will meet 620:005 College Reading and Writing requirement 1A, PSY-151 General Psychology will meet 400:001 category 5B, SOC-121 Principles of Sociology will meet 980:001 category 5A.
3. PHY-157 General Physics I or PHY-161 Physics 1 can be used to satisfy requirements in the Math/Science Core of the Manufacturing Technology program in addition to satisfying the Liberal Arts Core Category 4B (includes lab requirement).
4. CHM-133 General Chemistry 1 or CHM-121 & CHM-122 General Chemistry & General Chemistry lab can be used to satisfy the Math/Science Core of the Manufacturing Technology program in addition to satisfying the LAC 4B (includes lab requirement). If a student takes both the Physics and Chemistry courses only one of these courses can be used in the Liberal Arts Core Category 4B but the other course can be applied to University Electives.

Figure 4. Sample block articulation agreement.

The fourth page of the articulation agreement includes approximately nine general advisory statements for transfer students. The advisory statements consist of items such as minimum grade requirements for admission to UNI, maximum number of approved technical courses accepted by UNI, and other general provisions for completing a four-year degree.

Incentives to Pursue Articulation

The reasons to make articulation agreements depend largely on the expectations of the participants and actual or perceived benefits derived from the process. The most important reason for developing articulation agreements is to improve access: giving students more options and smoothed pathways to achieving degree completion. This is also relevant to the central mission of the community college system - to provide service to local citizenry in the form of occupational or vocational training, remedial education, college preparatory courses, and specialized community service (McDuffie & Stevenson, 1995; Wattenbarger & Witt, 1995). Articulation agreements complement traditional community college roles by providing greater access to education in addition to their already established open-door admission policies, lower cost per credit, ability to live at home while working on a degree, and more extensive academic advisory support (Bryant, 2001; Cohen, 2001). Administrators can successfully market articulation agreements as another example of service to their constituency.

Altruistic incentives aside, the ability to increase the productivity of staff, faculty, and classroom or laboratory resources is a strong motivator for administrators trying to stretch shrinking budgets. Administrators at two- and four-year institutions seeking articulation agreements can benefit through improved student

retention rates and cost savings by focusing course offerings from their respective institutions (Reese, 2002). Having one institution offer core classes or specialized education while the partnering institution supports prerequisite or capstone courses in a discipline can conserve effort, alleviate classroom space problems and improve faculty productivity by elimination of duplicate course offerings.

Faculty who participate in the development of articulation agreements can gain valuable insight into the methods, content, and efficacy of cohort programs. The collaborative environment required to make good articulation agreements opens the door for the exchange of ideas and mutually beneficial program development. Rather than expecting administrators to shepherd the articulation agreement through the system, it is important that faculty take responsibility for the process. As one of seven guiding principles for assessing the strength of state articulation agreements, Ignash and Townsend (2001) argued that faculty are the best judges of the quality in the curriculum. "Faculty from both two-year and four-year institutions have primary responsibility for developing and maintaining articulation agreements. As the content area experts, faculty should develop articulation agreements" (p. 178). Faculty ultimately determine the content, focus, and desired outcomes of the curriculum and, therefore, are in the best position to determine equivalency in order for the articulation process to be successful for students and institutions alike.

Conclusion

Building ties between academic institutions through the articulation agreement is a growing need in society where individuals who have completed degrees are not only desired, but also required. Universities, colleges, community colleges, and even high schools have a vested interest in the future growth of programs that offer less resistance to transition between successive levels of education. The need for a well-defined and accessible system for students who either elect to take or must take an alternative path to the bachelor's degree is apparent. Institutions that lag behind or choose to ignore this growing trend of articulated programs, do so at their own risk.

This is not to say that the articulation agreement process or its outcomes are without problems, but are minor deterrents when compared to the extensive benefits derived by students, faculty, administrators, institutions, and, ultimately, national educational achievement. We believe that articulation has a role to play in future iterations of higher education. The form and expected outcomes depend on faculty, institutions, and government mandates. The needs of students and ultimately society, however, will determine how this comes to pass.

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Ethical Issues in Technology Education in Taiwan

Kuen-Yi Lin

Introduction

A significant trend in technology education has shown internationally widespread acceptance with the increasing needs of developing students' technological literacy on both the elementary and secondary level from manual training to basic competency. Therefore, more and more countries have developed their national technology standards in order to enhance students' technological literacy.

Standards of Technology Education in Taiwan

As standards have developed in technology education around the world, including countries such as the United States, the United Kingdom, Australia, New Zealand, and others, Taiwan is no exception. The standards of technology education in Taiwan can be divided into two different areas: (1) basic competency in developing standards of technology education for elementary and junior high schools (like Australia), and (2) developing standards of technology education in senior high schools (like the United States). No matter which area of standards is adopted, the major purpose of standards in technology education is to develop students' basic technological literacy on different educational levels. Therefore, the standards of technology education in Taiwan can be described as follows:

1. The elementary and junior high level

With the trends of educational reform, Taiwan has made many changes at the elementary and junior high levels. For the purpose of coherence and integration, a so-called "nine-year joint curriculum" was created. There are two major categories of competency indicators in technology education in the nine-year joint curriculum, which includes both "Technological Development" and "Design and Making of Products."

(1) Technological Development

The three levels of competency indicators in the nine-year joint curriculum are shown in Table 1.

(2) Design and Making of Products

There are two different levels of competency indicators in the nine-year joint curriculum as shown in Table 2.

2. The senior high school level

The recent reform in technology education at the senior high school level does not follow the trend of developing competency indicators in the nine-year joint curriculum. The reforms follow the form of content standards like that of the United States. The new temporary standards in technology education can be divided into two parts:

(1) Standards of the core course in technology education

In order to make sure that senior high students can possess the same basic competency, the Department of Education decided to formulate the common core curricula for senior high schools, including high schools and vocational-technical schools. Technology education was, therefore, also an important subject in the formulation of the common core curricula, and its standards are listed in Table 3.

(2) Standards of advanced and optional courses in technology education

In addition to the standards of core courses in technology education as mentioned previously, there are six additional standards of advanced and optional courses in technology education:

- Communication Technology,
- Construction Technology,
- Manufacturing Technology,
- Transportation Technology,
- Energy and Power Technology,
- Technology and Engineering.

Level	Grades	Category	Competency Indicators
1	3 & 4	The Nature of Technology	1. To understand the importance of technology in daily life. 2. To know the characteristics of technology.
		Technology	1. To feel the mutual relationships between personal life and Society and technology. 2. To know the products in common use in our daily life.
2	5 & 6	The Nature of Technology	1. To know the classification of technology. 2. To understand machines and tools, materials, and energy.
		The Evolution of Technology	1. To know the technology in the era of agriculture. 2. To know the technology in the era of industry. 3. To know the technology in the era of information. 4. To know the internal and overseas invention and innovation in technology.
		Technology and Society	To understand the traffic and leisure facilities in common use in the community.
3	7-9	The Nature of Technology	1. To understand the relationship of science, technology, and society. 2. To understand the relationship of science and technology. 3. To understand the relationship of science, technology, and engineering.
		The Evolution of Technology	1. To understand the development of technology in Taiwan through the technological products in daily life. 2. To understand the trends of technological development. 3. To have their own viewpoints about the development of technology.
		Technology and Society	1. To understand different kinds of technological industry. 2. To know the mutual relationship between the development of industry and technology. 3. To know related occupations in technology. 4. To know educational and training approaches in technology. 5. To realize the relationship between personal development in life and technology.

Source: Department of Elementary Education, (n. d.).

Table 1. Competency Indicators in Technological Development

Ethical Issues in Technology Education

Over the past several years there has been a considerable amount of professional pressure, and numerous position papers expressing a need for technological ethics in technology education. As a society experiences the trends of globalization and advanced technology, there is an increasing need to discover what people in the technological society should understand regarding new issues of technological ethics. For example, ethics and ethical decision making have become increasingly important as technology has permeated the workplace (Hill & Womble, 1997). In other words, to keep pace with change in society, new ethics have been suggested to help advance technological literacy by highlighting the relationships among humans, the environment, and technology (DeVore, 1980, 1991).

Reed, Hughes, Presley and Stephens (2004) mentioned that "a great deal of the technology education literature regarding ethics stress the need for teachers to include the social context inherent in science and technology studies (STS)" (p.171). In addition to the topic of STS, environment pollution, labor issues, nonrenewable energy sources, medical care for the aged population, and technological control of the

Level	Grades	Competency Indicators
1	5 & 6	1. To utilize thinking, brainstorming, and concept mapping in developing creativity and expressing a person's ideas in changing products. 2. To use many different ways of thinking, especially about function and shape in changing things. 3. To know and design the basic shape. 4. To understand the process of making prototypes.
2	7-9	1. To read both illustrations and manuals of technological products. 2. To use language, images, written words, pictures, drawings, and real items to express creativity and ideas. 3. To understand usable resources and analytic jobs in designing. 4. To design the procedure of solving problems. 5. To simulate the process of mass production. 6. To execute, test, and adjust a product during the process of making it or at the end of making it.

Source: Department of Elementary Education, (n. d.).

Table 2. Competency Indicators in Design and Making of Products

environment have been mentioned as content foci for ethics in technology education (Hill & Dewey, 2001; Hendricks, 1996). Reed and colleagues (2004) were curious about how many ethical topics were addressed in technology education textbooks. They used the 20 areas in the ITEA Standards for Technological Literacy for textbook vendors to identify in which of the categories their curriculum materials teach about ethics. Seventeen of the 20 areas mentioned some ethical issues.

This study focused on the junior high level, and for it a questionnaire was developed employing the same 17 competency indicators in Technology Education that were used in the Reed, Hughes, Presley, and Stephens (2004) study. In order to understand the technology teachers' viewpoints about ethical issues, technology teachers were selected as the participants instead of textbook vendors. In sum, this study attempted to clarify some of the issues facing technology education in Taiwan and then to compare the results of this research with findings in the United States.

Purposes of the study

Specifically the study sought the following:

1. To explore the ethical issues in technology education in Taiwan through a survey of technology teachers in junior high schools.
2. To distinguish the differences regarding ethical issues in technology education between Taiwan and the United States.
3. To generalize the major ethical issues in technology education and offer some suggestions to Taiwanese technology teachers and others teaching ethics in technology education.

Methodology

In order to achieve the purposes of this study, a questionnaire survey was employed. The participants, instruments and procedure are explained next.

Participants

Since the junior high technology teachers understand their students better than others, the major participants of this study were junior high technology teachers. However, the time for the "Living Technology" curriculum in junior high schools in Taiwan was sometimes utilized in teaching Natural Science curriculum. For that reason, the researcher selected junior high technology teachers according to their actual teaching situations. The participants were not randomly selected from a population. A total of 50 junior high technology teachers were invited to participate in this study in order to analyze ethical issues in technology education in Taiwan.

Category	Sub/category	Content Standards
The Nature of Technology	The Meaning of Technology	1. To explore the nature and meaning of technology, and its relationships with life, society, and culture. 2. To discuss the problems of ethics, morals, and laws in technology.
	The Evolution of Technology	To explore the evolution and development of technology.
	The System of Technology	To explore the system, method, management, evaluation, and impact of technology.
Technology, Science, Environment	The Utilization of Resources	To discuss the situation of utilizing resources in the and development of technology.
	Technology and Science	1. To explore the relationship and differences between science and technology. 2. To solve technological problems by using scientific principles, technological knowledge, and engineering concepts.
	The Impact of Technology in the Environment	To discuss the problems of environmental change and pollution through technology, and to build the conception of environmental protection.
Technological World	The Scope of Technology	To understand the scope and classification of technology.
	The Outline of Technology	1. To understand the mass media, applications, services and their relationships with life in communication technology. 2. To understand the materials, methods, process, and their relationships with life and environment in construction technology. 3. To understand the materials, methods, products, and their relationships with life in manufacturing technology. 4. To understand carrying machines, logistics, systematic planning, and their relationships with life in transportation technology. 5. To understand the categories, development, application, the setting of power supply, and their relationships with life in energy. 6. To understand the situation, trends, influences of bio-related technology (such as medical treatment and agriculture) and other emerging technologies.
Creative Design and Making of Products	The Meaning, Method, and Procedure of Technology	To become aware of problems and think about the methods and steps in the daily life; furthermore, to generate many solutions and choose the best solution in order to achieve the purpose of innovation.
Creative Design and Making of Products	The Planning and Making of the Design of Products	1. To utilize written words, diagrams, engineering drawings, computer drawings, or other methods to express creativity and ideas clearly, and to arrange the process of complete production. 2. To display creativity, ideas, and design in making real objects.

Source: Department of Secondary Education, (n. d.).

Table 3. Standards in Technology Education in the Formulation of the Common Core Curricula

Instrument

The major instrument used in this study was called "The Importance of Ethical Issues in Technology Education Questionnaire." It contained two main parts: "Personal Data" and "Ethical Issues in Technology Education." The personal data included gender of teacher, school name, and major teaching grade. The ethical issues in technology education component included the 17 competency indicators in the nine-year joint curriculum. Participating technology teachers were asked to rate the importance of competency indicators in combination with ethical concerns by using the same 5-point scale ranging from "very important" to "very unimportant."

The creation of the questionnaire emphasized reliability and validity. The reliability of the questionnaire is demonstrated in Table 4. It indicates that each part and the whole of questionnaire was greater than .80. The content validity of the questionnaire was determined by one professor and two technology teachers who specialize in technology education. The instrument was designed particularly for this study.

Table 4. The reliability of the questionnaire

Questionnaire	Cronbach
Part 1: Technological Development	.8449
Part 2: Design and Making	.8370
Whole	.9101

Procedure

The researcher reached every participant through e-mail with a cover letter and an electronic questionnaire. Follow-up e-mail was sent to non respondents at 7- to 10- day intervals. These approaches were used to acquire the highest possible participation in the study. Forty of the 50 junior high technology teachers returned their surveys, resulting in an 80 percent return rate. Because the participants were invited by the researcher, any generalization beyond the persons who participated in the study should be made with caution. Information collected from the respondents' completed questionnaires were coded and analyzed using SPSS.

Results and Discussion

The Analysis of Participants' Data

There were 40 junior high technology teachers involved in this study. Among them, 25 are male teachers, and 15 are female (see Table 5). Twenty-four technology teachers lived in the north of Taiwan, 7 lived in the middle of Taiwan, and 9 lived in the south of Taiwan (Table 5). Furthermore, 14 technology teachers taught the seventh grade, 14 technology teachers taught eighth grade, and 12 technology teachers taught the ninth grade. There is no doubt that the selection of technology teachers contains different characteristics for the purpose of avoiding possible error.

Ethical Issues in Technology Education in Taiwan

The first research question focused on how junior high technology teachers view the importance of various competency indicators of ethics. The results of this analysis are shown in Table 6.

1. Nine important ethical issues are generated in technological development

According to the results of analysis, nine important ethical issues (M > or = 4.0) in technological development are "to realize the trend of technological development (M = 4.39, SD = .82)," "to understand the development of technology in Taiwan through the technological products in daily life (M = 4.38, SD = .68)," "to understand the relationship of science and technology (M = 4.34, SD = .75)," "to realize the relationship between personal development in life with technology (M = 4.21, SD = .74)," "to realize the related occupation in technology (M = 4.18, SD = .73)," "to understand the relationship of science, technology and engineering (M = 4.11, $S D$= .73)," "to show their own viewpoints about the development of technology (M = 4.11, SD = .99)," "to understand the relationship of science, technology and society

Table 5. Participants' data

	Gender		Location			Teaching Grade		
	Male	Female	North	Middle	South	7	8	9
N	25	15	24	7	9	14	14	12

Items	*M*	*SD*	Rank
Part 1: Technological Development			
1. To understand the relationship of science, technology, and society.	4.05	.80	8
2. To understand the relationship of science and technology.	4.34	.75	3
3. To understand the relationship of science, technology, and engineering.	4.11	.73	6
4. To understand the development of technology in Taiwan through the technological products in daily life.	4.38	.68	2
5. To know about trends in technological development.	4.39	.82	1
6. To share their own viewpoints about the development of technology.	4.11	.99	6
7. To know about different kinds of technological industries.	3.89	.80	10
8. To understand the mutual relationship between the development of industry and technology.	4.00	.70	9
9. To know about related occupations in technology.	4.18	.73	5
10. To understand educational and training approaches in technology.	3.87	.99	11
11. To realize the relationship between personal development in life and technology.	4.21	.74	4
Part 2: Design and Making			
1. To read both illustrations and manuals of technological products.	4.21	.96	3
2. To use language, images, written words, pictures, drawings, and real items to express creativity and ideas.	4.45	.76	1
3. To understand usable resources and analytic jobs in designing products.	4.21	.78	3
4. To design the procedure of solving problems.	4.45	.76	1
5. To simulate the process of mass production.	3.45	.95	6
6. To execute, test, and adjust a product during the process of making it or at the end of making it.	4.05	.98	5

Table 6. The Analysis of Ethical Issues in Technology Education

(*M* = 4.05, *SD* = .80)," and "to realize the mutual relationship between the development of industry and technology (*M* = 4.00, *SD* = .70)." Therefore, there are nine important ethical issues in technological development according to technology teachers' opinions in Taiwan. In other words, if technology teachers want to teach ethical issues in technology education, they can plan either learning content or activities when they are teaching about technological development in a course on technology education.

2. Five important ethical issues are generated in design and making of products

In contrast, according to the results of analysis, the most important ethical issues (*M* > or = 4.0) in design and making are "to use the language, images, written words, pictures, drawings, and real items to express creativities and ideas (*M* = 4.45, *SD* = .76)," "to design the procedure of solving problems (*M* = 4.45, *SD* = .76)," "to understand usable resources and analytic jobs in designing products (*M* = 4.21, *SD* = .78)," "to read the illustration of combination and manual of technological products (*M* = 4.21, *SD* = .96)," and "to execute, test, and adjust a product during the process of making it or at the end of making it (*M* = 4.05, *SD* = .98)."

In light of that, there are five important ethical issues in the design and making of a product, according to technology teachers in Taiwan. Therefore, if technology teachers want to teach ethical issues in technology education, they can also incorporate such content or activities when they are teaching about product design and the making of products within technology education.

3. The most important issue suggested in this study corresponds with the literature

According to the results shown in Table 6, one of the most important issues was "to design the procedure of solving problems (*M* = 4.45, *SD* = .76)" in the standards of technology education in the nine-year joint curriculum in Taiwan. However, Hill and Womble (1997) mentioned that ethics and

Content Standards in United States	Competency Indicators in Taiwan													
	1. To understand the relationship of science, technology, and society	2. To understand the relationship between science and technology	3. To understand the relationship of science, technology, and engineering	4. To understand the development of technology in Taiwan through the technological products in daily life	5. To know about trends in technological development	6. To share their own viewpoints about the development of technology	7. To understand the mutual relationships between the development of industry and technology	8. To realize the related occupation in technology	9. To understand the relationship between personal development in life and technology	10. To read both illustrations and manuals of technological products	11. To use language, images, written words, pictures, drawings, and real items to express creativity and ideas	12. To understand usable resources and analytic jobs in designing products	13. To design the procedure of solving problems	14. To execute the test and adjust of product during the process of making it or at the end of making it
1. Characteristic and scope of technology														
2. Core concepts of technology										+	+	+	+	+
3. Relationships among technologies and connections between technology and other fields	+	+	+				+							
4. Cultural, social, economic, and political effects of technology									+					
5. The effects of technology on the environment														
6. The role of society in the development and use of technology				o	o	o								
7. The influence of technology on history														
8. Design											+	+	+	
9. Problem Solving										+	+	+	+	
10. The impacts of products and systems							o			+				
11. Medical								+						
12. Agricultural and biotechnology								+						
13. Energy and transportation								+						
14. Information and communication								+						
15. Transportation								+						
16. Manufacturing								+						
17. Construction								+						

NOTE: + high relationship, o low relationship.

Table 7. The Comparison of Ethical Issues in Technology Education

ethical decision making have become increasingly important as technology has permeated the workplace. Junior high technology teachers in Taiwan had the same viewpoints, and how to teach ethical decision making in the procedure of problem solving should be emphasized.

4. The most insignificant issues might be hard to incorporate with ethics

According to the results shown in Table 6, the most unimportant issue was "to simulate the process of mass production (M = 3.45, SD = .95)" in the standards of technology education in the nine-year joint curriculum in Taiwan. The main reason for this result might be that it is difficult to incorporate ethical considerations into the process of mass production.

5. There were no significant differences in the views of technology teachers with different backgrounds

Beyond the descriptive analysis of the questionnaire, a t-test and ANOVA also were used in comparing the differences in the

views of technology teachers with different backgrounds. The factors of gender, teaching grade, and teaching area were insignificant in terms of technology teachers' views about the importance of incorporating competency indicators for ethics in technology education in Taiwan.

6. Similarities and Differences between Taiwan and the United States

The results in Taiwan (Table 6) can be compared to those seen in the United States (Reed et al., 2004). As the matrix results in Table 7 show, the lack of inclusion of ethical issues related to the "Characteristic and scope of technology," "The effects of technology on the environment," and "The influence of technology on history" should be addressed in the future.

Conclusions

According to the previous analysis and discussion, the following conclusions can be stated:

1. *Nine ethical issues in technological development and five ethical issues in design and making of products can be the focal point for ethics in technology education in Taiwan.*
2. *There are no significant differences concerning the inclusion of ethical issues in technology education between Taiwan and the United States.*

According to the results of this study, technology teachers do recognize that ethical issues are important in technological development and the design and making of products. The result of this study can be a beginning point for developing effective approaches for the teaching and learning of ethical issues in technology education. Success in this venture will result in students being much more savvy about the ethical dimensions of modern technology; they will also be able to operate more effectively as both workers and citizens in the future.

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Operating a Successful PowerTech Creativity Contest

Jon-Chao Hong, Chan-li Lin, and Ya-ling Lin

Abstract

To help cultivate future talent for creating technology, the PowerTech Youth Creativity Contest was first held in 2000 by the Taiwan Creativity Development Association (TCDA) and the National Taiwan Normal University (NTNU). It has since been organized regularly on a yearly basis, with the number of contending teams growing from 78 in the first year to 414 in 2006 (3-4 members each team). The categories have been extended from the elementary school level to include junior high school categories. The activity design adopts the project-based learning approach and aims to develop important technological creation abilities for students, particularly with respect to knowledge application, psychomotor skills, and creative thinking in which the planning ability, imagination, analytical skill, and implementation ability will be developed, and some affective domains such as persistence, high regard for efficiency, quality improvement ability, and teamwork spirit will be cultivated through project competition and realization.

The purpose of this article is to describe the operation principles behind the PowerTech contest from four different dimensions: (1) contest design and its rationale, (2) contest promotion which includes the application of information technology (IT), and the social resource identification and application. It is hoped that the discussion of this article will be valuable as a referential basis to organizers of similar activities.

Introduction

Education reform is a necessary means to the enhancement of national competitiveness, including intra-institutional or extra-institutional educational reform measures aimed at equipping learners with creative abilities or problem – discovering and solving skills. The ability to create technology, in particular, helps lay the foundation for national competitiveness. This is why the cultivation of technological - creating abilities in the younger generations has always been among the top priorities of domestic educational reform measures. In light of this, technology educators too should strive to broaden and deepen their effort to create technological ability in young students.

According to the investment theory of creativity by Sternberg (1995), creativity requires a confluence of six distinctive resources: intellectual abilities, knowledge, thinking styles, personality, motivation, and environmental context. In other words, in order to create effectively, individual creators must possess sufficient domain knowledge and realize their full intellectual potential. To help technology take root, educators need to devise a group activity and a mechanism to involve students and encourage them to explore technological inventions. This paper therefore focuses its discussion on the operations of the PowerTech Youth Creativity Contest (henceforth PowerTech Contest) from the group activity-mechanism perspective.

The Rationale of PowerTech Contest

Sternberg (1985) developed a triarchic theory of intelligence, highlighting the individual differences in intelligence and dividing human intelligence into analytical, creative, and practical intelligences. These are described as follows: (1) analytical intelligence includes the ability to analyze, compare and contrast, evaluate, explain, judge, and criticize, (2) creative intelligence includes the ability to create, design, invent, imagine, and suppose, and (3) practical intelligence includes the ability to use, apply, implement, employ, and contextualize.

In other words, technological creation should be a comprehensive embodiment of a pool of integrated abilities, including knowledge application, practical intelligence, thinking ability, and action taking (Magee, 2005). Taiwanese students in general perform very well in knowledge memorization and reasoning, but they are rather weak in knowledge application and innovation. Regarding practical intelligence, the majority of the students in Taiwan are lacking in hands-on experiences. Many school assignments that require hands-on practice are often done by parents. In terms of thinking ability, the current constructivist teaching approaches in Taiwan have led to a general lack of plurality and flexibility among students, particularly with respect

to their problem-discovering and problem-solving abilities. The situation is worse with elementary school pupils because the younger the age, the more easily bored the students become. This shows that domestic students in general lack the abilities to implement and complete a task.

Given this background, many nationwide contests to create technologies have based their contest design on the successful development of such abilities as knowledge application, pluralistic and flexible thinking, practical intelligence, and a careful attitude in students. According to the spirit of the Nine-Year Integrated Curriculum for Mandatory Education in Taiwan, a domestic technological creation contest should strive to cultivate the following 10 abilities for students:

1. Self-understanding and potential development.
2. Appreciation, performance, and innovation.
3. Career planning and life-long learning.
4. Expression, communication, and sharing.
5. Respect, caring, and teamwork.
6. Cultural learning and international understanding.
7. Planning, organization, and implementation.
8. Technology and information application.
9. Active exploration and research.
10. Independent thinking and problem solving.

Furthermore, technological creation contests for youths have the following personal, societal, and economic benefits:

1. Individually

a. Pre-production design drawing improves planning ability.

b. Flexible thinking and knowledge synthesis enhances imagination.

c. Project production encourages independent thinking and promotes originality.

d. Comparison of their own and rivals' work helps them to learn analytical skills.

e. Utilization of equipment and hand tools for material processing, production, and formative design improves practical skills.

f. Competition stimulates persistence and cultivates sportsmanship.

g. Team cooperation embodies the concept of symbiosis and makes students a better team player.

2. Socially

a. The organization of a nationwide contest for technological creation helps involve people at all levels of the society and boosts their interest in technological creation.

b. The organization of a nationwide technological creation contest increases opportunities for inter-school exchange.

c. The activity itself helps the concept of *technological creation* to take root into the daily lives of the citizens.

3. Economically

a. The cultivation of product R&D capabilities helps increase the added-value of technological products.

b. The cultivation of manufacturing R&D capabilities helps boost production efficiency and quality.

Theme Selection and Its Meaning

From the corporate management point-of-view, the PowerTech Contest itself can be seen as the product, and the participating students are its customers. In order to capture precisely what the market demands are we need to develop and put in place a system of effective management. Cooper (1993) pointed out in his review of three high-tech product cases following the common characteristics of successful technological inventions: (1) close collaboration between the inventor and the customer, (2) well-defined market demands, and (3) the existence of a technical champion. Based on the rationale discussed in the previous section and the past experience of TCDA and NTNU organizing the youth creativity camp activity, the PowerTech organizers selected "The Queen of Ants" and "King of Beasts" as the theme for elementary school students to compete and "The Totoro of Buses" and "The Giant of Bugs" for junior high school student to compete, with an aim to develop the participants' ability to construct and improve their technological knowledge. The contest requires rival teams to apply relevant theories of physics for the internal structure of their invention, including the electrical motor and the gear set in the power system, and the linkage mechanism in

the transmission system. Since no specifications and dimension requirements are given for the final product, teams are allowed to fully stretch their creativity and are required to search for the needed knowledge and to put their theories into practice. In addition, students also need to learn to utilize unprocessed materials provided by the contest organizers and apply their creative thinking skills to produce a project. Below is a brief summary of the characteristics of the end product, and the categories and method of the competition.

Contest Theme Selection

The elementary school competition has two themes. The first theme "The Queen of Ants" requires a final structure that contains a body comprised of three separate parts linked with a linkage device and a cross-shaped foot stand. The final product is expected to perform the mechanical functions of spinning and crossing a hurdle. The second theme "The King of the Beasts" requires a final structure that has the ability to walk with four legs by using crank and linkage devices. An animal appearance is also an important part of the competition, and the competing teams are free to add any aesthetic element or any defensive/offensive function to their creation.

In junior high school competition, the first theme is "The Totoro of Buses," a four-wheel-drive vehicle with an arch-shaped roof that can maintain a continuous and smooth movement of rolling over when it hits against a vertical wall through its wheel-body coordination and center-of-gravity design. "The Giant of Bugs" requires the use of a linkage structure together with the crank movement and the front-end chassis-to-ground friction design to enable the Bug to crawl forward with alternating stretching and recoiling movements like a caterpillar. The competition is divided into different categories according to the level of difficulty in project production and mechanical requirements, and it is conducted in two stages (preliminary and final).

Table 1. Four Projects of Technological Creativity Contest

Item	Description
The Queen of Ants 	The Queen of Ants is a robot with a structure with three interconnected body parts and a crossed-leg design for hurdle crossing. Pupils can learn about the various fundamental technological concepts through the design of a power system, including the gear drive system (the principle of leverage), DC electricity application features (difference between parallel and serial circuits) and component linking methods, all of which are useful for creation of technological products of different mechanical structures and functionalities.
The King of Beasts 	The King of Beasts is a four-legged, animal-looking walking robot for use in a wrestling contest. In addition to the relevant principles of physics mentioned above, pupils can also learn about the basics and the design of a linkage structure, and about how to transform the rotary movement of a motor into linear movement, and how to increase friction (by increasing product weight or changing the material texture, etc.) in the contest.
The Totoro of Buses 	The Totoro of Buses is a four-wheel-drive motor vehicle with an arch-shaped roofline design to capacitate continuous rolling movement. Through motor-driven vehicle design and production, pupils can learn about gravity (vehicle body's center of gravity) of vehicle body, centrifugal force (generated during rolling), streamline design, etc.
The Giant of Bugs 	The Giant of Bugs is a robot emulating the stretching and contracting movement of a real worm for use in a straight-line speed race and a tug-of-war contest. In addition to providing pupils an opportunity to synthesize various concepts of physics and to develop a basic understanding of biology, the product requires the use of environment-friendly materials and processing methods for appearance design. This helps incorporate the concept of biological chain into product design, and this challenge demands a good balance between the mechanical and functional structure of the product and its appearance design.

Content Method Analysis

The PowerTech Contest requires the creative project to be produced and completed on site within the one-day competition. During the production process, all teams work on their projects in an isolated area to protect them against external disturbances and unwanted interferences, including instructions (oral or otherwise) from teacher advisors and parents, who are only allowed to observe the contest from outside the isolation line. This particular arrangement has been used to ensure that the entire competition process and setting are fair, just, and open.

The PowerTech Contest contains three subcategories: power contest (e.g., speed racing and push), form design contest, and innovation process records contest. In power contest, the contesting teams are required to make designs for each required contest item according to the mechanical features under the given theme. At the same time they must take into consideration the respective constraints of each required item, and then seek to optimize the mechanical design. Table 1 summarizes the different contest items for respective themes.

In the innovation process records contest, an expert review meeting was convened one week before the final competition to evaluate the innovation process records of the rival teams, which should include their problem-discovering and problem-solving methods, idea-searching and idea-generation methods, and technological innovation processes that were recorded during their meetings with their teacher advisor. The form design contest was held on the day of competition, and the evaluation is based on the contesting teams' overall structure design, color applications, environment-friendly material employment, and processing skills. The final score is determined by the total score of all the subcontests. In other words, the contesting teams are required to put in a carefully measured amount of effort into the respective preliminary contests in order to win the game. Through participating in the entire process from planning and design to pre-contest practice and the final competition, students should be able to develop a basic design concept that emphasizes not only the mechanical function but also the formative design, instead of overemphasizing one aspect at the expense of the other.

Operating a Successful PowerTech Contest

The goal of the contest is to help students to learn to utilize limited resources to achieve project objectives through planning, implementation, and evaluation. Therefore, the operation of the PowerTech Contest should cover all aspects of resources including people, processes, materials, and finances. As a regular activity of a nonprofit organization, a PowerTech Contest indeed faces serious obstacles in all aspects in its pursuit for sustainability. Hence, an effective management mechanism is required in order to help the contest overcome the various challenges it may face in the course of development.

As already mentioned in the previews section on PowerTech Contest rationale, in order to create a technological project, students must have abundant knowledge and possess various skills and capabilities (including knowledge application, plurality and flexibility in thinking, and implementation and persistence). The Ministry of Education has also pointed out that technology should be an integral part of the learning of Natural Science and Life Technology in its Nine-Year Integrated Curriculum for Mandatory Education. Currently, however, students' understanding and skills for technological creation remain largely insufficient for a successful implementation of the new curriculum. Therefore, in preparing for the contest, the organizers foresaw several problems. First, who should be the target audience of the contest? Because students largely lack technological creation capabilities, the end "product" may not be one that could be sold on the market, and the goal of helping to cultivate students' technological creation abilities may not be fully realized. The second challenge was about how to get the word out to the target audience. What could be done to improve the visibility of the activity among possible contestants? This second question would entail marketing.

The organizers mistakenly decided to address the second question first during the first-year of the contest due to a lack of experience. The organizers adopted a media propagation strategy, but much of the effort was to no avail. That experience taught the organizers to deal with the first challenge first in order to process a successful event. In addition, for the contest to continue yearly, the organizers also need to address the issue of sustainability. And

this third problem has to do with the sustaining of participants' motivation and interest. Below is a brief discussion of how these three difficulties can be resolved.

The problem of "Who is Capable?"

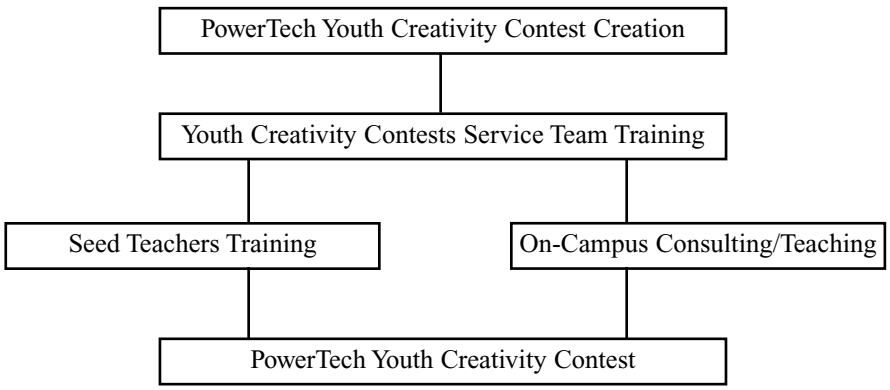
Since most of the students had no previous experience making technological creations in school, they probably had little self-confidence for such a contest. It is therefore important to provide a learning opportunity for those who were willing to give it a try. Also, considering the fact that the contest is at "national level," such a learning opportunity has to be provided nationwide, not limited to certain cities or counties. According to "The Tipping Point: How Little Things Can Make a Big Difference" (Gladwell, 2000), a contest must have relevant connectors in order to become popularized. In other words, teacher's interest has to be cultivated first, instead of students, and they had to be provided with technological creation experiences. The organizers therefore recruited students from college-level teacher-education programs to form the Youth Technological Creation Service Teams and to provide necessary training to them. The purpose of setting up these teams is twofold: (1) to provide an educational internship opportunity for these college students, and (2) to reduce the budget requirement for organizing teacher-training programs as part of the PowerTech Contest promotional campaign.

During the second-year PowerTech training, the service teams used the National Museum of Natural Science and the National Science and Technology Museum as their bases to train seed teachers by stages and to utilize various collaborative learning mechanisms through knowledge collection, diffusion, transmission, and innovation in order to help the trainees to help their students. In addition, to increase participation rate, the service teams toured elementary and junior high school campuses to provide guidance and to help increase the ability and confidence of prospective participants. The flowchart of the PowerTech Contest is shown in Figure 1.

The problem of "Who should promote to?"

Compared to the National Science Fair that already has a history of over 20 years, the PowerTech Contest is relatively new and unknown to most of the parents and teachers. To acquaint and familiarize parents and teachers with the contest, multiple media channels were used and a consulting center was established to help promote the activity and provide all necessary assistance. The media promotional campaign was divided into two stages. In the first stage, reports plus advertisement were published in Mandarin Daily News whose main readers are elementary school teachers and students, and other print media such as promotional leaflets and direct marketing materials, were placed in technological-innovation-related social and educational institutions, including the National Museum of Natural Science, the National Science and Technology Museum, and the Science Education Center. All promotional materials included a brief introduction about the organization and implementation of the activity as well as the contact information. During the second stage, organizers started promotional activities, provided guidance on school campuses and established a PowerTech Contest Consulting Center to coordinate the handling of inquiries. In addition, the TCDA created a new column on its organizational Website to disseminate relevant information about the contest, including technological innovation teaching, FAQs, and online registration, in order to increase the visibility of the contest and the registration rate. Through these efforts, the number of participating teams grew exponentially from 78 in the first year to 414 in 2006.

Figure 1. Power Tech contest flowchart



The problem of "Who has the willingness?"

According to the theories of incentives (Rice, 2006; Baer, Oldham & Cumming, 2003), one would offer a "carrot" in front of a horse for it to move forward. Therefore, the PowerTech Contest organizers provided a free trip to Japan to see a robot contest (sponsored by domestic business enterprises) as the final prize. Also, officials from the Ministry of Education and National Science Council were invited to be award presenters at the award ceremony, which was also a great encouragement for the participants. In addition to student awards, teacher advisors were also given awards for their leadership and dedication. This was to encourage them to continue their efforts and to lead another team in future contests.

According to the equity theory, fair games promise chances to win, and the chances to win sustain the willingness to participate. In order to ensure the principles of fairness, justice, and openness, the PowerTech Contest required the participants to produce their product on site on the day of competition to avoid similar criticism on science fairs about the possible master-hand hidden behind the scene. For score calculation, the contest included the creating competition contest (60%), the modeling design contest which aims to encourage students to utilize their artistic talents and improve their command over aesthetic expression (20%), and the teacher advisor's innovation process record journal (20%), to ensure that teachers indeed participated in the process. As long as teachers are involved in the process, they are sure to gain something; and as long as they feel rewarded, they will be motivated to lead their students to participate in the contest.

Finally, according to game theory, an interesting game must also be competitive. The competition may be against time, against a rival, or against both at the same time. The PowerTech Contest not only upholds the principles of fairness and openness, the contest design, including the speed race, wrestling, and tug-of-war competition between participants' creative inventions, also imitates real, live human competition so that students can become highly involved and motivated to make improvements to their invention and to enter the competition again in the future to prove that their improvements indeed work better. Based on the three guiding principles discussed previously, it is believed that the PowerTech Contest will continue in the years to come.

Conclusion

For a nonprofit organization to hold a sustainable activity in this rapidly changing society, and thereby fulfilling the missions and ideals of the organization, a process of strategic planning and managerial thinking as stringent as that followed by the corporate world is necessary. The core of the PowerTech Contest also lies in its ability to fulfill its educational functions and purposes. Next follow the conclusions of this study.

Building a professional operation mindset to boost competitiveness

The organizers of this nationwide contest successfully formulated and designed a creative activity that not only appeals to today's youngsters but also meets their demands for science education. In addition, the organizers have incorporated novelty features in the contest designed to attract students, and they have reviewed the effectiveness of its activity implementation throughout the whole process of design, development, and assessment.

Shaping a professional image to lure new "customers"

The PowerTech Contest has focused its public and media promotion efforts on building a professional image in order to increase its name recognition. Also, various new marketing approaches (regional integration, total marketing) were incorporated in order to create positive and effective word-of-mouth marketing via participating students, so that all the limited resources can be fully exploited.

Extending the reach and scope by involving relevant institutions

In addition to internal management strategies, the organizers also strengthened its partnership with external resources. For instance, the first three contests all collaborated with the National Museum of Natural Science and the National Science and Technology Museum and used them as bases for service team training and contest venues. Such cross-institutional partnership and collaboration further ensured an effective use of the limited operating resources of the contest.

Since there is still room for improvement in terms of general considerations and specific

measures of the contest, the organizers will strive to make continuous improvements to ensure that technological creation can truly become a part of everyday life and that their countries' economic competitiveness will be further lifted as a result.

Acknowledgement

The PowerTech contest is mainly sponsored by National Science Council and Ministry of Education of Taiwan.

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Exploring the Influence of New Technology Planning and Implementation on the Perceptions of New Technology Effectiveness

Al Bellamy

Abstract

This study explored influences that perceptions of new technology implementation and planning processes, and dimensions of organizational climate have on perceptions of new technology deployment effectiveness. It also examined the extent to which dimensions of organizational climate moderates the relationships among new technology implementation, planning, and new technology deployment effectiveness.

Data for this study was collected from 100 employees within 6 different types of organizations that had recently installed new technology. The results of the study indicate that these factors do indeed influence new technology deployment effectiveness. Organizational climate was not shown to have a moderator affect.

Introduction

The rapid speed of technological development and its effect on organizational strategy, structure, and processes has created a critical need for a systematic approach to managing technology. Technology Management "…links engineering, science, and management disciplines to address the planning, development, and implementations of technological capabilities to shape and accomplish the strategic and operational objectives of an organization" (Manufacturing Studies Board 1986). Technology management has its roots in strategic management, engineering management, innovation management and R & D management, all dating back to the 1970's (Ulhoi, 1996). Technology management during the past two decades has emerged as a viable framework within corporate strategy making (Burgelman, Madique, & Wheelwright, 1995; Collier, 1985; Porter, 1985) and is considered to be an independent sub-discipline of organizational management. Its interdisciplinary framework focuses upon understanding the peculiar integration between information history and radically new modes of production that is rarely understood within the industrial technology paradigm of current management thought (Bellamy, Becker, Kuwik, 2001). For the conceptual purposes of this paper, technology is defined as the ideas, tools, and knowledge that are utilized for developing, transforming, or modifying a product, service, and skills. This definition acknowledges the nonmaterial aspects of technology as well as tools and equipment. Technology management refers to the management strategies and processes that are utilized in the effective deployment and maintenance of technology. Strategies and processes consist of such things as the assessment and requisite changes of the organizational structures, work processes, modes of integration, communication networks, and human resources that are needed to effectively bring about an isomorphic relationship between technology and the accomplishment of organizational objectives.

This exploratory study examined the extent to which perceptions concerning technology planning, implementation, and organizational climate influence perceptions of the effectiveness of new technology. The study is further concerned with exploring the extent to which organizational climate moderates the relationships among technology planning, technology implementation, and technology effectiveness. Previous and existing literature has tended to focus more on the macro level aspects of technology management and strategy (such as environmental monitoring of technology, product development and innovation,) and technology leadership (Barclay, 2002; Barclay, 1990; Cooper and Kleinschmidt, 1995; Clarke and Thomas, 1990). The emphasis placed upon these broader aspects of technology management is understandable given the implications that technology has for improving an organization's competitive position. However, specific organizational processes such as the way in which organizations go about planning and implementing technology are equally salient to the management of technology. The influence that these processes have on technology management, has for the most part, been ignored within the empirical literature. What does exist within the literature are theoretical statements regarding the importance of implementation and planning processes. However, there is a critical need to empirically investigate the impact that these processes have on technology outcomes.

Technology is believed to have more effective outcomes when it is integrated systematically within an organization's strategy process (Steele 1989: Uhoi, 1996). The micro processes of planning and implementation relate to an organization's strategic behavior toward technology management. Conducting empirical research on how these factors influence the deployment of technology will provide deeper insights into the processes needed for developing an effective technology management strategy.

Factors Examined in Study

Planning and Implementation Factors

The way in which internal planning and implementation processes are managed could greatly influence the fecundity of new technology. Analyses of how these processes are managed could be seen as an indicator of the extent to which organizations strategically approach the deployment of new technologies (Hong & Kyung-Kwon, 2002). Technology implementation and planning refers to the extent in which the organization has strategically approached the deployment of new technologies and the manner in which it has prepared for the execution of the technologies prior to their implementation. The processes incorporated within this design have been cited to influence the overall effectiveness of both the deployment and utilization of technology (Bancroft, 1992; Haddad, 2002).

The implementation factors examined within this study consisted of perceptions relevant to the structure of the implementation process (cross-functional teams), and the extent to which pre-assessment of such things as training needs, required organizational changes, and the capabilities of the new technology was conducted prior to the deployment of new technology.

The study approached the planning process by examining the extent to which the organization devoted time to technology planning, the level of clarity within the planning process, and the extent to which a strategic plan was utilized.

Although the implementation and planning factors incorporated within this study do not exhaust all of the possible factors related to the deployment of technology, it does include a representative cadre of constructs that has been identified within the conceptual literature as being relevant and significant to the implementation of technology (Cleland & Bursic, 1992; Haddad, 2002; Preece, 1995; Steele, 1989).

Criterion Factors

Three types of factors were examined to determine the impact that the technology implementation and planning factors and organizational climate have on new technology outcomes. They are perceived unanticipated outcomes, perceptions of whether the technology accomplished what it was intended to achieve (Overall Perceptions), and perceptions related to its impact on production issues (Production Outcomes).

Organizational Climate

When exploring the ways in which management practices are related to technology implementation outcomes, it is important to realize that these relationships occur within the context of organizational characteristics, such as its climate (Barley, 1990).

> Organizational climate refers to:
> "a relatively enduring quality of the internal environment of an organization that is (a) experienced by its members, (b) influences their behavior, and (c) can be described in terms of a particular set of characteristics or attributes of the organization" (Tagiuri, 1968, p 35).

This definition conceptualizes climate as a construct that is linked to perceived qualities of the organization such as leadership, organization design, decision-making processes, and organizational policies and procedures (Guion, 1973). Perceptions of these organizational traits can influence individual behavior in relation to organizational effectiveness (deWitte and de Cock, 1988). More specifically, organizational climate appears to influence the manner in which an organization conducts its planning for new technology. For example, an organization that is characterized by its members as being rigid and unwilling to change would probably approach new technology planning and implementation differently than an organization described as open and that does not resist change. There may also be parallel differences in the effectiveness in which new technology is deployed (Sparrow & Gaston, 1996). The perceived climate of the organization may mediate the relationship among technology, the planning processes, and the perceived effectiveness of the deployment of technology.

There is a lexicon of studies and writings that point to the usefulness of the climate

variable in conducting organizational analyses (Sparrow & Gaston, 1996). It has been linked to motivation and job satisfaction (Reichers & Schnieder, 1990). It has also been shown to mediate the relationship between job satisfaction and performance (deWitte and de Cock, 1988). Although recent attention has been focused on examining the influence that climate has on innovation and organizational learning (Agrell & Gustafson, 1994; Anderson & West, 1994) very little empirical attention has been directed to describing its role in technology management issues.

This study examined the following four dimensions of culture extrapolated from the Business Organization Climate Index (BOCI) (Payne & Mansfield, 1978): (a) questioning authority, (b) administrative efficiency, (c) open-mindedness, and (d) innovation. These four factors were chosen from among 17 factors within BOCI because they appeared to be the most relevant toward the subject of implementing and planning for new technology.

Research Questions

This study explored the following research questions:

1. What is the nature and strength of the relationship among technology assessment, technology planning factors, and perceived technology effectiveness outcomes?

2. What is the impact of organizational climate on technology assessment, technology planning, and perceived technology effectiveness outcomes?

3. In what way does organizational climate moderate the relationships among technology assessment, technology planning, and perceived technology effectiveness?

Methodology

Sample

Data for this study was collected from 101 employees who had direct experience with selecting and implementing new technologies within their work units. These respondents were selected from six departments within six different organizations located in Southwestern Michigan. Access to each of these departments was attained through 6 graduate students who were enrolled in a technology management class during the Winter 2 semester of 2002. These students were employed in these departments. Figure 1 presents an overview of the sampling demographics of these departments. Participants within each organization specified within the chart, represent the number of people within a particular work unit who were directly involved with the planning and implementation processes of their new technologies.

Measurement.

All of the departments with the exception of one were involved in the implementation of new information technology (non-mechanical). Examples of the technologies include CAD/CAM software, group decision-making software, and accounting management software.

Figure 1. Demographics of sample

Type of Organization	Size of Work Department	Occupation of Respondents	Number of Respondents
Health Care Insurer	150	Managers and Supervisors	20
Military Logistics	90	Information Systems Admin.	16
Police Agency	108	Managers	10
Manufacturing	30	Managers and Supervisors	9
Engineering* Design	77	Engineers	12
Engineering* Design	52	Engineers	17
University	71	Academic Administration	17

*Indicates two departments from same organization.

One department (manufacturing) had recently installed new numerically controlled machinery. Each respondent completed a questionnaire and was informed to respond to technology implementation, planning, and outcome items as these pertained to the most recent new technology within their departments. For each of the items within the questionnaire, respondents were asked to circle the response value that most indicated their opinion concerning the statement within the item.

Planning

A technology planning scale was developed by combining each of the first five items listed within Figure 2. A five point scale and five anchor response format was utilized for each item in which respondents were asked to describe the extent to which each item was used during the technology planning process. Anchors ranged from "Strongly Agree" to "Strongly Disagree" with corresponding scores of 1 through 5. A value of five was assigned to a "Strongly Agree" response whereas a value of 1 was assigned to a "Strongly Disagree" response. Scores for this scale ranged from 8 to 25, with a median of 17. The alpha reliability for this five-item scale is .86. These items are representative of the domain of ideas pertaining to technology planning delineated within the technology management literature. As such, the items appear to have high content validity. The high alpha reliability for the scale lends further support to the scale having good content validity.

Item 6, the use of a strategic plan for the new technology, was used as a separate one item scale. Factor analyses revealed that it is a separate factor from the created implementation scale. Higher scores on each of the scales indicate a higher orientation toward new technology planning.

Implementation factors

Eight items pertaining to technology implementation were included within the questionnaire (Figure 3). Each item utilized a seven point scale and three anchor response format in which respondents were instructed to rate the extent to which each item was utilized during the most recent technology implementation within their department. Anchors ranged from "Strongly Agree" to "Strongly Disagree" with corresponding scores of 1 through 7. A value of seven was assigned to a "Strongly Agree" response while a value of 1 was assigned to a "Strongly Disagree" response.

Items 1 through 6 were combined to form one implementation scale. Scores ranged from 9 to 41, with a median of 27. The alpha reliability for this scale is .87. Figure 3 illustrates each of the implementation items. These items are representative of the domain of ideas pertaining to technology implementation delineated within the management of technology literature. As such, the items appear to have high content validity. The high alpha reliability for the scale lends further support to the scale having good content validity.

Figure 2. Planning Factors

1. The extent that management had a clear understanding of the objectives of the new technology.
2. The amount of time devoted to planning for the new technology
3. The extent to which there was a clear plan for implementing the new technology.
4. The extent to which there was appropriate planning for costs associated with upgrades for the new technology.
5. The extent to which workers were informed of the new technology before it was implemented
6. The use of a strategic plan for the new technology.

Figure 3. Implementation Factors

1. The extent to which training needs related to the new technology were assessed.
2. Assessment of the new technology's impact on existing personnel functions.
3. Assessment of the organizational changes needed to fully support the new technology.
4. Assessment of the capabilities of the new technology.
5. Assessment of the financial feasibility of the new technology.
6. Assessment of how the new technology would affect job responsibilities.
7. The extent to which there was top management involvement during the implementation process.
8. The use of cross-functional planning and implementation teams.

Items 7 and 8, top-management involvement and the use of cross-functional teams were used as separate one-item scales. A factor analysis revealed that they are separate factors from the created implementation scale. Higher scores on each of the scales indicate a higher orientation toward new technology assessment.

Organizational Climate

This variable was measured by utilizing four dimensions of the Business Organization Climate Index (Payne & Mansfield, 1978), which contains 17 climate dimensions. These four dimensions were selected because they appear to be relevant to the technology implementation concepts of this particular study. Participants were asked to describe the extent to which each of the climate items were indicative of their work department. A four-point scale and four-anchor scale format was utilized with responses ranging from "Definitely True" to a "Definitely False". A score of 4 was attached to a "Definitely True" response and 1 to a "Definitely False" answer. Each dimension consists of eight items. The four dimensions along with their alpha reliabilities, range of scores, and median values are as follows:

Questioning Authority: alpha = .77; range of scores = 10-26; median = 21.00

Administrative Efficiency: alpha = .81; range of scores= 7-26; median = 19.00

Open-mindedness: alpha = .89; range of scores=15-30; median = 21.00

Innovation: alpha = .82; range of scores=15-27; median= 20.50

Higher scores on each of the dimensions indicate a higher orientation towards that aspect of organizational climate. A copy of the items contained within each of these climate dimensions is provided within Appendix A.

Technology Outcomes

Eight items were used to measure perceptions of new technology outcomes. These eight items were used to create three separate technology outcome variables: perceptions of unanticipated new technology outcomes, (3 items) perceptions of improved performance and morale (4 items), and overall perception of whether the new technology accomplished its intended objectives (one item). The scale and response format for the first and third outcome variables are the same for the planning factors. The items along with the alpha reliabilities for the unanticipated technology outcome and accomplish intended objectives variables are as follows:

Unanticipated Technology Outcomes Scale.

Scores for this scale ranged from 3 to 15, with a median of 9. The alpha reliability for this scale is. 83. The high alpha reliability gives evidence to this scale having high content validity.

1. The new technology had an unanticipated impact on employee's job responsibilities.
2. The new technology had an unanticipated impact on employee work stress.
3. The new technology had an unanticipated impact on work processes.

Perceived Performance and Morale Scale (Overall Perceptions).

The performance and morale variable used an eight point scale response structure ranging from 0 to 7 with four anchors. A zero response indicates a very low level of the item, whereas a response of 7 indicates a high level for a specific item. Scores for this scale ranged from 0 to 27, with a median of 14. The alpha reliability for this scale is .88. The high alpha reliability gives evidence to this scale having high content validity. Performance and morale scale consisted

Table 1. The Effect of Perceptions of Technology Assessment and Planning Factors, Organizational Climate Dimensions, on Perceptions of Technology Outcomes

N = 100

	Assessment	Planning	Questioning Authority	Innovation	Open Mindedness	Admin Efficiency	Top Mgt Involvement	Strategic Plan	Cross Functional Teams
Unanticipated Outcomes	-.170*	-.204*	-.210*	.151*	-.251**	-.173*	-.195*	-.142*	.022
Productivity Outcomes	.523**	.480**	.113	.039	.045	-.029	.237**	.402**	.417**
Overall Perception	.347*	.316**	.013	-.115	.044	—.091	.125	.167*	.100

*P ≤.05 **p ≤. 00*

of the extent that the following things occurred as a result of the most recent new technology.

1. Improved productivity
2. Improved product or service quality
3. Enhanced the competitiveness of the organization
4. Improved employee morale

Results

Research Question One:

"What is the nature and strength of the relationship among technology assessment, technology planning factors, and perceived technology effectiveness outcomes?" As revealed in Table 1, the new technology assessment and planning factors are significantly correlated with each of the technology outcome variables. The negative correlations between these factors and unanticipated outcomes indicate that increases in planning and assessment activities decreases the instances of unintentional outcomes that could negatively affect the effectiveness of the new technology. The positive correlations between the implementation and planning factors and the productivity and overall perception variables, shows that engaging in technology planning and assessment processes improves perceptions of its effectiveness.

The study also reveals statistically significant correlations between top-management involvement during the implementation and planning processes and the unanticipated outcomes and productivity criterion factors. This factor, however, is not correlated with employee's overall perceptions of the new technology accomplishing what it was intended to accomplish.

Table 1 shows that the use of cross-functional teams during the planning and implementation processes is significantly correlated only with the productivity outcome variable. An interesting finding shown in Table 1 is that the four climate dimensions are only significantly correlated with the unanticipated outcome variable. No statistically significant correlations are shown with the other two outcome factors.

Table 2. Effect of Organizational Climate Factors on Perceptions of Technology Assessment and Planning Factors, Management Involvement, The Use of Cross Functional Team, and The Use of a Technology Strategic Plan

N = 100

	Questioning Authority	Innovation	Open Mindedness	Admin Efficiency
Assessment	-.001	.160*	.089.	.001
Planning	-.001	-.026	.017	-.133
Top Mgt Involvement	.235**	-.037	.111	.037
Cross Functional Teams	-.033	.151*	.097	.040
Strategic Plan	.165*	-.179*	.108	.698**

* p < .05 **p < .00

Table 3. Correlations Between Technology Assessment and Planning Factors, Controlling for Dimensions of Organizational Climate

N = 100

	Control Factors							
	Questioning Authority		Innovation		Open Mindedness		Admin. Efficiency	
	Assessment	Planning	Assessment	Planning	Assessment	Planning	Assessment	Planning
Unanticipated Consequences	-.17	-.20*	-.19*	-.20*	-.17	-.21*	-.17	-.23*
Productivity Outcomes	. 53**	.48**	.52**	.45**	.52**	.47**	.52**	.48**

* p < .05 **p < .00

Research Question Two

"What is the impact of organizational climate on technology assessment, technology planning, and perceived technology effectiveness outcomes?

Table 2 reveals that relatively few statistically significant correlations between the organizational climate dimensions and the assessment and planning factors are found within this study. However, the data does indicate that each dimension has a different influence on these factors. The questioning authority and administrative efficiency dimensions reveal two relatively strong and statistically significant correlations. The questioning authority dimension is positively related with the amount of top-management involvement. This finding seems to imply that top-management involvement with the implementation and planning processes influences a climate where employees are encouraged to challenge issues surrounding new technology. The strongest correlation is shown between the administrative efficiency and the strategic plan variables. This finding alludes to the idea that departments that are highly structured in terms of having such things as well organized work processes, that sufficiently disseminates information to employees, and that are concerned about work quality, are more oriented toward developing strategies for technology deployment. A related finding is that all but one (open-mindedness) of the organizational climate dimensions correlates with the strategic plan variable.

Table 2 reveals statistically significant correlations between the innovation climate dimension and the technology assessment, the use of cross-functional teams, and strategic plan factors. In short, based upon having the greatest number of statistically significant correlations, one can partially assume that an innovative climate is the most significant factor of the organizational climate dimensions examined within this study. In comparison, a climate of open-mindedness appears to be the least significant.

Research Question Three

"In what ways do organizational climate moderate the relationships among technology assessment, technology planning, and perceived technology effectiveness?"

The results presented within Table 3 indicate that none of the organizational climate factors moderate the relationships between the technology implementation and planning factors and the technology outcome variables.

Discussion

Practical Implications of Study for The Management of Technology

The results of this exploratory study provide confirmation to the somewhat ubiquitous conceptual proposition that the structure of the implementation process and the nature of the planning process influence the effectiveness of the deployment of new technology. Both the assessment and planning factors were shown to be correlated with each of the criterion factors. The practical implication of this finding is that it informs managers that engaging in specific assessment and planning processes of new technology *prior* to its deployment may lead to better technological outcomes. Managers oftentimes approach performance issues within their company through the use of technology. The data from this study strongly alludes to the idea that the "manner" in which new technologies are deployed have a high if not equal degree of saliency than the new technology itself. Particular attention should be focused on the relationship between employee's perceptions of the assessment/planning process and the unanticipated outcomes variable. Unanticipated technological outcomes are very commonplace in most organizations. They also carry a heavy financial and performance cost. To the extent that these perceptions of employees can be translated into valid unanticipated outcomes, the results of this study suggest the following things to management regarding how unanticipated outcomes of new technologies can be reduced:

1. Develop an assessment plan that analyzes such things as the technology's impact on employee training, work processes, and job responsibilities.

2. Develop a technology management strategy that includes not only the technical and financial aspects of the new technology, but also a robust planning process that examines such things as the clarity of the implementation plan, and the extent to which management has a clear understanding of the objectives of the new technology.

3. Make use of cross-functional teams in developing and implementing the technology strategy.

4. Conduct a comprehensive study of the climate of the organization.

These suggested steps should be conducted prior to the deployment of new technologies.

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Appendix A

Questioning Authority

1.____Criticism of policies and practices are encouraged.
2.____When people disagree with a decision, they work to get it changed.
3.____People here are not likely to accept managerial ineptitude without complaint or protest.
4.____When people dislike policy they let it be known in no uncertain terms.
5.____People avoid direct clashes with senior personnel at all costs. (R)
6.____Many people will not hesitate to give strong support to a project that senior management is opposed to.
7.____People who get pushed around here are expected to fight back.
8.____People delight in challenging official polices.

Open Mindedness

1.____Errors and failures are talked about freely so that others may learn from them.
2.____No one needs to be afraid of expressing extreme or unpopular viewpoints here.
3.____The expression of strong personal belief is pretty rare here. (R)
4.____One of the values most stressed here is open-mindedness.
5.____People here tend to be cautious and restrained. (R)
6.____People here speak out openly.
7.____Criticism is taken as a personal affront in this organization. (R)
8.____People here feel free to express themselves impulsively

Innovation

1.____Policy changes occur slowly here and only after considerable deliberation.
2.____Quick decisions and actions are not characteristic of this place. (R)
3.____Thinking of alternative ways in which problems might be solved or things done differently is encouraged here.
4.____New ideas are always being tried out here.
5.____The latest scientific discoveries make a few changes in the way this place is run.
6.____Unusual or exciting plans are encouraged here.
7.____There are conventional ways of doing things here which are rarely changed. (R)
8.____Programmes here are quickly changed to meet new conditions.

Administrative Efficiency

1.____Work is well organized and progresses systematically from week to week.
2.____Most activities here are planned carefully.
3.____People get sufficient notice of policy decisions to able to plan their own work accordingly.
4.____Work is checked to see if it is done properly and on time.
5.____The flow of information downward is smooth and efficient.
6.____There is no wasted time here; everything has been planned right to the minute.
7.____There is a specific place for everything and everyone here.
8.____The quality of work is rated or evaluated frequently.

(R) Denotes that score was reversed.

Cell Phones in American High Schools: A National Survey

S. John Obringer and Kent Coffey

Abstract

A survey instrument to determine school policy and practice regarding cell phone use by teachers and students was developed using a literature review, a panel of experts, and then a pilot study with typical respondents. The survey was mailed out randomly to 200 high school principals representing all 50 states. The return rate was 56 percent with responses coming from all regions of the country. The findings include: (1) A majority of high schools (districts) had policies in place, (2) parents generally supported the school's cell phone use policy, (3) classroom teachers used cell phones at school for non-school-related business, (4) disciplinary action for inappropriate cell phone use by students ranged from a mild reprimand to confiscation of the cell phone, and (5) the potential misuses of camera phones in high schools has not been fully addressed by many schools. Because cell phone use has become a part of American culture, and this technology is constantly being upgraded, school or district policies should be revamped periodically to stay abreast of this phenomenon. Specific recommendations are put forward.

Technology and Policy

The expansion of cell phones during the past decade has made it commonplace for students and teachers to have cell phones in the school setting. Data from 2004 indicated that 58 percent of 6th –12th graders have a cell phone and 68 percent of students regularly bring cell phones to school ("NetDay's 2004," 2005). The number of cell phones in the United States rose from 1.2 million in 1987 to 145 million in 2002 (Danforth, 2003). No reliable estimate has been found for teachers, but anecdotal data indicate that a majority of classroom teachers have access to a cell phone.

Educators, administrators, and school boards are concerned about many issues related to the use of cell phones at school: distractions to the learning environment (Gilroy, 2003), cheating on tests and quizzes through text messaging (Meer, 2004), cyber bullying students by sending nasty messages ("Bullying shoots," 2005), phoning in bomb threats (Danforth, 2003), using calculator functions to cheat on math tests (Hurst, 2004), and jamming phone lines in the event of an actual emergency ("Calling cell," 2002). Many parents believe that cell phones would be especially useful in an emergency situation. However, 68 percent of police officers assigned to schools believe that cell phone use would actually hamper school safety in a crisis (National School Safety and Security Services, 2005).

In addition, 21 percent of students who bring cell phones to school have video/photo capabilities on their phones (Carroll, 2004). These video/photo capabilities present additional concerns. One issue is that camera phones can be used to take photographs of quizzes or exams and transmit them to classmates (Hurst, 2004). An especially egregious problem is the use of camera phones to take embarrassing photographs of classmates in private areas (e.g., restrooms or locker rooms) and share them with others electronically. This technology raises legal issues of privacy, sexual harassment, and theft of proprietary information (Carroll, 2004). This rapidly evolving problem has led the Montana High School Association to strongly recommend that schools develop policies to prohibit the use of camera phones, especially in locker rooms (Carroll, 2004).

Cell phones also do offer advantages. Parents want their children to have cell phones due to their involvement in activities (e.g., athletics) or to assuage safety concerns (Dianis, 2004). They can be important for school supervisors who are at crossings or playgrounds who may need to call for help quickly in case of an emergency (Galley, 2000), and a cell phone may facilitate students in planning after-school work and other activities ("The right to ring," 2004). Additionally, the camera phone can have a number of educational benefits. The camera capability can be used to record field trips or school events, to enhance reports with visuals, and to develop photo essays (Dyrli, 2004).

The purpose of this study was to measure, through a national survey, administrators' perceptions of cell phone issues and related policies for students and teachers. Many administrators

and school board members are familiar with the cell phone policies of their own districts as well as surrounding districts. This study also allows them to compare their policies with national trends.

Methodology

A literature review was conducted to determine the issues and controversies associated with the use of cell phones in school settings, resulting in a large number of potential items identified for possible inclusion. The investigators then developed a draft of the survey. A panel of experts (building principals) was assembled to review the draft survey. The panel consisted of 11 principals who were selected to represent both rural and suburban settings along with small and large schools. The panel of experts provided feedback on the clarity, purpose, and comprehensiveness of the survey. Using their feedback, the survey was modified and a relatively small pilot study was conducted using an intact group of 15 educators associated with the university. The pilot study revealed no problems with the survey instrument. The survey was then finalized with 19 items, divided into three types of responses: yes/no, agree/disagree, and short answer.

The survey was mailed to high school administrators in all 50 states. Schools and administrators were randomly selected from *Patterson's American Education* which lists every U.S. school and its current address, grouped by state. Using a random number generator, four high schools from each state were chosen, and a survey was mailed to the principal of each chosen school. A follow-up survey was mailed to schools that didn't respond to the first mailing.

The statistic used for this study was a chi-square with a .01 level of significance. For questions 1-8, the chi-square tested goodness of fit using the yes/no responses. For questions 9-15, two items (strongly agree/agree) were grouped together, and the other two items (strongly disagree/disagree) were grouped together. In this case, the chi-square tested goodness of fit using the agree/disagree responses. For questions 16-19, the open-ended responses, these were tallied to determine any common themes or patterns.

Results

The initial mailing yielded 77 valid responses. The follow-up mailing yielded 35 additional responses for a total of 112 responses. This represents a response rate of 56 percent. The returned surveys represented 46 states (12 southern states, 11 northern states, 11 midwestern states, 10 western states, and 2 noncontiguous states).

Questions 1-8

As shown in Table 1, four of the eight yes/no questions met the .01 level of statistical significance and are examined below:

Question 1: Does your school/district have a written policy regarding cell phones?

Table 1. Responses of High School Principals to Information Questions

	Yes	No	Sig.
1. Does your school/district have a written policy regarding cell phones?	84 percent	16 percent	**
2. Does your school permit cell phone use by teachers?	78 percent	22 percent	**
3. Does your school permit cell phone use by students?	24 percent	76 percent	**
4. Does your school allow students to leave cell phones on silent mode?	47 percent	53 percent	
5. Do teachers have access to a hard-wired phone in their classrooms?	56 percent	44 percent	
6. Do you believe that teachers who utilize cell phones use them only for school-related business?	6 percent	94 percent	**
7. Does your school district supply cell phones for administrators?	54 percent	46 percent	
8. Do bus drivers have cell phones supplied by the school/district for safety?	47 percent	53 percent	

**$p < .01$

Eighty-four percent of the responding principals indicated that their schools did have a written policy on the use of cell phones.

Question 2: Does your school permit cell phone use by teachers? Seventy-eight percent of the responding principals indicated that their schools allow teachers to use cell phones.

Question 3: Does your school permit cell phone use by students? Only 24 percent of the responding principals indicated that their schools allowed students to use cell phones.

Question 6: Do you believe that teachers who use cell phones use them only for school-related business? Only 6 percent of the responding principals indicated that cell phones were used by teachers primarily for school-related business.

Questions 9-15

As shown in Table 2, all seven of the agree/disagree questions met the .01 level of statistical significance. The questions are examined below:

Question 9: Direct instructional time is lost due to cell phone use by teachers. Twenty-two percent of responding principals agreed with this statement, whereas 78 percent disagreed with the statement.

Question 10: Teachers having cell phones improves school safety. Seventy-three percent of responding principals agreed with this statement, whereas 27 percent disagreed with the statement.

Question 11: Teachers having cell phones facilitates prompt teacher-parent communication. Thirty-three percent of responding principals agreed with this statement whereas, 67 percent disagreed with the statement.

Question 12: Major incidents of violence (e.g., Columbine High School) influenced this school's/district's policy on cell phones. Twenty-one percent of responding principals agreed with this statement while 79 percent disagreed with the statement.

Question 13: Parents are supportive of the school's overall cell phone policy. Eighty-two percent of responding principals agreed with this statement, whereas 18 percent disagreed with the statement.

Question 14: Cell phone use by teachers adversely affects the sustained focus of teachers on the classroom/students. Thirty-one percent of responding principals agreed with this statement while 69 percent disagreed with the statement.

Question 15: Text-messaging features are a problem/potential problem during tests and examinations. Eighty percent of responding principals agreed with this statement while 20 percent disagreed with the statement.

Table 2. Responses of High School Principals to Judgement Questions

	Agree	Disagree	Sig.
9. Direct instructional time is lost due to cell phone use by teachers.	22 percent	78 percent	**
10. Teachers having cell phones improves school safety.	73 percent	27 percent	**
11. Teachers having cell phones facilitates prompt teacher-parent communication.	33 percent	67 percent	**
12. Major incidents of violence (e.g. Columbine High School) influenced my school's/district's policy on cell phones.	21 percent	79 percent	**
13. Parents are supportive of the school's overall cell phone policy.	82 percent	18 percent	**
14. Cell phone use by teachers adversely affects the sustained focus of teachers on the classroom/students.	31 percent	69 percent	**
15. Text-messaging features are a problem/potential problem during tests and examinations	80 percent	20 percent	**

**$p < .01$

Questions 16-19

The patterns and themes of the four open-ended questions are presented below:

Question 16: Principals were asked, "What is the exact policy if a student's cell phone rings during class?" By far, the most common response was immediate confiscation of the cell phone. The penalties were quite broad ranging from confiscation for the remainder of the class period to confiscation for the entire semester. Other reported consequences included: Saturday detention, 3-day suspension, and cell phones returned only to parents.

Question 17: Principals were asked, "What is the exact policy if a teacher's cell phone rings during class?" For most respondents, the school's cell phone policy did not address this issue. The second most frequent response was some type of administrative warning.

Question 18: Principals were asked, "Approximately what percent of your school's teachers, if any, misuse cell phones for personal business?" The percentages of teacher misusing cell phones during instructional time ranged from 0 percent to 100 percent. However, the vast majority of principals rated the problem at 5 percent of teachers or less.

Question 19: Principals were asked, "How has your school addressed the issue of camera phones affecting students' privacy (e.g., in a school locker room, at a nurse's office, or for uploading videos to the web) or being used by students to take photos of a test for friends?" The most common response was that students should not have a phone out during school hours. The second most common response was that many schools have not yet addressed the potential misuse of camera phones.

Discussion

Cell phones have become an integral part of our society, and like most technologies, they have both positive and negative aspects. With technology expanding so rapidly, it can outpace American schools' ability to make appropriate policies.

An examination of the responses to the information questions found in Table 1 revealed the following factors. Almost all schools/districts have a written policy regarding cell phones; however, these policies primarily address students' use of cell phones. As cell phone features increase (e.g., storing documents on them), the policy will likely need to be revisited. Almost all schools permit cell phone use by teachers. This is potentially problematic in that many companies (e.g., Microsoft) are either banning or putting significant restrictions on employee's use of a cell phone during working hours. Perhaps the most common feature of school cell phone policies is that students are prohibited from using the devices at school, and in some cases even bringing cell phones to schools is strictly disallowed. Responding principals believed that teachers used cell phones for purposes other than school-related business. This would be acceptable provided the calls are made during their planning/free periods, at lunch, or after the school day ended. Optimally, however, personal business should be performed after official school hours.

The judgment questions in Table 2 revealed the following factors. Responding principals believed that instructional time is not lost because of teachers' use of cell phones. Teachers who possess cell phones can improve school safety. This issue would be especially true when teachers perform outside-of-the-classroom duties. They could rapidly contact school and public safety officials in the event of an accident or emergency. Teachers having cell phones does not facilitate parent-teacher communication. This is not surprising since teachers have had regular access to telephones for many years when it became necessary to contact a parent. The addition of cell phones probably does not change this dynamic. Major incidents of violence (e.g., Columbine High School) did not influence a school district's policies on cell phones. It is likely that many school districts developed cell phone policies as the use of cell phones became pervasive in the culture and began to have an impact on students' work and the classroom. School safety was probably only one factor, among many, that led to the development of cell phone policies. Parents are generally supportive of the school's cell phone policy. Most district policies restrict cell phone use by students during the school day, and parents seem to believe this is appropriate. Parents seem to

agree that cell phone use could be a significant distraction during instructional time. Sustained focus of teachers on students is not affected by the teacher's own use of a cell phone. This correlates with the findings on the previous question concerning the potential affect that a teacher's cell phone use can have on instructional time. Text messaging features are problematic during tests. Text messaging can take place without teachers being aware of it because phones are becoming smaller and more easily obscured. In addition, many students are extremely rapid and proficient at text messaging and could share answers on both multiple choice and essay type items.

The open-ended questions revealed an interesting range of responses. Some conclusions that may be drawn include the following: in general, many district administrators have codified their response when a student's cell phone rings during class, but they have not addressed this same issue for teachers; principals possibly may be hesitant to address the staff's use of cell phones because of their own personal use of this technology; and in many districts, the issue of camera phones have simply not been addressed.

Although not statistically significant, it was somewhat surprising on the basis of Question 8 that the number of districts that do supply cell phones to bus drivers ($n = 48$) was smaller than the number of districts that do not supply cell phones to bus drivers ($n = 55$). Time on a school bus is clearly a time when the students are less supervised and away from established methods of communication. If a school district were extremely conscious about safety issues, bus transportation would likely be a key area where cell phones could potentially affect students' safety.

Cell phones are now an accepted part of the school culture for teachers and students. Most schools or districts *do* have policies in place, and principals believe that parents are generally supportive of the approved policies. The findings in this study run contrary to a number of national incidents in which parents opposed the school's restrictive policy on cell phone use (e.g., Broward County, FL; Salinas, CA; Crosby, TX). Parents seem to believe that cell phones improve the safety of their children, but this may be more an issue of culture and convenience.

The dichotomy between a principal's perceptions that cell phones are used by teachers for issues other than school-related business and their perception that this has no impact on instructional time is difficult to reconcile. It seems unlikely that teachers' use of cell phones for personal business would not to some extent compromise a sustained focus on instruction. In addition, anecdotal evidence suggests that many teachers make and receive phone calls during class time.

The fact that almost all principals listed a specific consequence for a student's cell phone ringing during class indicates that this is an ongoing problem. A student's cell phone ringing during class time would almost certainly have a negative impact on instruction.

Industry trends indicate that within the next year a majority of cell phones will have photo capability as a standard feature. Because the survey revealed that a number of schools have not addressed the issue of camera phones in their current policy, this is an area that will have to be dealt with in the near future.

The capabilities of cell phones have been evolving quite quickly. During the past few years, cell phones have gone from a simple communication tool to include a calculator, a clock with alarm, games, a video function, a calendar, an FM radio, a music player, a picture ID, streaming multimedia, a speaker phone, a hard drive, and a camera with flash. If cell phones mimic other technologies, these features will only increase. Schools will be pressed to stay ahead of this fast-moving technology. A policy on cell phone use made only a few years ago may be outdated by today's technology. As new technology emerges, policies must grow and change as well. This presents an ongoing challenge for school leaders.

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Appendix 1

For questions 1-8 circle Yes or No:

Yes	No	1.	Does your school/district have a written policy regarding cell phones?
Yes	No	2.	Does your school permit cell phone use by teachers?
Yes	No	3.	Does your school permit cell phone use by students?
Yes	No	4.	Does your school allow students to leave cell phones on silent mode?
Yes	No	5.	Do teachers have access to a hard-wired phone in their classrooms?
Yes	No	6.	Do you believe that teachers who utilize cell phones use them only for school-related business?
Yes	No	7.	Does your school district supply cell phones for administrators?
Yes	No	8.	Do bus drivers have cell phones supplied by the school/district for safety?

For questions 9-15 circle SA for strongly agree, A for agree, D for disagree and SD for strongly disagree:

SA A D SD	9.	Direct instructional time is lost due to cell phone use by teachers.
SA A D SD	10.	Teachers having cell phones improves school safety.
SA A D SD	11.	Teachers having cell phones facilitates prompt teacher-parent communication.
SA A D SD	12.	Major incidents of violence (e.g. Columbine High School) influenced my school's/district's policy on cell phones.
SA A D SD	13.	Parents are supportive of the school's overall cell phone policy.
SA A D SD	14.	Cell phone use by teachers adversely affects the sustained focus of teachers on the classroom/students.
SA A D SD	15.	Text-messaging features are a problem/potential problem during tests and examinations.

For questions 16-19 please answer briefly:

16. What is the exact policy if a student's cell phone rings during class?
17. What is the exact policy if a teacher's cell phone rings during class?
18. Approximately what percentage of your school's teachers, if any, misuse cell phones for personal business?
19. How has your school addressed the issue of camera phones impacting student privacy (e.g. in school locker room, nurse's office, uploading videos to the web, etc..) or students taking photos of a test for friends?

The Journal of Technology Studies

Training Transfer between CD-ROM Based Instruction and Traditional Classroom Instruction

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Abstract

Many research studies on the effect of organizational factors on training transfer have been conducted, but few studies have considered the effect that different training delivery methods have on training transfer. This study sought to identify if there is any difference in the perceived transfer of training between traditional classroom instruction learners and computer-based instruction learners. Other demographic variables (e.g., years of work experience, age, level of education, years of experience as a supervisor, online course experience, and gender) also were investigated to assess their influence of the transfer of training. The study results revealed that training delivery methods did not make any significant difference in the transfer of training while several demographic variables were associated with significant differences in some of the five subcategories of training transfer construct (organizational support, supervisory support, peer support, motivation, and self-efficacy).

As globalization increasingly affects the workplace, today's organizations are facing severe competition from around the world. Among many performance solutions to equip organizations and their employees with competitive organizational and individual competencies to lead the global business environment, learning has been considered one of the most promising solutions that strategically addresses performance issues at the individual, group, and organizational level (Poell & Krogt, 2003). For private sector organizations, the return on training investment has been a critical issue to verify the impact that training has on improved organizational performance (Phillips, 1997). As advancements in learning and performance technologies have created a strong impetus to use technology-driven learning solutions, more organizations utilize cost-saving learning technologies to improve performance in all domains of the organization (Clark, 1999). As a technology-driven learning solution, computer-based instruction (CBI) has been one of the most frequently used methods proven to be a cost effective and yet instructionally sound delivery method for learning (Blotzer, 2000; Wilson, 2000).

Millions of dollars are spent each year to deliver training programs in the workplace (Greengard, 1999). In a recent benchmarking survey, it has been estimated that the corporate expenditure for training in the United States was $3.5 billion during 2002 (Levis, 2002). It is still unclear, however, what types of training methods have produced tangible results for organizations. Traditionally, instructor-led classroom training has been the dominant style of training delivery (Evuleocha, 1997; Lawson, 1999). Other studies indicate that technology-driven training programs continue to expand in public as well as private organizations (Filipczak, 1996). With more investment being made on technology-driven training programs, this would seem an appropriate time to measure whether it would be a better alternative to traditional classroom training.

Problem Statement

Computer-based Instruction (CBI) has been at the forefront of discussion among many researchers because of its cost effectiveness for learning and performance improvement (Mottl, 2000; Wilson, 2000; Lawson, 1999; Rand, 1996). Mottl (2000) asserted that traditional classroom instruction costs approximately $75 an hour, where as CBI costs about half the traditional classroom instruction costs. Due to this cost ratio, the use of traditional classroom instruction declined, and technology-driven courses are predicted to rise. According to a recent survey, the volume of traditional classroom training decreased from 77 percent to 72 percent between 2001 and 2002 and training delivery via learning technologies increased from 10.5 percent to 15.4 percent between 2001 and 2002 (Thompson & Wellins, 2003). This kind of trend raises critical questions about the effectiveness and ability to transfer CBI compared to traditional classroom instruction (Filipczak, 1996; Mottl, 2000; Maul & Spotts, 1993; & Greengard, 1999).

There is an evident gap in the knowledge base when comparing CBI to traditional classroom instruction as it pertains to transfer of training. Since the advent of CBI, abundant amounts of research studies on technology-based training programs and their effectiveness have surfaced (Wilson, 2000; Greengard, 1999;

Fister, 1998; Filipczak, 1996; Rand, 1996). These studies document that the use of CBI in education results in higher learning retention rates (Kerr, 1998), higher return on investment (Allen, 1996), reduced learning time (Maul & Spotts, 1993), and reduced costs for training delivery (Lawson, 1999) compared to the use of traditional classroom instruction. Because traditional classroom training is still the dominant means of instruction in the corporate environment, little research has been done to compare the two types of training (CBI versus traditional classroom instruction) and measure the perceived barriers for effective transfer of training (Evuleocha, 1997; Lawson, 1999; Filipczak, 1996). Most of the research on CBI and traditional classroom instruction concentrated on the mere advantages and disadvantages of both training methods. Little evidence has been shown as to the transferability of CBI compared to the traditional classroom instruction. A comparison between CBI and traditional classroom instruction is necessary to differentiate which type of training would produce more appropriate results for the transfer of training that results in performance improvement.

Research Questions

1. The purpose of this study is to determine the motivational factors, support factors, self-efficacy, and demographic factors that affect the employees at a paper-production company in the United States and their intentions to transfer training as measured by the Training Performance Transfer Instrument (TPT). Several research questions were developed to address the research purpose.

2. Is there a significant difference in the transfer of training between the CD-ROM-based learners and traditional classroom-based learners based on the five training transfer variables of organizational support, supervisory support, peer support, motivation, and self-efficacy?

3. What demographic variables (e.g., age, job title, years of full-time experience, level of education, years of experience as a supervisor, and gender) affect learners' perceived training transfer?

Theoretical Framework

Training Transfer Models and Variables

Training transfer studies have focused on several meaningful constructs including individual and organizational variables that are believed to promote or hinder the transfer of learning in organizational settings. Baldwin and Ford (1988) proposed a training transfer construct in three domains of transfer: training inputs, training outputs, and conditions of transfer. Parry (1990) described three factors for improving training transfer: personal factors, instructional factors, and organizational factors. Foxon (1997) believed that transfer of training was a process rather than an outcome or product of training. Foxon's transfer model is expressed in terms of initiation of transfer, frequency of transfer, and overall transfer. This model contains several transfer factors: organizational climate, motivation to transfer, manager support, peer support, and action planning. Holton (1996) developed the Learning Transfer Systems Inventory (LTSI) expressing training transfer as a function of ability, motivation, and environmental factors at three outcome levels: learning, individual performance, and organizational performance. Geilen (1996) presented another training transfer construct containing transfer variables of training design characteristics, trainee characteristics, and work environment characteristics.

Apart from these integrated models of training transfer, other research studies were conducted to verify independent variables in work system factors and people factors (Rainey, 1993), organizational culture (Tracey, Tannenbaum, & Kavanagh, 1995), opportunity to use training (Ford, Quinones, Sego, & Sorra, 1992; Lim, 2001; Clarke, 2002), match between training and organizational goals (Montesino, 2002), availability of mentor (Richey, 1990), goal setting (Gist, Bavetta, & Stevens, 1991), identical elements between training and work setting (Garavaglia, 1993), and support from peers and supervisors (Ford et al., 1992; Tracey, Hinkin, Tannenbaum, & Mathieu, 2001). From the review of many transfer studies, the concept of transfer of training seems to contain some meaningful themes to expand the research study. First, the concept of transfer of training can be viewed either as process or outcome. Second, various transfer variables either promote or hinder the transfer process. The transfer variables can be categorized into personal factors (learning readiness, self-efficacy, goal setting, motivation, etc.),

instructional factors (transfer design, identical content, transfer strategies, action learning, etc.), work factors (opportunity to use training, availability of tools, availability of mentor, etc.), and organizational factors (peer support, supervisor support, reward system, organizational culture, etc.). Third, these transfer variables interact with each other to form situation-specific force of training transfer either with negative or positive influences.

Computer-based Instruction and Learner Variables

A CBI program generally includes tutorials, practice exercises, and case studies with more sophisticated interactions incorporating game-based activities and business simulations (Rand, 1996). Compared to traditional classroom instruction, several advantages of CBI include consistent learning content, anytime and anywhere learning, interactive learning to promote learners' interest, automated record keeping and tracking, multimedia content, self-paced learning, and reduced training time and costs (Kerr, 1998; Lawson, 1999). Some shortcomings of CBI, however, also exist. These include the lack of human aspects in interaction (Sullivan, 1998), ineffective hands-on practices and lack of instructor feedback requiring self-motivation for learning (Rodriguez, 1999), difficulty to update content change (Fister, 1998), lack of peer interaction (Rand, 1996), and computer literacy issues (Lawson, 1999). Despite these weaknesses of CBI, Goldstein (1998) advocates that CBI systems are learner-centered-environments that provide self-paced learning and interactive training sessions satisfying a user's learning style. Several features of CBI, such as video, audio, and interactive testing, are believed to maintain an individual learner's attention and can improve learning compared to traditional classroom instruction.

Among several learner variables that affect the transfer of training, motivation to transfer and self-efficacy were identified as ones that play a major role in learning transfer (Machin & Fogarty, 1997; Foxon, 1997; Facteau, Dobbins, Russell, Ladd, & Kudish, 1995). First, self-efficacy refers to one's beliefs and feelings of self-worth regarding how well he/she can perform and be responsible in a learning task (Bandura, 1994; Foster, 2001). Bandura posited that confidence in one's ability for success will affect the learner's initial willingness to try, individual persistence, and the level of personal investment. For concepts of motivation, Pinder (1998) described work motivation as a set of internal and external forces that initiate work-related behavior and determine its form, directions, intensity, and duration. Ambrose and Kulik (1999) claimed that there were two types of motivational forces: environmental forces (organizational reward systems, the nature of work being performed) and personal forces (individual needs and motives) on work-related behavior. Herzberg's two-factor theory of motivation distinguishes between intrinsic (motivators) and extrinsic (hygiene) factors (Herzberg, 1982). Other job-related motivation factors include opportunities for promotion and job challenges (Kaplan, Jayaratne, & Chess, 1994). Motivation is also influenced by such factors as trainees' confidence in their ability to use the new skills, by their perception of the relevance of the training to their work, by their ability to identify work situations where using the skills would be appropriate, and by their belief that using the new skill will improve their job performance (Baldwin, Magjuka, & Loher, 1991; Holton, 1996; Noe, 1986; Tannenbaum, Mathieu, Salas, & Cannon-Bowers, 1991). A study conducted by Machin and Fogarty (1997) examined several individual characteristics (self-efficacy, motivation to transfer, training reactions, goals for transfer, and commitment to transfer goals) and concluded that self-efficacy and motivation to transfer training were significantly related to positive transfer intentions.

Methodology

This study utilized a quantitative approach to compare differences in perceived transfer of training between CD-ROM-based learners and traditional classroom learners. The sample for this study was the full-time employees of a branch mill of a paper-production company located in a southeastern state. The entire population of employees at the mill was surveyed. This sample was chosen based on its accessibility to the researchers. Approximately 370 questionnaires were distributed, and 278 responses were returned, which equaled a 75 percent return rate. The survey instruments were distributed in person at the morning and evening shift change meetings. Mail delivery was also used to reach employees who could not be contacted during team meetings. After two weeks, a follow-up e-mail was sent out to participants who had not finished the survey. Traditional learners were differentiated from CD-ROM-based learners

based on the amount of CD-ROM-based experience the person declared on his or her survey.

From a review of literature to find the most suitable instrument for the purpose of this study, three instruments were selected and compared: the Trainer's Assessment Proficiency (TAP), the Wechsler Memory Scale III, and the Training Performance Transfer (TPT). After further investigation of the three instruments, the researchers concluded that the TPT was a better fit for the purpose of this study. This instrument is subdivided into two sections. The first part consists of five sub-scales that included 42 performance statements to determine the identified factors or barriers in the transfer process. These five subscales are: (a) supervisor support, (b) organizational support, (c) peer support, (d) self-efficacy, and (e) motivation to transfer. The instrument uses a Likert-type scale ranging from one to five (1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Usually, and 5 = Always). The second part of the survey consists of eight demographic questions regarding age, gender, years of full-time work experience, job title, years of experiences as a supervisor, CD-ROM course experience, online course experience, and level of education. The TPT instrument was used with consent and permission. Data analysis revealed the Cronbach's alpha for the five sub-scales were all higher than .74.

The data analysis utilized descriptive statistics to interpret employees' demographic information and calculate the mean scores of the TPT's sub-scales. The independent variables in this study were the employees' demographic information. The dependent variables consisted of the five sub-scales that either inhibited or promoted the transfer of training as measured by the TPT instrument. A univariate analysis of variance (UNIANOVA) test was conducted to analyze the employees' perceptions of the transfer of training process according to the five descriptors (self-efficacy, peer support, organizational support, supervisor support, and motivation). The Tukey Honestly Significant Difference (HSD) post hoc test was used to analyze any differences that persisted among the eight demographic variables (age, gender, years of full-time work experience, job title, years of experiences as a supervisor, CD-ROM course experience, online course experience, and level of education).

Background Information about the Company

The paper mill, which was used for this study, is one of many paper mills located in the United States and abroad by this particular paper-production company. The mill was designed using high-performance work teams (HPWT). This type of work design allows teams and individuals to be more actively involved in the day-to-day decision-making process. The mill is operated with 12-hour rotating shifts in order for the mill to run 24 hours a day, 365 days per year. The employees of the mill have received traditional classroom training in the areas of team building, new hire orientation, leadership, and many other topics. All employees of the mill received competency-based training that combines traditional classroom instruction with on-the-job instruction. Some employees have received instruction on OSHA safety training via CD-ROMs and web-based instruction to teach the purchasing system at the mill.

Findings

Two research objectives were set for this study. The first objective was to identify differences that might exist between traditional classroom learners and CD-ROM-based learners based on the five descriptive factors and their perceptions of transfer of related training. The second objective was to determine any differences that might exist between traditional classroom learners and CD-ROM-based learners based on the eight demographic factors.

Demographic Characteristics

The demographic information collected for this study includes age, gender, years of full-time work experience, job title, years of experiences as a supervisor, CD-ROM course experience, and level of education. Data analysis revealed that 137 (49.3%) participants did not have any CD-ROM course experience, 80 (28.8%) participants had less than 20 hours of experience, and 61 (21.9%) participants had more than 20 hours of course experience. For the purpose of this study, the 141 respondents who had less than 20 hours and more than 20 hours were defined as CD-ROM-based learners (50.7% of all respondents). Regarding job title, 181 (65.1%) were machine operators, 41 (14.7%) were maintenance personnel, and 56 (20.1%) were resource personnel respectively. For the number of years of full-time work experience at the company, 43 (17.3%) respondents had less than one year of experience, 78 (28.1%) had one to five years of experience, and 152 (54.7%) had five or more

years of experience. In terms of level of education, there was only one respondent (0.4%) who had less than a high school diploma, 184 (66.2%) attained a high school degree or GED, 55 (19.8%) had two years of college or associate's degree, 27 (9.7%) had a bachelor's degree, and 11 (4.0%) had completed at least some graduate work. For the years of experience as a supervisor, 149 (53.6%) of the respondents reported no experience, 42 (15.1%) had less than two years of experience, 69 (24.8%) respondents had between two and eight years, and 18 (6.5%) had more than eight years of supervisory experience. Responses to gender revealed that there were 62 (22.3%) female and 216 (77.7%) male participants. The age of the respondents was also examined. Among all respondents, 22 (7.9%) were 20 to 26 years of age, 84 (30.2%) were between the ages of 27 and 35, 167 (60.1%) were between the ages of 36 and 55, and 5 (1.8%) were over 55 years old.

Difference in the Transfer of Training Between the Two Delivery Formats

In order to examine if there is any significant difference in the perceptions of transfer of related training between CD-ROM-based instruction and traditional classroom instruction based on the five subcategories of supervisor support, peer support, self-efficacy, organizational support, and motivation, a Univariate Analysis of Variance (UNIANOVA) was calculated. The analysis revealed there were no significant differences between CD-ROM-based learners and traditional classroom learners for the five subcategories. Table 1 shows the Cronbach's Alpha scores for the five subcategories.

Effect of Demographic Variables on Training Transfer

In order to investigate if there is any significant difference in perceptions of the transfer of training as measured by the TPT survey based on the eight demographic variables used in this study, a UNIANOVA was conducted. From the data analysis, the demographic variable of job title and years of work experience registered a significant difference for the organizational support. For supervisory support, job title, years of work experience, and level of education indicated significant differences for the transfer of training. For peer support, only years in work experience showed a significant p-value. For motivation, job title, years of work experience, years of experience as a supervisor, and age indicated a significant difference. Lastly, for self-efficacy, job title, years of work experience, level of education, and age were found to have significant p-values. These findings are summarized in Table 2.

The Tukey HSD test was used to explore any further differences within some the subcategories of the demographic variables (age, years of full-time work experience, job title, and educational level). When the subcategories of the years of full-time work experience were compared with organizational support, respondents with less than one year perceived a significantly higher organizational support than either those with one to five years or those with more than 5 years of work experience. Respondents with one to five years of work experience also indicated a significant higher mean score for organizational support than those with over 5 years of work experience. For supervisor support, those with more than five years of experience were significantly different in their perceptions of supervisor support than respondents with less than one year and one to five years of experience. With respect to peer support, respondents with more than five years of experience reported significantly different perceptions of peer support compared to those with less than one year of experience and those with one to five years of experience. The Tukey HSD compared years of full-time work experience to motivation looking for significant differences. The analysis found that respondents with more than five years of experience were significantly different in their perceptions of motivation from those with less than one year of experience and those with one to five years of experience. Regarding

Table 1. Cronbach's Alpha for the Five Subcategories

	Organizational Support	Supervisor Support	Peer Support	Motivation	Self-Efficacy
Questions	1, 5, 6, 8, 11, 12, 16, 22, 29, 31, 35, 37	4, 9, 15, 20, 24, 27, 32, 33, 40, 41	10, 21, 34, 42	2, 13, 19, 26, 28, 30, 36, 38, 39	3, 7, 14, 17, 18, 23, 25
Cronbach's Alpha	.7427	.9214	.8561	.7146	.8590

Subcategories		Job Title	Yrs. Wrk. Exp.	Edu. Level	Yrs. Exp. Sup.	Age
Organizational Support	Sig.	.004*	.000*	.056	.575	.493
	F value	5.528	10.900	2.340	.664	.803
Supervisory Support	Sig.	.006*	.000*	.013*	.354	.442
	F value	5.248	12.782	3.235	1.090	.900
Peer Support	Sig.	.676	.004*	.332	.371	.069
	F value	.392	5.563	1.154	1.051	2.392
Motivation	Sig.	.000*	.000*	.139	.046*	.026*
	F value	14.168	13.170	1.754	2.708	3.152
Self-efficacy	Sig.	.026*	.025*	.047*	.067	.004*
	F value	3.718	3.736	2.446	2.412	4.546

*Significance at .05 level.
Note. Yrs. Wrk. Exp. = Years of full-time work experience, Yrs. Exp. Sup. = Years of experience as a supervisor.

Table 2. UNIANOVA for the Demographic Variables and the Transfer Subcategories

age, responses of those between the ages of 20–26 were significantly different than those ages 27–35 and those 36–55. Those ages 27–35 had significantly different responses from those ages 20–26. Respondents ages 36–55 were significantly different in their perceptions of motivation than respondents ages 20–26.

With regards to self-efficacy, respondents ages 20–26 were significantly different in their perceptions of self-efficacy as compared to those ages 27–37 and those 36–55. Those who were 37–55 were significantly different than those ages 20–26. Respondents with 36–55 reported significant differences in perception than those ages 20–26. Respondents with years of full-time work experience reported significant differences in their perceptions of self-efficacy. Respondents with less than one year of experience felt significantly different than respondents with more than five years of experience. Those with more than five years of experience felt significantly different than those with less than one year of experience. In job title, there were significant differences reported in the respondents' perceptions of self-efficacy between machine operators and resource personnel. Table 3 presents the findings from the Tukey HSD tests.

Conclusion and Discussion

This study has sought to identify differences that might exist between traditional classroom learners and CD-ROM-based learners based on their perceptions of transfer of training for the five descriptive factors. It also tried to determine the effect of the eight demographic variables on the five training transfer factors. Several conclusions could be drawn from the study's findings. First, the study revealed there is no significant difference in the perception of the transfer of training between the employees who

Table 3. Tukey HSD Tests for the Subcategories of the Demographic Variables

Demographic Variables	Comparison Groups		Training Transfer Variables				
			OR Support	Supervisor Support	Peer Support	Motivation	Self-efficacy
Job Title	Machine	Resource	.230	.099	.123	<.001*	.006*
	Resource	Maintenance	.324	.193	.087	.031*	.336
Yrs. Wk. Exp.	> 1 year	1-5 years	.015*	.071	.215	.068	.420
	> 1 year	< 5 years	.001*	<.001*	<.001*	<.001*	.021*
	1-5 years	< 5 years	.030*	.004*	.042*	.008*	.278
Age	20–26	27–35	.082	.557	.343	.007*	.028*
	20–26	36–55	.239	.463	.175	.006*	.012*

* Significance at .05 level.

had traditional classroom training and those with CD-ROM-based training. This implies that delivery methods may not influence the transfer of training of a specific training program. Rather, other variables (e.g., years in full-time work experience, job title, and age) were found to significantly influence the transfer process of a training program. Second, among the different variable categories, personal variables, such as motivation and self-efficacy, indicated more associations with the demographic variables than the organizational variables of organizational support, supervisory support, and peer support. Third, the fewer years of full-time work experience, the greater the chance to transfer training.

The study results reveal that there are no differences in the perceptions of transfer of related training between traditional classroom instruction and CD-ROM-based instruction within a manufacturing company. Therefore, this finding may justify using more CBI for training delivery in these types of organizations. The benefit of CBI would lower training costs for program development, delivery, and evaluation while keeping the same level of training transfer. One consideration, however, is that instructional designers of the CBI programs may need to tailor their training programs more closely to the demographic differences in their workplaces. According to the study's findings, aging workers with higher levels of work experience in the machine trades need more support from the organization, supervisors, and peers to transfer their training to jobs and tasks. Issues of motivation and self-efficacy for these aging workers should also be addressed to promote higher transfer of training. This implies that human resource development efforts and resources within a corporate environment should be balanced to address workplace performance issues between the existing human resources and the new hires. The existing workers also become a critical target population who need to learn and transfer their skills, otherwise they may become stagnant, and this can hinder the transfer of training.

Limitations of the Study

This study produced several meaningful findings regarding the transfer of training research. The major findings, however, may contain some limitations for generalization. The subjects of the study were limited to a specific industry-paper production, and data collection was undertaken at a paper mill. The study utilized subjects' perceptions about the transfer of training instead of actual transfer performance data. Due to these limitations, the generalization of the research findings may not be appropriate.

These data might serve as a baseline for future research in the area of transfer of related training pertaining to CD-ROM-based instruction and transfer of training studies. In order to broaden the scope of this study, future research studies should utilize larger populations from other manufacturing companies and other industry sectors. Also, gathering actual performance data to document the transfer of training is another extension of this study. More research should be conducted to explore CD-ROM-based instruction and other technology-based instruction (e.g., online instruction, simulation, and virtual reality). Research concerning technology-based instruction and its ability to transfer to the job should be conducted both qualitatively and quantitatively to further explore in-depth information about the training transfer process.

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Adoption of Aquaculture Technology by Fish Farmers in Imo State of Nigeria

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Abstract

This paper evaluated the level of adoption of aquaculture technology extended to farmers in Imo State, Nigeria. To improve aquaculture practice in Nigeria, a technology package was developed and disseminated to farmers in the state. This package included ten practices that the farmers were supposed to adopt. Eighty–two respondents were randomly selected from the three zones of the state. Data were collected through structured interview schedule. The results showed that the level of adoption of the technology was low. Less than half of the respondents adopted the technology. After the construction of the ponds, which were usually not to specification, the farmers found it difficult to adopt the other recommendations, (e.g., pond maintenance, feeding, harvesting, and fish preservation). It was discovered that the farmers did not have adequate funds to maintain their small ponds and to purchase the necessary feed and other necessities for aquaculture. To increase the level of adoption of aquaculture technologies in Nigeria, it is necessary to change its perception from subsistence to commercial and sustainable farming practice; to assist the farmers with credit facilities and to provide closer monitoring of the process by extension agents.

Introduction

In Nigeria, fish production is not only important as a source of rich protein, but it also can be used to bring about institutional changes. These changes can offer access to production assets and resources, which can help to empower the poor and directly promote their livelihood (Obikezie, 1999). Unfortunately, Nigeria is not producing enough fish for consumption; also, the fish industry is not providing the much needed financial empowerment that the fish farmers need. According to the Food and Agriculture Organization of the United Nations (FAO, 2006a) there is a huge supply demand gap for fish and fishery products in Nigeria. According to the report, there is about 400,000 tons of supply in comparison to the 800,000 tons of demand. This makes Nigeria one of the largest importers of fish in the developing world, importing 600,000 metric tons annually (Moehl, 2003). It is therefore necessary to ensure that improved fish production technologies that have been developed and disseminated are adopted, in order to increase fish production.

The fishery industry is crucial to the World economy. The livelihood of millions of people worldwide are dependent on fish farming (Greenfacts, 2004). Fish provides a rich source of protein for human consumption. The flesh of fish is also readily digestible and immediately utilizable by the human body, which makes it suitable and complementary for regions of the world with high carbohydrate diet, like Africa (FAO, 2005a). Research results have linked seafood consumption to reduced risk of disease. The U.S. Government has recommended that all Americans eat two seafood meals per week (Healthnews Digest, 2006). In 2002, the world's total fishery production was reported to be 133 million tons (Vannuccini, 2004).The production from world capture fisheries amounted to 93.2 million tons. This represents a slight increase of 0.4 percent compared with 2001, but a 2.4 percent decline from the peak of 95.5 million tons reached in 2002. About 74 percent of fish produced were used for direct human consumption (Vannuccini, 2004).

Globally, however evidence indicates that in many areas fishery management is failing (Cichrame, 2000). Though it has been geared toward full employment and social peace, the management of the fishery industry has not achieved this goal. According to FAO reports (2005b) the system is not operating in a sustainable and efficient manner. Over the years, however, efforts have been made to develop new technologies, which have been introduced to the industry. This has led to more fish being caught, but this has also resulted in the overexploitation of fisheries (MacLennan, 1995).

The global fisheries production data is not a true reflection of the development in some of the regions of the world. The Less Developing Countries (LDCs) have been experiencing serious decline in production in recent years. Per capita fish supply in the LDCs is still relatively low at an estimated 8.5kg in 2001 (industrialized

countries = 13.2 kg) (Greenfacts, 2004). In Africa, the fish sector provides income for over 10 million people engaged in fish production, processing and trade (New Partnership for African Development, 2005). Fish has also become a leading export commodity for Africa with an annual export value of $2.7 billion (U.S.). Yet these benefits are at risk as the exploitation of natural fish stocks is reaching its limits (Mutume, 2002). Although there is a paucity of information on the status of the fisheries industry, and the role it plays, it is estimated that Africa produced 7.3 million tons in 2003, and 4.8 million tons was from marine fisheries (FAO, 2003).

Aquaculture is the breeding and rearing of fish, shellfish, or plants in ponds, or any enclosure for direct harvest of the product. It has come to greatly augment the dwindling marine fish production worldwide, and this field is growing rapidly (Muir & Nugent, 1995; FAO, 2004). Data from Greenfacts (2004) has shown that aquaculture is the fastest-growing animal-based food production sector, particularly in the developing countries – mainly from China and other Asian countries. In Africa, the governments of the continent under the aegis of the African Union, have identified the great potential of aquaculture and are determined to encourage private sector investment (NEPAD, 2005). The potential exists for aquaculture to make a difference as shown by pilot projects, although these pilot projects fail when they are scaled up (New agriculturists, 2005). While capture fisheries production has stagnated throughout the African continent at about 8 kg per person, aquaculture-based consumption has continually increased from 50 gm per person in 1984 to 100 gm per person in 1992. However, this is still 1.3 percent of total fish intake (Bardach, 1997).

Nigeria has over 14 million hectares of inland water surface, out of which about 1.75 million are available and suitable for aquaculture (FAO, 2006b). In Nigeria, aquaculture is predominantly an extensive land based system, practiced at subsistence levels in fresh waters (Anyawu-Akeredolu, 2005). Commercial farming has yet to become widespread (Fagbenro, 2005). At present, most fish farmers operate small-scale farms ranging from homestead concrete ponds (25-40 metres) to small earthen ponds (0.02-0.2 hectares). The industry produced over 30,000 tons of fish in 2000 (FAO, 2005c).

The development of aquaculture can only be enhanced by the introduction of modern technologies. While there have been instances of successful introduction of technologies to boost production in Bangladesh (Thompson, Sultana, and Khan, 2005) and Ghana (World Fish Centre 2005), the major problem has been the lack of appropriate technology (Gupta, Bartley, & Acosta, 2004; Toure & Noor, 2001; UNDP, 2004a). Aquaculture technologies have been developed and disseminated to farmers. While some scholars have stated that what is needed is to develop the technologies and make them available (Joshua & Omidiji, 2002), others insist that the transfer of technology would be more effective when there is a greater interaction among the developers, transfer agencies, and the farmers (Dlamini 2003; Yap-Gnaore, Ehui, & Shapiro, 1995). However, the crucial point is for the farmers to be able to afford any technology extended to them. A UNDP Report (2004b) indicated that it was the inability of farmers to afford the technologies extended to them that made farmers abandon the ponds. Rogers (2003) has added another dimension by stating that the adoption of technology can be affected by the way it is named and positioned.

This paper evaluated the adoption of an aquaculture technology package extended to farmers in Imo State, Nigeria. The objective was to identify the level of adoption. This is necessary because public sector extension is seldom properly evaluated (Farrington, Christopolos, Kidd, & Bechman, 2002) and so often the level of performance of a particular technology introduced is usually unknown.

Methodology

Study Area.

Imo is one of the 36 states in Nigeria located in the southeastern part of the country. The land area is estimated at 5100.1 square km. The state lies within Latitude 5˚ - 6˚ North of the Equator and Longitude 6.5˚ and 7.5º East of the Greenwich meridian. Apart from Imo River and Oguta Lake, the state is blessed with many inland waters such as the Igwu, Otamiri, Nworie and Ogachi rivers (Iloeje, 1999). The population of the state stands at 2,485,499 according to the National Census of 1992. Generally, about 80 percent of the people engage in agriculture.

Extension services are fully funded by the State under the Agricultural Development

Project (ADP). The State is divided into three agricultural zones, namely Owerri, Orlu and Okigwe zones.The zones are further broken down into blocks. A block is an agricultural area covering a specified number of villages and supervised by extension agents. Again, each block is further divided into circles or cells. Each block contains eight circles. A circle is an agricultural area containing a number of farm families. Thus, the Owerri zone has 18 blocks and 144 circles; Orlu and Okigwe have 10 blocks and 80 circles each. In all, the State is made up of three zones, 38 blocks and 304 circles.

Data Collection

A total of eight blocks were randomly selected, four from Owerri and two each from Orlu and Okigwe zones, and two circles were also selected from each block. A comprehensive list of 520 fish farmers was obtained from the ADP and the village heads. Seven farmers were picked from each circle, resulting in a total of 112 respondents. However, only 82 of them were available for an interview, which was conducted using a structured interview schedule. Due to some educational and cultural considerations, trained enumerators were hired to interview the farmers and record their responses during the interview.

Aquaculture Technology

The technology that was disseminated to farmers was a 10-item package (see Table 1). It included information on pond-site selection, pond construction, pond installation, pond preparation, stocking of pond, transportation of fingerlings, feeding, pond maintenance, harvesting of fish, and fish preservation. For each item an action had to be taken, and each respondent was asked whether that action was taken. Every positive answer meant that the item was adopted. The cumulative positive responses of each respondent indicated the level of adoption. The total level of adoption was determined by calculating the percentage of the total positive responses. The personal and socio-cultural factors associated with the farmers were also studied.

Results and Discussion

Factors Associated with the Adoption of the Technology

It has been noted that people do not just adopt a technology because it is available to them. Even when the technology is available and appropriate, some personal and socio-cultural factors bear on the decision to adopt or not (Berdegue & Escobar, 2001; Daniel, Wilson, & Myers, 2005; Garforth, Angell, Archer, & Green, 2003; Perkin & Rehmand, 1994). In this study some of these socio-cultural factors were identified and studied (see Table 2).

Table1. Questions on the Adoption of Aquaculture Technology

Practice	Yes	No
Site selection Did you do any soil testing before selecting your site?		
Pond construction Is your pond constructed to the dimensions recommended by the ADP?		
Pond installation Did you install water inlet and outlet devices in your pond?		
Pond preparations Did you lime the pond before flooding with water?		
Pond stocking Do you stock the pond based only on the specifications by the ADP?		
Fingerling transportation Do you transport your fingerlings in plastic bags alone?		
Fish feeding Do you feed the fish according to ADP recommendations alone?		
Pond maintenance Do you check the walls of the pond quarterly?		
Harvesting Do you restrict the harvesting to the time recommended by ADP only?		
Preservation Do you use the chilled holding recommended by the ADP?		

From Table 2, 73 percent of the respondents were male. In most cases, fishing activities were done by men, though women are more engaged in the processing and marketing areas. Given the cultural life of most rural African communities, women are still largely kept in the background. So when studies are being conducted, men (usually husbands) are most likely to answer for women (wives). This becomes prevalent because in most communities almost every adult female is likely to be married. This is verified from the result in this study. Almost all the respondents (93%) were married.

Table 2. Selected Personal and Socio-cultural Factors Associated with the Adoption of Aquaculture.

Factors Frequency (# = 82)		Percentage
Male respondents	60	73
Age (30-49)	46	56
Basic education	52	56
Married	76	93
Fulltime farming	27	33
Access to demonstration	62	76
Utilized demonstration	24	29
Popularity of practice	5	6
Community restriction	42	51
Cultural inhibition	79	96

The mean age of the sampled group was 34 years. More than half of the respondents (56%) were between the ages of 30 and 49. This indicated that the respondents were relatively young. The mean age of farmers in Nigeria is usually between 45-48 years (Ezedinma & Otti, 2001; Ogunwale, 2000). The reason for this age composition is easily explainable since aquaculture is relatively new in the country, and there was the deliberate intention by the ADP to target younger farmers who are likely to be interested in homestead fish farming. The results also showed that the respondents were well educated. About two-thirds of them had received a basic education, (i.e., attending twelve years of formal education). Only 3 percent of them did not attend any formal school. This level of education should encourage the adoption of the technology.

Only 33 percent of the respondents were full-time farmers. The rest were artisans, civil servants, business people, and others. Again, this reiterates the fact that the technology was targeted at younger and more educated members of the community. The objective was to introduce aquaculture as a hobby that one can add on to one's other vocation. Hence, the technology was introduced as a simple and subsistence farming rather than a commercial farming venture. Some scientists blame this faulty approach for the failure of aquaculture practice (Fagbenro, 2005).

In introducing aquaculture to the farmers, the extension agency established demonstration farms to teach them. This study found that a vast majority of the respondents (76%) had access to the demonstration farms. However, only about a quarter of the respondents (29%) utilized them by attending the demonstrations (Table 2). The result of this study also showed that aquaculture was not yet a popular vocation. However, there was no cultural inhibition or restriction on land use against the practice.

What can be deduced from these results is that the personal and socio-cultural characteristics of the respondents were favourably disposed to the adoption of the innovation. It was introduced at the homestead, simply, as an activity that would bring additional income to the household.

Adoption of Aquaculture Technology

Results from Table 3 show that the total level of adoption of the technology was 41 percent. Out of the ten components of the technology, about half of the respondents adopted pond construction practice (54%) and pond installation (51%) respectively. Also, 50 percent of them adopted the recommended transportation practice of fingerlings, but only 27 percent of them adopted the proper site selection. However, less than 50 percent of the farmers adopted other practices like pond preparation (44%) feeding (47%) pond maintenance (44%) and stocking practice (34%). In contrast, although 39 percent adopted harvesting practice, only 19 percent of them adopted the preservation practices.

Table 3. Distribution of Respondents According to Percentage Adoption of Technology.

Practice Frequency (# = 82)		Percentage
Site selection	22	27
Pond construction	44	54
Pond installation	42	51
Pond preparation	36	44
Stocking	28	34
Transportation	41	50
Feeding	39	47
Maintenance	36	44
Harvesting	32	39
Preservation	16	19

Level of adoption # = 41 percent

The recommended practices could be categorized into three groups (i.e., pond construction, raising the fish to maturity, and the processing of the harvest). From the result, it could be seen that the adoption level descended from the first to the last group. From the data, half of the respondents adopted the pond construction, which also included installation, preparation, and stocking. Here the adoption of the site selection recommendation was low, and that is understandable. The technology materials recommended that a proper site should be selected in terms of choosing appropriate topography with perennial source of water, and ensuring good quality of soil through soil analysis. However Imo State is very densely populated, so there is more pressure on land availability. Farmers are forced to choose any available land, and they do not even have the financial resources to carry out the tests required for water and soil analyses. It will be assumed that the construction of the pond received the highest adoption score for obvious reasons. Construction of a pond is the necessary first thing to do. At this point, the extension agents, eager to get people to adopt the innovation, provided the highest level of supervision. With the promise of more incentives, farmers were likely to construct the ponds.

After the construction of the ponds, however all other practices to raise the fish were not fully adopted. The exception here was the transportation of the fingerlings where 50 percent of them adopted it. Again, this was not surprising because transportation of fingerlings is the most delicate aspect of aquaculture (Gertjan & Janssen, 1996) and sometimes only 5 percent of the fingerlings survive due to inappropriate handling (Brown & Laland, 2001). Feeding and maintenance of the pond were adopted by less than half of the respondents. It could be assumed that at this point, farmers receive less supervision from the extension agents. After they helped with the construction and stocking of the pond, the agents would assume that the farmers would practice the other recommendations. Feeding was always a problem because farmers were not always able to afford the cost of the feed and to devote themselves to required feeding regime. This could be due to sudden change in the price of feed as a result of inflation. Sometimes, the feed would not even be available in the market. Due to the low quality of locally produced fish feed, farmers often depended on imported feed. However, these are more expensive and may be scarce because of import policies.

Harvesting and processing practice received the lowest level of adoption. About 39 percent of the respondents adopted the harvesting practice. It was discovered that since the technology was introduced as subsistence farming, the farmers found it convenient to harvest the fish at will rather than waiting for the appropriate time. Less than a quarter of the farmers adopted the preservation practice. Since this practice entailed procuring other equipment, not many resource-poor farmers could afford the extra cost of equipment. Since the harvest was very poor, due to the small farm size, there was hardly any need to preserve the fish since they were usually consumed at harvest.

Conclusion

Results from this study showed that the level of adoption of aquaculture technology in the Imo State of Nigeria was low. Many of the farmers who were supposed to be engaged in aquaculture had abandoned it. Important components of the technology that had to do with raising and processing the fish at harvest were adopted by few of the respondents.

The major reason for the low adoption of the technology was the poor economy, which raised the rate of inflation. The farmers continued to experience dwindling disposable income that could be ploughed into the farm. A corollary to this was the inconsistency of some of the Government's policies. There were usually policy changes regarding the importation of feed. When the feed was not available, the fish would die, and the farmers would abandon the ponds.

It can also be inferred that the initial policy of the extension agents to introduce aquaculture as subsistence farming was wrong. When people do not see a technology as generating income immediately, the motivation to commit resources to the venture will not be there. Of course, this was the reason why the technology was targeted at those who already had other sources of income. It therefore means that the poor economy is affecting every sector in the country. For aquaculture in Imo State, therefore, it became a vicious circle. The farm size was too small to generate enough income to sustain the farm.

To improve aquaculture in the State and in Nigeria, the practice should be reintroduced as a commercial venture that could generate income and become sustainable. It also means that the Government must identify genuine investors in the business who are ready to go into the venture full time, and provide adequate financial credit for them.

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Volume XXXIII, Number 2, Spring 2007

The Education of Indentured Servants in Colonial America

By Mark R. Snyder

Abstract

This article serves as a foundation for understanding the earliest form of technical instruction in colonial America. It is a synthesis of historical studies that have addresses the education of indentured servants and apprentices in colonial America. It defines indentured servitude and contrasts it with apprenticeship—a form of indentured service. The paper addresses how indentured servitude in colonial America became established and how those who were employed through such means fared. Primary emphasis is on the education that indentured servants and apprentices would have received and how that varied by time periods and regions. This manuscript reveals that three general changes occurred: 1) from the adaptation of traditional practices from England to support agricultural labor in the early colonial period, 2) through a transition period caused by slavery (primarily in the south) and an increased need for apprentices in skilled trades (primarily in the north), and 3) until the late colonial period when education was emerging as a value that would help America succeed in its independence.

Preface

Technology is a topic that should be addressed in educating the youth of the United States. Historically, there have been differing views regarding the need for instruction of technical processes. Yet, throughout the past, numerous systems and methods have been devised to achieve this goal. More recently, various disciplines have recognized technology as an integral part of their fields. Specifically, the broader study of technology has been accepted as the primary motive for the profession of technology education.

This article can help students who are preparing for careers in technology education to establish a historical background for better understanding the field in which they aspire to become teachers. The primary purpose of this study is to provide a historical account of one of the earliest forms of technical learning in America. It also describes the practice of indentured technical instruction as a system utilized by the colonists and how it helped shape education even as it exists in modern society. It presents a general overview of circumstances that have influenced the instruction of "technics" throughout the past and provides a foundation for understanding how technology education has evolved. This is accomplished by identifying numerous resources and providing a synthesis of prior historiographical efforts. Since this review cites period sources, in unedited form, some words appear in their original spelling.

Introduction

Indentured servitude was a critical institution in the development of the American colonies primarily because a large number of people were needed to occupy colonial America. There were many changes made in the system of indentured servitude and many differences in the regional application of indentured servitude within the American colonies throughout the period. There were also distinct changes in the relationship between education and indentured servitude. Initially, there was little interest in the education or training of indentured servants. When native-born children began entering the system as apprentices, the master became the primary source for a basic education. Finally, as schools developed, the role of master as an educator as decreased to its vocational aspect.

When researching the topic of indentured servitude in colonial America, it is easy to develop a skewed impression of this practice. Many historians who mention the indenture system typically paint a simple picture of an individual who happily worked for another man until his term was served and he would become self-reliant. Specific studies that focus exclusively on the lives of indentured servants in colonial America will describe a variety of situations in which a person might have become an indentured servant, served their indenture, been treated during that period of indenture, and fared after the indenture was completed. Thus, it would not be accurate to stereotype indentured servants into one simple image.

It is also important to point out that the terms *indentured servant* and *apprentice* are closely related but, in fact, have slightly

different meanings—particularly when referred to in the history of colonial America. An indenture is a contract that binds a person to work for another for a given length of time. An apprentice is a person under such a legal agreement that works for a master craftsman in return for instruction in a specific trade and, formally, support. Many of those who came to the American colonies already knew a trade, such as farming, but could not afford the cost of the journey across the Atlantic. Thus, they would agree to an indenture that bound them to a wealthy planter for a few years and then be released to make a living themselves. In this example, the indentured servant was not an apprentice, per se, because he already knew his trade. In contrast, an apprentice also usually was bound by a contact and thus considered indentured. Only the institution of apprenticeship combined technical education and labor with the promise of eventual self-employment.

The Early Arrival of Indentured Servants

Indentured servants probably arrived in America not long after the first English colony, Jamestown was established in 1607. "That a man should become a bond servant by legal contract was not strange, for the ancient institution of apprenticeship was known to all" (Smith, 1947, p. 13). Galenson (1981) reported that the Virginia Company had put this system to use by 1620. Alderman (1976) wrote, "around 1624 the servants began to sign formal indenture" (p. 57). The practice of indentured servitude made it possible for emigrants from many European nations to journey to the New World and was, indeed, a common practice that was vital to the economy and social development of colonial America.

Those who could not afford passage to the New World often pledged service to a colony in exchange for the cost of the trip and the boarding fees accrued through the duration of the indenture. In fact, the large majority of immigrants to the Chesapeake colonies of Maryland and Virginia prior to 1700 were British indentured servants who served British colonial planters. Wesley F. Craven (1971) approximated the population of white indentured servants in seventeenth-century Virginia to be perhaps three-fourths of the total population and John Pory, a resident of Virginia in 1619, stated, "Our principall wealth . . . consisteth in servants" (Craven, 1971, p. 13). As farms and plantations grew larger, and trade increased, so did the need for labor. This need was met through indentured servitude and was greatest in the colonies from Pennsylvania south. The New England colonies were more likely to use the labor of freemen and apprentices rather than indentured servants until later in the colonial period.

Indentured servants throughout the colonies were either voluntary or coerced by legal authority. Those who became indentured servants of their own accord were reasonably well treated and had similar rights to the freemen before the law. However, their indentures could be bought or sold without their consent. Otherwise, they could trade, own property, provide testimony in court and were provided special laws to protect them from abuse (Ballagh, 1895, p. 44). The length of time that voluntary servants were bound was typically dependent on the amount owed for the transportation to the colonies, "usually for from three to five years" (Talpalar, 1960, p. 198). Whatever the length of their servitude, once their indenture was completed the liberated servants expected to receive the "freedom dues" that they had earned through very hard work. For the indentured farmer this might have included tools, livestock, corn, tobacco, and other necessities for them to start anew.

Assisted Emigration and Runaways

The system of indentured servitude was ideal for the "assisted emigration" of undesirables. "Of the Scotch prisoners taken at the battle of Worcester, sixteen hundred and ten were sent to Virginia in 1651 . . . Many of the Scotch prisoners of Dunbar and the rebels of 1666 were sent to New England and the other plantations." Also, the social climate in England at this time was rather volatile due to overpopulation; therefore "in 1661 . . . power was given to Justices of the Peace to transport felons, beggars and disorderly persons" (Talpalar, 1960, pp. 299-300). Even the trade companies got into the act by negotiating with other countries for the trade of their undesirables. Subagents, or recruiters, would also stoop to persuading, or even kidnapping, young or intoxicated victims in order to turn a profit by selling them into indentures once in the colonies. This practice was known as "spiriting" and those who had been "spirited" were indentured according to the "custom of the country" which was a method of expediency in these matters. Others who became indentured

involuntarily included felons and debtors already within the American colonies. Rather than imprisoning potential laborers, the Pennsylvania Council declared it "highly reasonable that people fitt for Labour, or performing any Service by which they can earn Money, should by the same Method make Satisfaction for their just Debts" (Morris, 1946, p. 14).

In many cases, the outlook for indentured servants was bleak. Morgan (2001) reported that during the mid seventeenth-century, "in both Chesapeake colonies servants were forbidden to leave their homes without a license or pass" (p. 20). Involuntary servants had fewer rights than the voluntary indentured servants and many of them were prone to running away, for which there were a variety of punishments prescribed by the different colonies. The harshest punishment was in Maryland where a 1639 law stated that runaway servants were to be executed. Other penalties included extended indentures, payment for lost time extracted from the freedom dues, and literally being branded with the letter "R" (Morgan, 2001, p. 20-21).

Many lawmen arrested suspicious characters who could not prove that they were free. In 1773, a "gaoler" in New Jersey posted this advertisement:

TAKEN UP and committed to the gaol of the City of Perth, Amboy, in the county of Middlesex, in New-Jersey, the 1st of July, 1773, an Irish servant man named JOHN RUTLEGE, who confesses he is the servant of one JOHN PATTERSON, of Tinicum township, Bucks county, and left his master last month, as mentioned in the paper of the 7th of June inst. His master may have him again by applying to the subscriber, and paying the reward for taking him up, and charges. OBADIAH KING, Gaoler (Heavner, 1978, pp. 118-119).

In Pennsylvania, and most other colonies, the laws aided the master of a runaway servant but recapture was more often the result of offering a reward—a financial burden usually transferred to the unsuccessful runaway servant. Despite offered rewards, a very large number of runaway servants were never recovered (Heavner, 1978, p. 116).

Overall, the experience of servitude in the colonies was dismal. According to Wood (1992), in the colonies, servitude was a much harsher, more brutal, and more humiliating status than it was in England (p. 53). Although some success stories exist, the majority of indentured servants lived difficult lives even if they served out their indentures and became free.

Poor Provisions for Education

The practice of indentured servitude prior to colonization had been primarily utilized for the training of youths in specific trades. However, the British colonizers of America molded the traditional form of the indenture system to meet their needs. The most obvious difference was the decreased interest in skilled craftsmen in the system-and the large demand for farmers. To estimate the occupation of male indentured servants in the colonies, Galenson (1981) used the records of indentured servants registered in Bristol, England between 1654-1660, just before their journey to the American colonies. What he found was that of the indentured servants registered in Bristol, roughly 30 percent were previously farmers, 10 percent were textile workers, 9 percent were laborers, and the rest were a variety of other occupations (41 percent did not specify an occupation). These records are indeed valuable, although little is known of the actual registration process or the accuracy of the records. These records also indicated facts such as the deterioration of agricultural conditions in England during this period and the destination of these particular Bristol registrants within the American colonies—more than half of them were sent to the colony of Virginia (Craven, 1971, p. 17).

Since the majority of indentured servants at this time were laborers and primarily young adults, the education of these early indentured servants was not considered a high priority. Labor was, in fact, the highest priority. Training, usually in husbandry, was the most education that one was likely to gain through indenture. Most training was considered unnecessary, if we reconsider the example of the English farmer who agreed to indentured servitude in order to pay for his transportation to America. Any education that an indentured servant received was likely the result of self-motivation or some special arrangement. "German servants often entered into indentures providing that they be taught to read the Bible in English" (Smith, 1947, p. 17). Also, the few children that were in the colonies as indentured servants prior to 1650 were probably given the benefits of a very minimal education. The rate of literacy for the

indentured servant population that emigrated from England was characteristically low as was evidenced by the large number of men and women who could not sign their names, but rather left their "mark" on their indentures (Galenson, 1981).

Change in the Southern and Chesapeake Bay/Colonies

Mary Newton Stanard, in her book *Colonial Virginia: Its People and Customs (1917),* found that of the indentured servants in Virginia for whom records exist (from the year 1625), there were a few that became quite successful. A few of her examples follow:

For instance, Richard Townshend had come to Virginia when a boy of fifteen, but we know that before long he was apprenticed to Doctor Pott to be taught to be a physician and apothecary . . . Abraham Wood was brought to Virginia . . . and in later years became a Major General of Militia, the greatest Indian trader of his time, and a leader in promoting Western exploration . . . John Upton . . . who became a burgess, commander of Isle of Wight and mintmaster general. (Stanard, 1917, pp. 46-48)

The population of the colonies was increasing, as was the need for skilled laborers. The New England colonies began to compete for the labor of indentured servants and after about 1700, the Chesapeake Bay colonies could not obtain, through traditional methods, the labor force required to maintain the growth of the plantation economy. The arrival of the *Cavaliers* in Virginia had brought about a change in the societal hierarchy of the colony (Stanard, 1917, p. 40).

The Cavaliers were formerly known as the Royalists, a political party that left England around 1650, following England's Civil War and the execution of Charles I. As they settled into Virginia, it was evident that their ideas differed from the traditional Puritan views on land and labor. Things started to change as this incredibly wealthy minority gained more and more power. According to Pulliam, (1999 p. 86) "The persons lowest in social rank were entirely dependent upon the wealthy and powerful for what little education they received." But because education was carefully reserved for those favored by birth, non-privileged southerners largely remained uneducated. "Rigid Southern social class distinctions allowed few opportunities for the indentured servants, the slaves, and the poverty-stricken freedmen to engage in cultural pursuits or to improve their minds."

At about the turn of the eighteenth century, "indentured servitude was retained: but labor ceased to be a value (Talpalar, 1960, p. 322). Due to the advent of Feudalism in the Southern colonies, the supply of white indentured servants to the tobacco planters had virtually come to a standstill. "By 1710, one-fifth of the region's population was black (Norton, 1986, p. 104). As black slave trade increased, and slave labor grew in the south, the role of the indentured servant began to change from primarily agricultural occupations to a wider variety of trade-oriented jobs.

"The apprenticeship program inherited from England had the two-fold objective of supplying the labor market and providing training in a trade" (Morris, 1946, p. 14). Eventually, a wider variety of trades emerged in which youngsters could become apprenticed. Most of the trades that existed during the later colonial era fell under general occupational headings. The textile processing industry included feltmaking and wool spinning as well as tailoring and hatmaking. Dealing or retailing was also considered a trade that an apprentice might learn. Food processing vocations such as butchering, baking or brewing were also plentiful during this time. Leather processing included the skills of tanning, currying, and saddlemaking. Metal trades included smithing of all sorts, while the wood and construction trades such as carpentry, joinery, masonry, plastering, wheelwrighting, and shipbuilding were also quite common (Davies, 1956, pp. 64-77). These are only a few examples of the many specialized trades for an apprentice.

Growth of Apprenticeship in the Middle and New England Colonies

While indentured servitude through migration decreased gradually, the number of children born to the colonists in America increased. It became common practice in the Middle and New England colonies for all but the rich, and perhaps the very poor, to have children learn to make a living either from their parents or through a traditional apprenticeship to a master craftsman. The primarily Protestant parents would try to have their children apprenticed to a trade that was stable, and would provide them with a reasonable living.

Because of this, highly skilled trades were very competitive and might come very dearly. "Doctor Benjamin Rush of colonial Philadelphia charged 100 pounds to take on an apprentice" (Heavner, 1978, p. 45). Oftentimes, local officials decided the fate of children by involuntarily binding them into an indenture. Many children would become apprentices at around the age of fourteen and serve a master craftsman for up to seven years. During this time, the apprentice would learn the trade secrets that his master used, often referred to as the "mysteries" of the trade.

As mentioned previously, the apprentice system was adopted from the English system, however, as shown in studies by Morris (1946), existing indentures revealed that the arrangements for apprentices in colonial America often held the masters responsible for different obligations than those in England.

In particular, the education and clothing of the apprentice became very important bargaining aspects of the indenture in colonial America. The majority of indentures that exist from this time period were printed documents that provided blank spaces for filling in the price, term, and any special provisions that were a part of the agreement. Most of the special provisions included mention of clothing—the master of one Daniel Hibler, indented October 13, 1773 in Philadelphia, promised "at the Expiration of the Term to give him two Compt. Suits of Apparel one of which to be new" (Heavner, 1978, pp. 106-107).

The colonists of the Middle and New England colonies were primarily Protestants who valued education and would bargain shrewdly so that their children might learn reading, writing, and cyphering along with gaining vocational skills. According to Quimby (1985), in his study of *Apprenticeship in Colonial Philadelphia*, approximately two-thirds of the indentures that he discovered, dated from 1745-1746 and 1771-1773, indicated provisions for education.

The Education of Apprentices

An apprenticeship is a process of learning by doing and, in essence, the combination of education and industry. Beyond vocational training, however, the master would be required to teach apprentices morality and practical studies such as simple bookkeeping, reading, and writing (Seybolt, 1917, p. 104). These obligations were carefully regulated by law, as was evident in the Massachusetts Bay General Court Order of 1642. Selectmen were employed to serve districts by visiting masters and determining whether they were following the law.

The education of apprentices enforced by law was a unique approach. "The Massachusetts Bay colonists had originated a brand-new idea; there was nothing in English law or custom that could serve as a determining precedent for this scheme" (Seybolt, 1917, p. 104). Other New England colonies quickly followed this pattern. The Connecticut code of 1650 and the Duke of York's Laws of 1655 were directly related to the Laws of Massachusetts. The New York law postulated that children be instructed in "matters of Religion and the Lawes of the Country . . . and in some honest and Lawful Calling" (Seybolt, 1917, p. 106).

The master, regarded in *loco parentis*, was usually required to provide such education for at least the first three years of a child's indenture. If the master and his family could not provide the necessary instruction themselves, the child was probably sent to a school during the winter, or whatever period the selected trade was not particularly busy. If it was available, evening schools provided a means for educating the working classes. "The indentures of Apprenticeship reveal the fact that there was an evening school in the Royal Colony of New York as early as 1690, and that by 1705 several had been opened" (Seybolt, 1917, p. 107). The demand for schools that taught technical subjects for apprentices can be seen in the following advertisement from Philadelphia's *American Weekly Mercury*, dated January 14-21, 1729 that stated:

At the Free-School in Strawberry-Lane, near the Market House, Philadelphia, are taught Writing, Arithmetick in all the Parts, both vulgar, Decimal and Duadecimal; Merchants Accounts after the Italian manner through all the Part of Commerce; Measuring all Artificers Work, Gauging, Dialling, with some other practical Parts of the Mathematicks: Also English and Latin. N.B. He also teaches a Night School at the Place aforesaid. By John Walby. (Quimby, 1985, p. 68)

Several successive Poor-Laws were also enacted in the Massachusetts Bay colonies

between 1703 and 1771. The intention of these laws was to ascertain that poor apprentices had the opportunity to learn reading and writing. These Poor-Laws essentially required that all children should benefit from an elementary education and in their final form specified that males should learn "reading, writing, and cyphering; females, reading and writing" (Seybolt, 1917, p. 105).

The Growth of Schools

Traditionally, the master was responsible for the actual education of the apprentice. However, the increasing growth of schools, and demands for educational requirements for all children, began to affect the apprenticeship system. Increasingly, masters began to accept the cost of having the apprentice taught in a school. Benjamin Franklin, who signed an indenture form that his business had printed, accepted his-10-year-old nephew James as his apprentice on the fifth of November 1740. For the first few years of his seven-year indenture, James was sent to school by his uncle before actually working in the printing office (Quimby, 1985, pp. iv & 70). Toward the end of the colonial period there is evidence that masters were relieved of even that obligation, as the parents of the apprentice often paid tuition expenses. Quimby (1985) cited records of indentures from the American Philosophical Society Library to reveal that in 1773 "Edward Bartholomew's mother paid for four quarters of night school while his master . . . paid for four quarters also" (p. 69). In another example from the same source: the "father of Michael Coats, apprentice to Samuel Loftis, chaisemaker, paid for all his son's evening school expenses" (p. 70) in the same year. Indentures also revealed that his master expected the apprentice, to learn certain skills or useful subjects by attending school. Yet another example from 1773 documented that "Conrad Gabehard, apprentice to a painter and glazier, was to be given three quarters of instruction in a drawing school" (Quimby, 1985, pp. 71-72).

Education the Key to Success

The fact that apprentices were gaining education from sources beyond what their master provided indicated that the relationship between the master and his apprentice was becoming less personal. It also indicated that apprentices were becoming more interested in getting an education that could help them advance themselves within their vocation, and sometimes beyond. Of course, when the apprentices completed their indenture they hoped to make their way as best they could with the trade that they had learned. It is known that the majority of apprentices were never so successful as to become master craftsmen and proprietors of their own business establishments. To a large extent, the success of apprentices who completed their indentures was dependent on the education they were motivated enough to pursue on their own (Kaestle, 1983, p. 31). Beyond the rudimentary skills that they were required to receive through their apprenticeship, the apprentices often read books. In Boston, and in some other cities, there was an Apprentices' Library with books that might be beneficial for apprentices. However, the reading that they did was usually not for pleasure, and rather toward some goal.

Some of those who served as apprentices were known to improve themselves beyond the realm of their trade and become quite important people in colonial history. Benjamin Franklin himself was once apprenticed to his brother who was a printer by trade. He became quite successful through hard work and grew to feel very strongly about industriousness. He eventually contributed a great deal to the vocational preparation and education of youth in colonial Philadelphia (Rorabaugh, 1986). Other such people included Paul Revere, who was apprenticed as a silversmith, Henry Knox, and Nathanial Greene, both American generals during the Revolutionary War.

Conclusion

There were basically three general changes in the attitude toward the education of indentured servants and apprentices in colonial America. These changes were largely due mainly to the diversity of the groups that settled the colonies, the regional differences between the colonies, and the rapidly changing environment within the colonies at this time.

The practice of indentured servitude in colonial America originated from the English system of apprenticeship. The traditional methods used by the English were molded to the needs of the early colonists in order to populate the New World. Early indentured servants were primarily laborers and particularly farm workers. Most of them were not apprentices, since they already knew their trades and needed little t raining. They either entered their indentured

servitude voluntarily to pay for the expense of their travel to the colonies or were coerced by officials or trade companies and became indentured against their wishes. The education of the early indentured servants was not of great concern because they were mostly young adult laborers and the literacy rate for these servants was usually quite low.

By the turn of the eighteenth century, slave labor had developed in the Southern colonies, cities were growing in the North, and the need for indentured servants as farm laborers began to decline. The American system of indentured servitude began to change back to a role similar to the traditional English system of apprenticeship established to train youth in vocational skills. The major change was the desire to educate the indentured apprentices since they were the native-born children of the primarily Protestant colonists. The Americans did add a few unique ideas to their system such as including basic educational skills as an integral part of the training that young apprentices received. In this scheme, the master was the primary source of the information and education received.

In colonial America, apprenticeship eventually became the primary method of technical instruction. In many colonies, the master became required by law to provide basic educational skills for their apprentices. These laws created for the education of apprentices had important implications for the education of all children. The philosophy of Naturalism, expounded by Rousseau, encouraged Democratic ideals and influenced the future of many nations, including America. In his book Emile, Rousseau described his philosophy of education, which would include the experience of learning a purely mechanical art. Often, Rousseau 's writing reflected the fact of the forthcoming Industrial Revolution, which was marked by the factory system of producing goods.

Soon schools began to develop for the benefit of all. Night schools were also offered for apprentices. Thus, as the American colonies neared their independence, the attitude and approach toward the education of apprentices had undergone yet another change. By the mid-eighteenth century the master was no longer the primary supplier of basic educational skills and was reduced to teaching vocational skills. The education that apprentices received became more centralized under the growing influence of schools. Considerable debate has surrounded the importance of the early laws related to the education of apprentices in laying the foundation for the American public school system. Perhaps the most important outcome was that various forms of local government took a position that the delivery of education for all was something to be valued.

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Professional Connections through the Technology Learning Community

By LeQuetia N. Ancar, Steven A. Freeman, and Dennis W. Field

Have you heard? The new buzzword is "learning communities." A learning community is a relatively old phenomenon that has resurfaced; it is making educators at institutions of higher education stand up and take notice. According to Angelo (1997), learning communities have produced significant gains in student involvement, learning, satisfaction, social connectedness, persistence, and retention, thus creating a more holistic and favorable educational experience. Grounded in collaborative and cooperative learning theories, learning communities have created environments in which student learning is the center of attention. Overtime, the acquisition of knowledge had come to be considered a highly social process in which construction occurs interdependently between students and teachers (Cross, 1998).

This social construction of knowledge and skills can be best supported in a learning community environment in which students have been given the opportunity to engage in activities that encompass a diverse set of perspectives from multiple sources. According to Matthews, Smith, MacGregor, and Gabelnick (1996), "learning communities juxtapose diverse perspectives and diverse disciplines, often creating rich social, cultural, and intellectual linkages" which ultimately have a positive and profound effect on the success of students (p. 6).

The Technology Learning Community (TLC), currently located in the Department of Agricultural and Biosystems Engineering (ABE) at Iowa State University (ISU), is an example of a program that fosters this type of learning environment connection. Through weekly seminars and team-based activities, the TLC enables student participants to actively construct their own knowledge base through the development of professional networks and relationships with faculty, staff, students, and industry professionals. This article examines the impact that the TLC has had on the educational experience of new and transfer students to the Department.

History of Learning Communities

The learning community concept was first introduced in the 1920s by Alexander Meiklejohn at the University of Wisconsin, as the Meiklejohn Experimental College (Smith, 2001). Heavily based on the philosophies of John Dewey, the primary purpose for this endeavor was to establish and nurture a higher education community that connected both the living and learning environments of students.

Many types of learning communities surfaced in the subsequent years. Formulated to best meet the needs of the students which they were intended to serve, learning communities began to take on many different appearances, although the foundational elements remained the same. These foundational elements include diversity, a shared culture, internal communication, caring, trust, teamwork, maintenance processes, and governance structures that encourage participation and sharing of leadership tasks, personal and professional development, and links to the outside world (Lenning & Ebbers, 1999).

With the foundational elements in place, learning communities typically align with one of four basic models (Freeman, Field & Dyrenfurth, 2001). These models are collateral course-based, residential, freshman interest group, or student type. Choosing a particular model will depend both on the needs and characteristics of the student participants as well as the cultures of the department and university (Shapiro & Levine, 1999).

The TLC at ISU does not fit the mold of any of the above-mentioned learning community models, which is why three faculty members in the Department of Industrial Education and Technology—a department that has since merged with ABE—decided to create a nonresidential, noncollateral, noncourse based learning community model in 1999. This program, along with several others on the ISU campus demonstrated the new shift in pedagogy from the teaching-centered approach to higher education to a learning-centered one, and the increased emphasis on student satisfaction and a holistic educational experience (Huba, Ellertson, Cook, & Epperson, 2003). Initiated in the mid-1990s, the learning community concept has grown

substantially at ISU, from 23 learning communities serving 1,114 students in 1998 to 47 learning communities serving 2,275 students in 2003 (Huba et al., 2003). In 2007 there are more than 60 learning communities that serve nearly 2,500 students from various classifications.

With the goals and objectives of the university-wide commitment to student learning and the learning community initiative in mind, Drs. Steven Freeman, Dennis Field, and Michael Dyrenfurth developed a model that best met the needs of the nontraditional and diverse academic and social backgrounds of the Department's students. With varying levels of prior academic and social experiences, students new to the Department—predominantly transfers from other colleges on campus—needed a channel through which they could become acclimated to an environment, people, and a professional culture that was new to them.

In its eighth year of existence, the TLC is providing an opportunity to make personal connections as well as to develop and maintain professional networks and relationships with faculty, staff, industry professionals, and students. Participants are required to attend (and contribute to) a weekly seminar with the other learning community participants, weekly meetings with a peer mentor, and at least one social outing, industrial field trip, professional society meeting, and industrial mentor meeting. These learning teams last for one academic semester and require a minimum time commitment of two hours per week from the student mentees, including one hour spent attending a weekly seminar that focuses on the development of professional and career-building knowledge and skills, and one hour engaging in activities that further enhance their knowledge base and academic, professional, and social support systems under the guidance of an upperclassman peer mentor. Participants discuss seminar topics, real-world issues, and departmental coursework, and take part in activities that foster interpersonal communication and active learning. Participants also engage in conversations and workshop activities with an industrial mentor to strengthen their communication skills, while they build their industrial technology knowledge base and skills.

Purpose of Study

The purpose of this study was to determine how the TLC initiative affected students' development of professional networks and relationships with technology faculty, staff, and industry professionals through weekly seminars and team-based activities. In addition, this research depicted the experiences, thoughts and feelings of TLC participants based on their perceptions and reality; ultimately this information could be used to develop grounded theories (see Taylor and Bogdan, 1998, p.137) or themes regarding TLC participation. A qualitative analysis of artifacts and a focus group yielded descriptive data from the TLC participants regarding their acclimation to the department and discipline of industrial technology. These data were then used to develop the grounded theories.

Participants

Nearly 500 students, and approximately 60 peer mentors, have participated in the TLC since fall semester 1999. Student participants (N = 163) from the fall 2002, spring 2003, fall 2003 and spring 2004 semesters and peer mentors (N = 7) from spring 2003 were used in this study.

The student population was predominantly composed of sophomores and juniors, (average age 20-21), who transferred from other departments within the ISU community, mainly the College of Engineering. Participants were generally Caucasian, predominantly male (94%), and previously had a less than favorable educational experience.

The peer mentor sample included upperclassmen industrial technology students who had successfully participated in the TLC and had shown substantial leadership and interpersonal skills. Each peer mentor had completed all freshmen and sophomore-level courses as well as an industrial internship. The seven peer mentors in the sample were Caucasian males (average age of 23).

Data Collection

Data were triangulated from two types of artifacts and a group discussion. The tools used in the collection of these data weekly summaries by students, the ISU Undergraduate Education Survey, and a peer mentor focus group. The primary tool, an artifact similar to a journal entry, was the weekly summary by students that were electronically collected via email and graded by the instructor of the seminar component of the TLC. These were filed in an electronic database for qualitative data, called QSR N5 NUD*IST (Richards, 2000), which enabled the researcher

to analyze the data and facilitate the development of the grounded theories.

A total of 14 weekly summaries per student per semester was expected, and they were worth a maximum of five points each. Students were not graded on quantity, but on quality and their ability to express their reflective thinking adequately. This data-collection tool was used primarily to gather the students' perceptions of their learning team and seminar activities. The main areas of inquiry were a summary of the previous seminar meeting, a summary of the learning team's activities during the previous week, the effectiveness or usefulness of the seminar and learning activities, and any concerns or issues regarding classes, advising, or learning environment.

A secondary tool used to corroborate the findings from the students' weekly summaries was an ISU Undergraduate Education Survey. The original survey included 67 generic questions designed to gauge the participants' feelings and opinions about the total learning community experience. It also documented their self-perception of personal knowledge and abilities, connections to other students and faculty, and average time spent on a weekly basis engaging in various activities. The survey was created and administered by the ISU Learning Community Organization. The survey was expanded by ten TLC-specific questions through the efforts of the TLC staff. The final survey contained both short-answer questions and Likert-scale questions.

Another secondary tool used in corroborating the findings from the students' weekly summaries was a focus group of the sample of peer mentors. This focus group was conducted by the ISU Research Institute for Studies in Education (RISE). RISE created an atmosphere that enabled the participants to openly and honestly express their opinions and concerns. For this group, nine questions were used to gather peer mentors' perceptions of their roles and the roles of the student participants in the TLC. Areas of interest that were important to the mentors in the learning community included mentoring activities, course objectives, lessons learned as peer mentors, and suggestions for improvement.

Findings

Fostering professional networks and relationships among TLC participants, faculty, staff, and industry professionals was one of the primary themes that emerged from the analysis of data collected for this study. Through weekly seminars and learning team activities, TLC participants were able to spend time each week building and strengthening these networks. The importance of these networks and the successful role played by members of the learning community in support of these networks were highlighted by student responses to the Undergraduate Survey. Students were asked to rate their experience in the TLC on a scale of one to four (1 = excellent, 2 = good, 3 = fair, 4 = poor) in terms of making connections with faculty, other students, and industry professionals. Between 80-90% of students rated their TLC experience either excellent or good, whereas less than 10% rated it as poor, thus reiterating the importance of this learning community component.

The first type of network, formed between TLC participants and faculty, occurred both inside and outside the boundaries of the classroom. Chickering and Gamson (1987) concluded that "student-faculty contact in and out of class is the most important factor in student motivation and involvement" (p. 4). Simply knowing that instructors are there to help on a social and academic level gives students a greater sense of belonging and connection.

The following statements, which are representative of the majority of the thoughts and feelings of students, appeared in weekly summaries following a faculty "meet and greet" session, seem to support the idea that a lessening of traditional barriers between teacher and student is beneficial.

- Last Tuesday's class was very interesting and informational. I had no idea how useful the safety option was to the industry today and that there was a huge demand for it already. It was cool to hear from the electrical guy because I always thought electricity was a cool area of study and he made it seem even more interesting and something that would be of interest to me in the future. Without the speakers, I would have been lost in the I-Tec field, because I'm new and really still do not know what it all consists of, but because of the speakers I think it gave me a better feeling for where I'm at now in my college career.

- I really got a lot out of the presentations by the faculty. It let me know what I can expect from their classes and got me interested in their areas of research.

- I found that this last Tuesday's class was extremely helpful in meeting professors that I may have.

In each of these responses, TLC participants expressed their appreciation for the opportunity to meet future instructors in a setting other than the instructor's classroom where there is a formal structure and relationship between teacher and student. Referring to the meeting as "cool," "interesting," and "extremely helpful" displays the importance of making this connection in the eyes of the students. The second student's comment about receiving information on the research area of a particular faculty member opened up the opportunity for a professional network based on this research topic.

Creating these types of networking opportunities in learning communities enables students to find a greater coherence regarding what they are studying, and it allows them to experience increased intellectual interaction with faculty members and other students (Smith, 1991). The student's comment: "I would have been lost in the I-Tec field" and his expressed sense of being better prepared for what may lie ahead and what he was already experiencing are indicators of the value placed on these opportunities. The importance of faculty-student connections has been reinforced by Cross (1998), "Students who have frequent contact with faculty members in and out of class during their college years are more satisfied with their educational experiences, are less likely to drop out, and perceive themselves to have learned more than students who have less faculty contact" (p. 7).

The second type of network was developed between the TLC participants and TLC/departmental staff. This was evident in their interactions with both their peer mentors and the departmental academic advisor. Peer mentors were a strong component of the TLC initiative and were instrumental in providing a collaborative learning environment in which participants were able to make connections and build their professional networks, thus enhancing their knowledge base and skills. Peer mentors "help students make connections to the course material and familiarize them with the services of the university during their first term when they are most in need of a sense of community and connection" (Matthews et al., 1996, p. 6). For example, when peer mentors were asked during the focus group why they felt building a sense of community was important and about their role in making it a success, they gave the following responses:

- I think you want to make things as a community. You got to get people knowing each other and people knowing other people in this department. Not only the students, but the teachers as well. If you get them in here as a freshmen and knowing more people and their professors right away, they will have a lot better time here and will progress better.

- At college it is really easy to get singled out and be left in the dust by yourself not knowing many people, especially when you are a freshman in huge classes. Within the learning community, you learn who has what classes and you can meet others in those huge classes.

- The class gives you all the stuff you need to go on. You get your resume and portfolio and you work together on all that stuff. And I try to get everybody as peers to critique each other too. And then every semester I see something on someone's resume that I want to put on mine, so I get something out of it too. I think the class is a good start that you carry through your whole college.

Fostering a sense of community that enables connections between the TLC students and departmental staff was instrumental in enabling participants to form networks, which in turn enhanced their overall educational experience by creating opportunities to learn from diverse perspectives. According to Matthews and colleagues (1996), "rich, rigorous learning environments, active participation on the part of students and faculty members, and a sense of community make a positive and often profound difference in fostering student success" (p. 4).

The final type of network was between TLC participants and industry professionals. The industry professionals served as industrial mentors and were members of the surrounding community, often ISU and departmental

graduates, who were generally practicing industrial technologists with an emphasis in either occupational safety or manufacturing. During an average semester, they met two or more times with an assigned learning team headed by a peer mentor. They discussed professional development topics, such as interviewing, resume and portfolio development, and industry expectations; visits to the industrial mentor's employment facility were common.

This particular TLC component is a unique attribute that is not being utilized by many learning communities throughout the ISU campus. This direct connection to the surrounding community enabled students to extend their knowledge beyond the confines of the traditional classroom and it went a step further than simply bringing in speakers. It opened participants up to a much larger and more diverse pool of information from which to build their own framework and make the often unforeseen connection between the classroom and industry. The value of TLC participants' interactions with their industrial mentors is evident from the following sample of representative comments taken from weekly summaries:

- They (industrial mentors) give real-life, experienced insight about what should be expected.
- I think the opportunity to be set up with somebody who is willing to help out is awesome.
- They (industrial mentors) guide us and give us advice.
- Actually seeing someone who has a job in the field I am going into really helps me get an idea of what I will be doing.

TLC participants clearly appreciated the opportunity to network with knowledgeable people outside their traditional educational environment. Industrial mentors validated students' goals of obtaining a degree and having a successful career in industrial technology.

Conclusion

The TLC is an example of a program that fosters the development of professional networks among student participants, faculty, staff, and industry professionals. The TLC enabled students to actively construct and strengthen their knowledge from diverse perspectives within and outside their traditional classroom learning environment. Through learning team activities and seminar sessions students were able to make the connection between their academic and professional life, which enhanced their educational experience.

Through a qualitative look at students' perspectives, thoughts, and feelings regarding their learning community experience, this study produced substantial evidence supporting the importance of making connections to one's environment and the ability of the TLC to foster this connection. Learning communities are part of the wave of the future for institutions of higher education that are striving to make the pedagogical and philosophical transformation from teaching-centered to learning-centered environments. As a unique learning community that does not fit the mold of any of the traditional models, the TLC is paving the way for other nontraditional higher education environments that wish to enhance the educational experience of students.

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Requirements, Benefits, and Concerns of Technology Education Cooperating Teachers: An Exploratory Study among Nine Midwest Universities

By Joe R. Busby and Davison M. Mupinga

Abstract

Student teaching experience is important in the professional preparation of teachers. Successful teaching practice hinges on the effectiveness of cooperating teachers (CTs) who spend considerable time supervising and mentoring student teachers. Unfortunately, the welfare of the cooperating teachers is often neglected, and this is detrimental to student teaching practice. This study established the requirements of becoming cooperating teachers, the rewards for cooperating teachers and challenges faced by technology education cooperating teachers in five upper Midwestern states of the United States associated with a program at one university. Data were collected from a sample of convenience (eight technology education cooperating teachers for one university), university websites, and interviews with university representatives. The minimum requirements for cooperating teachers ranged from teaching qualifications or license to additional graduate education classes or training. The CTs received cash, free meals or tickets or college tuition waivers as rewards. The CTs cited the following challenges: constantly changing administrative procedures from the students' universities, under-prepared student teachers, and lack of appreciation by the student teachers. Suggestions for improving the welfare of cooperating techers are provided.

Introduction

Student teaching has been identified as the most important experience in the professional preparation of teachers (Arnold, 1995). To become effective teachers, student teachers are required to learn what the career of teaching is about and then to practice their teaching skills during student teaching. However, the success of the teaching practice hinges on cooperating teachers (CTs) who will effectively supervise and mentor the student teachers (Coulon, 2000). Cooperating teachers are qualified teachers who are assigned to supervise student teachers during the student teaching experience. Although the cooperating teacher is only one member of the student teaching triad, that is, student teacher, university supervisor, and cooperating teacher, he/she has the most influence on the student teacher (Koskela & Ganser, 1998). Student teachers have identified CTs as very significant in their training because they spend more time with them than college instructors (Hynes-Dusel, 1999). With so much importance placed on the cooperating teachers, establishing the needs and challenges faced by the CTs becomes important. Essentially, the welfare of the CTs is important as they perform their vital roles in the preparation of tomorrow's teachers.

The processes and requirements for becoming a cooperating teacher vary from state to state. In some states, practicing teachers who meet a minimum number of years of teaching experience undergo formal training through workshops or education courses in addition to their teaching qualifications to become CTs. In all cases, the CTs serve as the primary guide and role model for the student teacher by providing evaluation and feedback (Rio Salado College, n.d.). Other desirable qualities of CTs include: willingness to share students and stand back while the student teacher tries, being a good role model, sharing teaching strategies, possessing a genuine enthusiasm for teaching, exhibiting sound behavior management, and honoring the requirements of the student teacher's university (Smoot, 2000).

The interaction between student teachers and their respective cooperating teachers has several benefits. The Oregon University System (2002) identified six benefits that CTs receive by working with student teachers:

1. Self-improvement, that is, working with students teachers helped to keep them current
2. Caused them to reflect upon their practices and instruction
3. Their students received more attention because of the presence of another teacher in the classroom
4. Increased level of satisfaction because of working with student teachers in a mentoring relationship

5. Camaraderie as the CTs participated in a shared experience and experienced a team atmosphere

6. Re-energizing experience for the CT.

Other rewards and benefits for cooperating teachers include payment (e.g., in the Commonwealth of Kentucky and Utah), and validation of veteran teachers' knowledge and teaching skills (Koerner, 1992). In addition, student teachers can heighten CTs awareness of innovative instructional and management techniques, which the CTs can subsequently incorporate into their own practice (Bowers, 1994). Other authors view the supervising of student teachers as boosting the CTs enthusiasm toward children and teaching (Tannehill, 1989).

Despite the intangible rewards outlined above, CTs also face problems and challenges. Anderson (1993, p. 607) identified thirteen most prevalent problems for cooperating teachers:

1. Not knowing the college's goals and objectives for the field experience

2. Student teacher often absent and/or frequently tardy

3. Lack of expertise in operating instructional equipment by the student

4. Student teacher that does not ask questions

5. Students with difficulties conducting lessons

6. Failure by the students to give clear and precise directions

7. Shortage of time to sit down and work with student teachers

8. Student teachers with inadequate classroom management skills

9. The college/university does not know what the student teacher has done or is doing

10. Student teachers with no interest in getting to know other teachers

11. Student teachers that do not prepare before teaching

12. Unprofessional behavior when interacting with students

13. No assistance from the college/university on working with student teachers.

For CTs, another problem with student teaching is reluctance to opening their programs to student teachers and university supervisors' scrutiny (O'Sullivan, 1990). Based on the reviewed literature, the importance of the CT during the student teaching experience cannot be overemphasized. However, CTs also have needs and may experience problems as they supervise student teachers. Such problems can affect their morale and can ultimately lead to a compromise of their services to the student teachers. Therefore, to maximize the student teaching experience, the concerns of the cooperating teachers should be identified and addressed.

Purpose and Objectives of the Study

This study established the requirements for becoming a CT; its authors reviewed the rewards and challenges faced by teachers serving as CTs in the field of technology education. Specifically, the researchers sought to: 1) describe the requirements for becoming a cooperating teacher; 2) identify the benefits and rewards for the cooperating teachers; and 3) identify the challenges faced by the cooperating teachers. Further, the researchers sought to compare the requirements for becoming a technology education cooperating teacher and the rewards provided to the teacher by universities with Technology Education programs in the following states: Illinois, Iowa, Michigan, Minnesota, and Wisconsin. Recommendations for improving the welfare of technology education CTs are also provided.

Method

A qualitative study approach was deemed appropriate to gain in-depth information in a natural setting (Strauss & Corbin, 1990). Data for this study were collected from a sample of convenience of eight cooperating teachers (CTs) in western-central Wisconsin. Each CT was supervising a technology education student teacher at the time of the study. All except one of the CTs had previously supervised student teachers. The CTs had 5 and 32 years of teaching experience and five of the CTs had supervised least four student teachers. Two of the CTs had supervised twelve or more student teachers. Because of their teaching experience and role as

CTs, these teachers were considered experts on this subject.

The respondents were asked nine questions pertaining to their demographic characteristics, the process of becoming a cooperating teacher, their responsibilities as cooperating teachers, and the rewards, problems, or concerns for cooperating teachers. The data were collected through open-ended questions sent to the respondents via email.

Additional data were collected from nine state-supported, public universities in Illinois, Iowa, Michigan, Minnesota, and Wisconsin offering technology education-for comparison of the process of becoming a cooperating teacher and rewards received by the cooperating teacher. The data were obtained from the student teaching web sites of the participating universities, and telephone interviews with the universities' representatives who coordinated the student teaching programs. This triangulation of data sources (Denzin, 1984) was considered important to ensure accuracy of the data.

Results

Eight male technology education cooperating teachers responded to the survey. The teaching experience for the CTs ranged from 5 to 32 years (mean =16). Five teachers had bachelors' degrees, and three had MS degrees in related teaching areas. The number of student teachers supervised by the respondents ranged from 1 to 13 and collectively totaled 80. The CTs were supervising student teachers from the same university.

Becoming a cooperating teacher

The process of becoming a cooperating teacher varies from state to state and also university to university. In Wisconsin, the Department of Public Instruction outlines three requirements for one to become a cooperating teacher:

1. Hold a Wisconsin teaching license and have volunteered for assignment as a cooperating teacher or practicum supervisor.

2. Have at least three years of teaching experience with at least one year of teaching experience in the school or school system of current employment or have at least three years of pupil service or administrator experience with one year in the school or school system of current employment, and

3. Have completed training in both the supervision of clinical students and in the applicable standards in Subchapter II PI 34.15 (see, Wisconsin Legislative Council, 2002 p.4; Wisconsin Department of Public Instruction, 2005).

According to the UW-Stout, School of Education (2005) educational professionals who desire to become cooperating teachers for UW-Stout have two options: complete the EDUC-727 "Supervision of Student Teachers" course or the "Cooperating Teacher Module". EDUC-727 is a 2-credit graduate-level online course offered to participants usually with two years of teaching experience. The second option, the Cooperating Teacher Module covers the framework for teacher education, duties and definitions, policies and procedures, evaluation of a student teacher, and e-portfolios. For further details on the modules, see the University of Wisconsin-Stout – School of Education (2005).

The requirements for becoming a CT for all nine of the universities in the study afford similarities and marked differences. CTs were required to have a minimum of three years experience by six of the nine schools. Seven of the universities required the CTs to hold a teaching certificate/license, and two of these universities required the same type of teaching certificate as the class the CT is teaching and that the student teacher is fulfilling. One university that required a teaching certificate/license allowed an alternative of a master's degree plus 30 hours to equal a teaching certificate/license. A master's degree is required by two universities and preferred by another. One university requires the CT to have tenure and another university requires the CT to live within the city where the university and the school district are located. Another university reported the contracting school district is responsible for any other requirements for the cooperating teacher other than the required teaching certificate/license. Two schools, located in the same state, required a training workshop or specified course offered by the university.

The information for becoming a CT is provided on-line by two of the universities. One interviewee for another university said the

information was on-line but could not lead the researcher to the location. The researchers did locate a link titled *Cooperating Teacher Handbook*, but the link was password protected. One other university had information regarding the rewards of being a CT, but it did not list the requirements for becoming a CT. Five of the universities did not have any CT information on-line.

Benefits for CTs as indicated by the universities

Rewards offered to the CTs by the universities are primarily stipends and graduate tuition wavers. Stipends are given by eight of the nine universities and range from $25 for a half semester assignment to $200 for the entire semester. Graduate tuition wavers are offered by five universities and vary from one to six hours of graduate credit. Four of these five universities offer the wavers without specification of courses to use the wavers other than for graduate credit. Two of the universities offer stipends and graduate tuition wavers to the CTs. A senior administrator at one of these universities reported that the current stipend is, "$75 for 15 weeks of supervision, $80 for 16 weeks, plus three hours of graduate tuition. The graduate tuition changes each time tuition rates increase, so currently this equals about $600. For some programs, the waivers also cover "fees and textbook rental." In addition, she reported that building administrators earn one transferable graduate tuition waiver for each three tuition waivers earned by their teachers. The university tries to group student teachers in sites, so administrators earn more tuition waivers. She said, "These waivers really help out beginning teachers."

Two universities have certain requirements that must be satisfied to receive tuition waiver or reimbursement. One university requires the graduate student to agree to become a CT before the tuition is waived for the required course. The other university facilitates the coordination of tuition reimbursement to the CT by their state department of education for the required course. A university offered an option of a stipend, graduate tuition waver for one hour, or performing arts event ticket valued at $125. All of the universities that offered graduate tuition wavers limited the wavers to their university.

A question arises as to origin of the money used to pay the stipend to the CTs. Three universities reported charging student teachers fees and using the fees to pay the stipend. One informant said this practice was clearly stated in the written material their student teachers received and the student teachers were fully aware of the use of the fee. It is unclear if this is a common practice utilized by the remaining universities that pay stipends.

Benefits identified by cooperating teachers

The majority of CTs felt their main responsibility was to supervise and counsel the student teachers to become successful teachers. Other responsibilities cited by the teachers included preparing student teachers for the workforce, providing leadership and quick coaching up front, allowing yourself to let go as the quarter progresses so they gain independence, and providing constant feedback and insight, overseeing the student teacher in development of curriculum, helping build classroom management skills, demonstrating skills in specific area, and being role models.

The cooperating teachers reported receiving $50.00 for one-half semester and $100.00 for a full semester of service supervising student teachers. Other rewards for serving as cooperating teachers include the ability to see the student teachers grow and gain confidence in teaching technology education and gaining new ideas from the student teachers.

One teacher noted, "Seeing the progress student teachers make during the term, getting to work with great people, using student teachers as a resource to see things from another perspective, keep material fresh by using new ideas, and . . . helping me constantly re-evaluate the teaching practices I'm using," [is my] reward. Another teacher remarked, "Seeing the student teacher come away from the experience with the confidence to operate [his/her] own class, [and] watching how students respond to different teaching methods." Additional benefits of supervising student teachers cited by CTs were:

"[Become] more aware of what I do right and wrong. I not only evaluate them, I ask them to evaluate me. I also have made some great relationships because of this association."

"Developing the future of the profession [and] developing personal relationships with others in the profession [networking]."

"Working in a small, one-person department, student teachers break the isolation barrier and bring in new and fresh perspective/ideas."

"Knowing I have contributed in helping student teachers become good teachers or knowing that I had a part in the continuation of technology education in the public schools."

"Knowing I made a difference and will make a difference in the future of how technology education teachers teach. Teachers may not receive too many positive strokes from the public or from past students but when we do [from the student teachers] it makes us feel like we have contributed to our future."

"Many of my student teachers have developed into good friends and colleagues [and this will] continue [through] their professional careers. [Also,] I can provide my students a better learning opportunity with another teacher in the room."

Concerns of cooperating teachers

Despite the rewards and benefits cited, CTs face numerous challenges. Many CTs acknowledged having been very fortunate to have well-prepared student teachers from the college. As one teacher noted, "It's always a lot of work at first but I've been very lucky with the people I've had a chance to work with. I'm concerned my luck might run out some day." However, not every cooperating teacher felt the same way. Among the main problems and concerns cited by the CT were administrative procedures that changed very often, lack of communication with incoming student teachers, unmotivated and overwhelmed student teachers, and unprofessional student teachers.

The CTs were concerned with the lack of or changing of administrative procedures. Over the years, the NCATE (National Council for Accreditation of Teacher Education) has required a change in data-collection procedures for accreditation purposes. In some cases, the data-collection process has been passed on to the CTs. One CT noted, "[The University] seems to change its forms on almost a yearly basis. It has also been unclear which forms should be filled and by who." Echoing the confusion, another CT asked, "Why are area high schools holding preliminary interviews with their student teachers? Is this something I should be doing? Is this something they shouldn't be doing? I know practice interviews are important, but what is the objective or the outcomes of the cooperating teachers holding these? Are they able to pick and choose who they take after agreeing to take someone initially?"

Regarding the lack of communication with incoming student teachers, the CTs also needed advance information on the student teachers they would be working with and they should be able to communicate with the student teachers before they started their assignment. In some cases, the timeframe in which students are placed at schools for student teaching by their host institutions leaves little time for relaying the information to the CT.

Other concerns cited by the CTs were unprofessional behavior by student teachers, such as improper relations with students, late work excuses, partying during the school week, and improper dressing. In one incident, the "student teacher was getting too friendly with female students. [I] explained repercussions and discussed what I saw, and [the problem] seemed to resolve itself." On unprofessional dressing, "[A student teacher] came to school dressed in less than a professional manner, [I] discussed what was appropriate for our school environment . . . and that seemed to take care of the situation," one teacher said. Added to these concerns are "student teachers who do not take constructive criticism."

CTs also felt student teachers were overwhelmed with work required by their colleges. According to one CT, "the student teachers seem to be so concerned with getting things completed for [their college] that they let the classes take a back seat." For one of the colleges, the students had to develop an online portfolio in a specific structure and this was very labor intensive and cumbersome. Again, this took away time from the assumed student teaching responsibilities.

Too many useless college evaluations were another concern cited by the CTs. As one CT noted, "the number of things doesn't really reflect what the student [teacher] is or has learned and what might be areas of concern. I could almost pull an evaluation from my files and write down what the Supervising person from [the college] will write on the first evaluation. Maybe some of these things should be incorporated into [the college's] curriculum."

A final concern on the quality of supervision of student teachers by CT was raised. One CT pointed out that, "I know several cooperating teachers who are doing a disservice to their student teachers by their lack of feedback and consistency . . . [student teachers need more guidance, and therefore] placement should be done more carefully."

Suggestions for improvement

To improve the welfare of the CTs, a number of suggestions were presented. Among these were offering incentives to CTs, providing opportunities to interview student teachers, surveying the CTs to establish any concerns, and conducting occasional workshops for CTs to discuss expectations and concerns. Here are some specific suggestions by the CTs:

> "Offer a course to provide consistency that is enticing to all cooperating teachers – [and] providing key responsibilities."
>
> "I interview all candidates and make my choice [of the student teacher] based on that interview."
>
> "The free meal offered by [the college] is appreciated to develop consistency among teachers, but offering a course with free credits would interest me more."
>
> "I think [the colleges] need to "evaluate" their programs and try to find ways to better prepare students to deal with students who do not conform to the norm."
>
> "The colleges should give student teachers more opportunities to learn to be speakers."
>
> "Student teachers are required to return to [the college] for discussion days. I think bringing in cooperating teachers for one day per year to update or review paperwork, and discuss expectations would help out a great deal."

Overall, the process of becoming a cooperating teacher varies from one state to another and among universities, even within the same state. To become a CT in some states, one has to attend formal training or take a college course in addition to attaining basic teaching qualifications. Other states as well as universities currently do not require any formal training before a person becomes a cooperative teacher. Despite enjoying their responsibilities, many CTs experience challenges ranging from lack of clarity or changing requirements and procedures from universities, lack of communication with incoming student teachers, and dealing with unprofessional student teachers. Among the suggestions to improve the welfare of the CT were consistency when dealing with all cooperating teachers, affording the CTs an opportunity to interview student teachers, requiring CTs to attend a day workshop at the college to review paperwork and touch base about student teaching expectations.

Conclusion

Since data were collected from a sample of convenience, the results of this study are not representative of all technology education CTs in the Midwest and therefore cannot be generalized. Furthermore, the data were collected using email (providing the possibility of identifying the respondents) and this may have affected the credibility of the responses provided by the teachers..

Two issues cited by the CTs as concerns that need further analysis were rewarding of graduate tuition waivers as benefits for cooperating teachers and the evaluation of the CTs. The use of graduate tuition wavers in conjunction with a stipend appears to be a novel solution for attracting more CTs. Although not a part of this study, one senior administrator at a university that gave both the stipend and transferable graduate tuition waivers, indicated the university benefited from the graduate tuition wavers by gaining more graduate students. The tuition waivers seemed to help the recipients to pursue and complete graduate programs.

To improve the quality of supervision that student teachers receive from CTs, there is need for an evaluation of the CTs. Because the CTs play such an important role in the training of student teachers, it seems important to have mechanisms in place to measure the quality of their service. The evaluation of CTs can provide useful information for the further training of CTs or the recognition of performers and nonperformers. Information from evaluations of this nature could be useful when placing student teachers.

A CT is a volunteer position and not an assigned function of a teacher's job. However, there is a need for the CTs to have a clearer understanding of what they are expected to do

(i.e., college expectations) and be recognized for the wonderful and hard work that they do to prepare tomorrow's teachers.

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Online Course Best Practices as Precision Teaching: Case Study of Quality Systems Courses

By John W. Sinn

ABSTRACT

Best practices for online courses are explored as precision teaching (PT) within the context of a case study analysis. The case study focuses on courses taught, 100 per cent online, as part of Quality Systems (QS) at Bowling Green State University (BGSU). PT literature establishes main attributes desired as the basis for best practices. The curricula of these QS courses are explored, with the "mechanics" and infrastructure analyzed to establish their functioning and best practices as main performance attributes, consistent with PT best practices. Attributes identified separately in PT and QS courses are aligned to demonstrate and make the case for best practices in online courses in general. Attributes presented as both PT and QS are explored relationally to demonstrate value-adding potentials as online best practices. Convergence of PT and QS findings are presented as a basis for consideration as broader best practices in online delivery strategies and methodologies.

Introduction

This paper addresses best practices in online courses, as precision teaching (PT), from a case study perspective. The case study focuses on courses taught by the author, 100 percent online, as part of Quality Systems (QS) at Bowling Green State University (BGSU). A brief review of PT-related literature establishes main principles as attributes desired for best practices; these are summarized in Table 1. QS courses developed and taught by the author are explained within an evolutionary backdrop, based on several years of experience. An overview of "mechanics" and infrastructure of the courses is given, and a flow chart is used to explain how the courses work (Figure 1). Best practices for QS courses are further analyzed, identified, and detailed as main attributes and summarized in Table 2, consistent with the approach used to help explain PT and best practices.

Attributes identified separately in PT and QS courses are aligned to demonstrate and make the case for best practices in online courses in general. Each attribute previously presented and discussed, as both PT and QS, was explored relationally and summarized in table 3, which was developed to demonstrate value-adding potentials wherever possible and appropriate, as online best practices. Table 3 shows convergence of PT and QS findings, and relationally as a basis for broader best practices in online delivery strategies and methodologies.

PT Overviewed

PT was born out of the work of B. F. Skinner and others associated with programmed instruction in the 1960s. Originated by Ogden Lindsley, a former student of Skinner's, the focus of PT was to systematize instruction in scientific ways, which then could be studied and analyzed for value adding performance changes with students, based on instruction. West, Young and Spooner (1990), summarized the PT field around a framework of several main principles:

- The student knows best.
- Direct measure of behavior.
- Use the rate of response as a basis for improvement.
- Graphically display and/or chart the process.
- Use descriptors and functional definitions of behavior.
- Conduct ongoing analytical investigations of best instruction.
- Emphasize positive learning and behaviors.

Although much of the work was initially focused on either special education or high-end learners, this approach has been effective in many traditional environments as well (Lindsley, 1991a). The approach is used to monitor and document the learning and behaviors of students over time to show not only that learning has occurred but also to determine the methods that were actually useful in achieving the desired results. PT is a graphically-based system of data and documentation used to assist in making decisions about instructional methods (Lindsley, 1992a).

Lindsley, describing the relationship of PT to Skinner's original work (1991b), discussed

several key attributes of the system. He indicated that rate of response is a fundamental opportunity in learning, but that robust measurements must be conducted to support the rate being defined. Measures must be made continuously using what has been termed celeration charts to demonstrate time and task accomplishment by learners. Significantly and ideally, these measures are conducted by both students and instructors, to document when and how the material under study was learned. Lindsley also indicated that the shape and texture of forms and charts used for recording information were important because acceptance of the systems are critical in their use.

Haughton (1971), identified that precise PT language must be used in all forms and charts, as part of the documentation process. PT was a direct teaching method to be applied systematically and in observable, documentable ways. Haughton also indicated that accurate and continuous data must be collected for analysis in direct, action-oriented, ways by instructors. Fluency, effects on learning, and instructional implications were also addressed by Binder, Haughton, and Van Eyk, 1990. Structurally, as a systemic approach to learning, four areas of growth are generally identified relative to PT: (1) establishing—until the learner has been engaged, learning cannot occur; (2) remembering—the learner must be able to show that he/she can recall the vocabulary in practice; (3) enduring—improvements can be demonstrated at higher levels based on what was learned at lower levels; (4) applying—new environments and applications can be observed based on transference of knowledge that has been gained foundationally (Johnson & Layng, 1992).

Exceptional learners frequently excel with PT based on their independent ability to learn and proceed rapidly through steps and stages while areas other students' learning may become stagnated (Binder & Watkins, 1990). Forms and formats must be designed to best facilitate both the stages of learning, and the comparisons and analyses as output products that engage students incrementally. Although forms and formats must not get in the way of learning, they also must facilitate, in balanced ways, the ability to observe and analyze outputs. Vargas and Vargas (1991) indicated it is key to start with prompts and signals, gradually withdrawing them as learning picks up momentum. They encourage going from easy to fine discriminations, starting with broad concepts, which require further definition and analysis as sub categories, all designed to be intentionally foundational.

Assessment surfaces among the literature on PT in various ways, which was alluded to earlier. Referred to as curriculum-based assessments (CBE), the approach builds on and around PT in various ways that are congruent with the principles being discussed and presented. CBE measurement procedures assess students directly using the materials in which they are being instructed in seemingly integrated ways. CBE sampling items have been structured to allow frequent and repeated measurement which are sensitive to change and documented graphically to allow monitoring of student performance for all to see (Hall & Mengal, 2002).

Binder and Watkins advocated that PT is a scientific approach which causes teachers and learners to assess and analyze ongoing learning and to document all that is done as a basis for making robust and valid decisions for improvement. Documentation that is inherent in PT graphical formats is readily transported and transferred to other persons and environments as examples and approaches, and can be applied for improvement. Need for frequent feedback and interaction, based on data and documentation, to be determined based on specific applications was underscored. Lindsley also provided additional detail on which systems to use in feedback, relative to how best to help communicate with students, teachers, administrators, parents, and others (1995).

The bottom line on PT is that a data and documentation relational system is developed between learners and instructors which forms a basis for optimizing the learning process. The highly organized, readily-managed systems approach to teaching and learning can lead to fluent learners, as they mature and gain knowledge, based on accurate and timely feedback around their improvement. Decision-making rules have emerged to help guide the teaching and learning processes, as standard forms and formats (Binder & Watkins, 1990). PT is a highly disciplined, economical, and "common sense" approach to the improvement process (Lindsley, 1992b).

Table 1 summarizes attributes identified through a literature review of PT. Each attribute is presented, along with author referenced by

Table 1. PT attributes defined and explained in a summary table.

PT Attribute	Reference, Year	Explanation, Definition
Charting, document, data	Lindsley, 1992b	Charting systems are used as basis to monitor progress, to document what is occurring in teaching and learning process. Data is used wherever possible as basis for decisions on method.
Rate of response, fluency	Lindsley, 1991b	Students show improvement by increasing productivity over time, assuming difficulty level constancy. More difficult work may initially slow rate, but with learning, rate should increase.
Writing, word precision	Haughton, 1971	Written communication in forms is significant, and can increase learning if done with precision and accuracy. How wording is done adds value, modeling proper writing performance.
Form and format, fluency	Binder & Watkins, 1990	Students need structure, how forms are designed can add value to the system, better facilitate learning. Like wording, the formats can serve a modeling role for how to organize information.
Simple to complex, fluency	Johnson & Layng, 1992	Stages, or phases, of learning are acknowledged to move learners appropriately. Design is from simple to complex based around establishing, remembering, enduring and applying.
Functional descriptors	Lindsley, 1991a	Outcomes and objectives in courses should be expressed in behavioral action terms to address what should be evidenced learners as changes to evidence learning.
Assessment	Hall & Mengal, 2002	Systemic and scientific approach, with documented evidence learners of work done, learning integrated curricularly, assessment is simplified and fairly straightforward, readily tracked.
Engaged, direct teaching	Vargas & Vargas, 1992	Only after students are engaged in relevant and meaningful instruction can they be expected to learn. Examples and other learners to support systems should be used at first, then gradually removed.
Student knows best	West, Young & Spooner, 1990	Students respond to that which they understand and are able to use flexibly relative to their knowledge, experience. Fluency over time shows flexibility in instruction and assimilation.

year, and sufficient explanation to define and support the inclusion of the attribute as a basis for foundational relationships to courses, particularly thought to lead to best practices in online teaching.

Quality Systems Courses

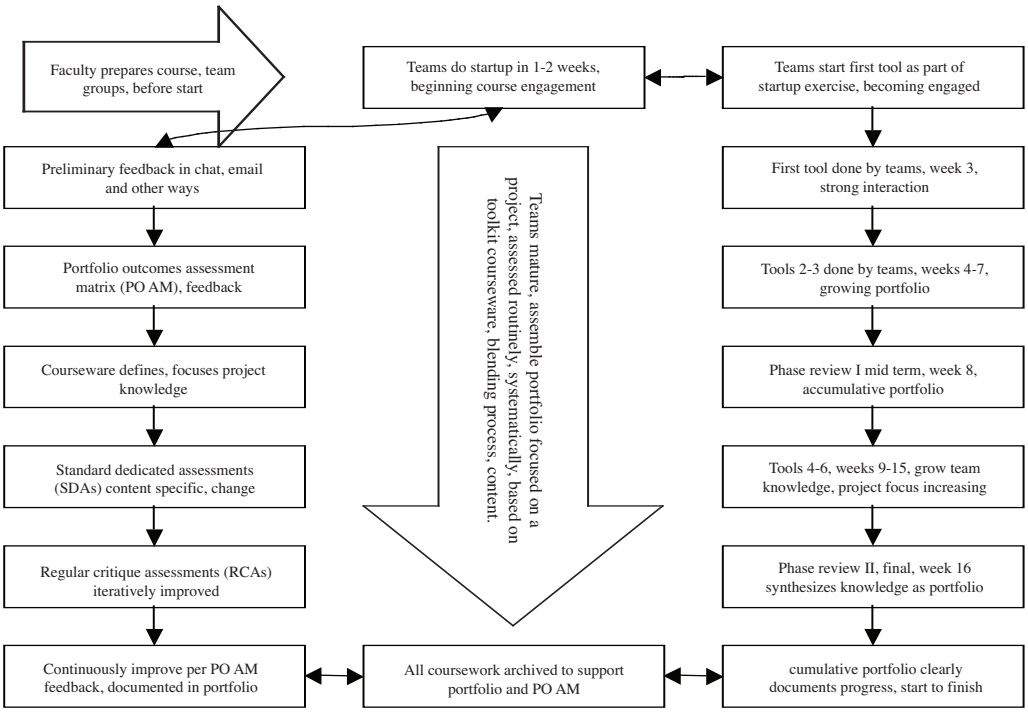
Created in the late 1980s at BGSU in response to quality professionals' demands, quality-related courses have been offered at the graduate and undergraduate levels, 100% online, since the late 1990s. Recently the undergraduate QS curriculum has been proposed as a concentration in a new curriculum titled Engineering Technology. The graduate-level Masters of Industrial Technology (MIT) degree uses four QS classes as a certificate. A Ph.D. consortium with other universities, through Indiana State University, uses three BGSU QS courses.

QS courses are designed and focused around quality improvement principles reflecting ISO 9000 standards and team-based problem solving in various environments, using lean and six sigma concepts. Functionally, course operation is described in Figure 1. The graphic moves from top to bottom, as a traditional 16-week course structure, and the large arrow connotes a portfolio being assembled, across the course, accumulatively synthesizing all student work.

Significantly, the course actually begins with the instructor preparing, or configuring it. Assuming the instructor understands the mechanics of the online environment (regarding configuration), and based around the mechanics of course delivery in the precision-oriented manner being discussed, configuration takes perhaps 10-12 hours, depending on how many teams are being set up per course. Functionalities used are discussion boards, chats, emails, and announcements for communication and management. Course information is used to provide examples, necessary content, and any long-term information for users. Many functionalities commonly used by others in the course shell are built into the courseware, requiring only basic elements of the Blackboard course shell. The course shell is a electronic vehicle for delivery of the course, similar to a traditional classroom.

Students register for courses, and are assigned in alphabetical order to groups/teams. Startup commences and team members become

Figure 1. Main steps in QS courses as flow across 16-week traditional course timeframe.



engaged, communicating via email in the course shells (required). The instructor typically will study this interaction and determine how and when to assist. As startup winds down, a first tool is started. The objective is to have startup done in 1.5 to 2 weeks, and a first tool finished within 3 weeks. During this time, the instructor watches, offers advice, emails, and comments in chats and at discussion boards. This is a very active period because most students are learning how to use the online systems and the instructor's courseware. Courseware is shipped from the BGSU bookstore as a CD when requested online, typically arriving via standard postal delivery within two weeks. First tool content and process information is posted in the course information area, enabling students to proceed.

Beginning with tool 1, and used for all work thereafter, the instructor uses the portfolio outcomes assessment matrix (POAM) as the primary method to communicate feedback to students based on their work. The POAM embodies outcomes and key attributes identified as critical to accomplishing outcomes, also listed. A rating scale is used for outcomes and attributes, assigning points to derive scores, and ultimately a course grade. This is summarized in spreadsheet format and shared with all when each tool is completed.

Chats are also held routinely when each tool is completed, (minimum), and additional chats are encouraged, because it has been observed that better performing teams commonly conduct more chats in the environment under discussion. The one required chat for each tool allows teams to do the minimum, and/or to do more in a fairly empowered manner, similar to traditional physical environments. The instructor does not necessarily participate in all chats, but he or she may request to be invited by teams. If a team is having difficulty with any aspect of the course, the instructor participates in chats for obvious reasons. Also, the instructor "pops" into chats at brief times, unsolicited, because some teams are reluctant to request assistance, sometimes not knowing they need help. Note that chats are required to be archived as teams do them, and this becomes a critical component in what is analyzed for assuring a team is maturing at an appropriate rate.

As the first three course tools are completed, during the first half of the course, functionalities that are identified are refined and mastered by teams, under faculty guidance. At mid-term, a first phase report is conducted (students have the opportunity to go back into the previously prepared work for previous portfolios). Based on earlier feedback, teams are encouraged to go back to the project under development and to

add and delete materials based on their evolving project objectives and focus. The mid-term phase presentation, equivalent to a mid-term exam in traditional courses, is an opportunity for teams to demonstrate their own "best practices" that they have developed and matured. Typically, while most are becoming comfortable with the course at this point, they are only beginning to master the content. The focus at mid-term is definitely shifting from "how do we do the tools and course" to what do we do? Content is taking precedence over process previously of primary interest for obvious reasons. As teams continuously improve, the focus on project objectives become increasingly clear and intentional.

After mid-term, phase I completion, 3 additional tools are completed by teams, and a phase II portfolio is prepared. Phase II exhibits many of the same attributes as phase I, but due to maturation and knowledge gained around a increasingly focused team, the best practices and what is synthesized as portfolio become much more robust. It becomes increasingly clear that progress has been made based on documentation by teams, all built around and within the custom courseware, by design.

Infrastructure Best Practices

Several course attributes are identifiable within the QS curricula as best practices under development; these can be related to PT based on the analysis provided here. Criteria used in the identification process for QS attributes as best practice were whether, and how, value is added. Each attribute is listed, further detailed, and described. Justification and explanation as a best practice is given as part of the discussion.

QS course attribute 1: Startup. A "startup" activity is conducted at the outset of the course; this is done both individually and collectively as team, helping all get started. Familiarity with all key information and systems used in the course, including the syllabus, past course assignments completed by previous teams, and other documents, is key in startup. Startup provides team formation and infrastructure, and it leads to the first full assignment, reinforcing electronic systems and all other key course attributes.

Startup is a best practice because, in a controlled manner, parceled out over time, all key elements of the course are introduced. Teams are formed, going through much of the "normal" team behavior; simultaneously they may be overwhelmed by a fairly complex course infrastructure, one they assumed to be fairly trivial and simple, "easier than real courses." Once startup is successfully completed, the team is moved past "process" issues to be more heavily involved in the content of the course.

QS course attribute 2: Custom Courseware. Author custom-developed courseware provides course content and process as a stand alone system in CD form. Courseware, titled "The Industrial Technologists' Toolkit for Technical Management" (ITTTM) is designed for conducting online technical and professional projects and applying quality system principles by student teams. These courseware systems guide and direct student work, based on a tabular format (template) explaining how forms are used, and they provide a place for written responses. Courseware content is written in 42 tools with six dedicated to each of seven possible courses in the courseware, further organized as long and short forms. Long form text is similar to chapters in conventional texts, and short forms are Power Point presentations.

Custom courseware is a best practice because it positions highly empowered, able student learners to take control of their desired course outcomes, and position their work to demonstrate accomplishment. The value added based on the systems is incremental and not necessarily readily noted on any one independent portfolio of work, but when all portfolios done by a team are noted in total, as students learn and come to appreciate the courseware.

QS course attribute 3: Courseware (SDA) Forms. SDAs, are forms oriented to specific content presented. Since content changes with each ITTTM tool, SDAs change to give examples of tool applications, questions to assist users, and reflection on how to improve the work of the team. This process engages users for collective thoughts, which are documented for future reference and improvement. Students conduct independent SDA work, addressing team project objectives, and they compile and synthesize one or more forms as team research methodology. Individual SDA work is organized and collectively managed to illustrate data and information for the project, and at a more robust level, all students review parts of each other's work as part of the team portfolio presentation. Quality is addressed in an organized way, as well as specific content, and all discussed in

chats and reviewed and analyzed for improvement via the discussion board.

SDAs are best practices because they focus very precisely on exactly what must be taught or engaged in the course, while ongoing dialogue and increased knowledge are "journaled" over time. As portfolio iterations move to phase reviews, student critiques based around SDAs allow all to see others' work, and consider how each fits in a synthesized, cohesive manner focused on the team project. Thus, part of the value-adding key, particularly in SDAs, is how students teach and learn by/with/from each other, by design. SDAs are applications of the content provided in the ITTTM, analogous to traditional lectures in the conventional teaching and learning environment. SDAs are designed to illustrate, in fairly specific ways, the current professional practices, and they engage students in the same as efficiently as possible. This is increasingly being done via MS Project software, particularly using Excel and related documentation tools.

QS course attribute 4: Courseware Required Continuous Application (RCA) Forms. RCAs, are ongoing forms that challenge student teams to consider ways to improve and how to better do the work in process terms, according to four forms, each further detailed as best practices (see following). As a group, however, and as part of the broader ITTTM courseware system, the RCAs make up a template that guides and facilitates the work of teams across the course, built on startup, and interfaced with SDAs.

RCAs intentionally, and systematically, provide a platform for continuous improvement. Teams are required to reflect on what and how to improve; and each portfolio is submitted with written documentation. The written documentation is "pulled" into each next portfolio presentation and modified based on what was learned, and interfaced with all else that is part of the systems (SDAs, chats, discussion boards, emails, and announcements from instructor, etc.). Across the course, RCAs are increasingly directly keyed to the course outcomes as shown in both the POAM and the syllabus. It has become increasingly clear that the repetition provided around outcomes, in positive ways within POAM as well as each RCA, and elsewhere, is one of the keys to tight and precise instructional delivery.

QS course attribute 5: Project Portfolio Assessment, Research Methodology, Plan (PPARMP). This plan describes the details that are under analysis in a student-led, team-based project to assist the team in explaining the project portfolio, driven by continuously evolved project objectives. As part of this plan, the FACR is part of each SDA, to help summarize collective knowledge related to how the SDA was used, and the findings, analyses, conclusions and recommendations. This plan (the PPARMP) and the FACR are ongoing, which help complete a research methodology.

The PPARMP, particularly as reflected in a team-based project is a best practice since real or simulated professional applications of principles under study and investigation are addressed. The system has used both real and simulated work but has moved increasingly to simulations of data and documentation around courseware systems, with students "modeling" their collectively configured portfolio of best professional practices. This has resulted in a tighter, more controlled project, course, and portfolio, driven by empowered students conducting project objectives.

QS course attribute 6: Review Of Literature, Documentation Assessment (ROLDA). This assessment is a review of relevant literature by all on the team, focused on content in each tool, and requiring additional information from external sources. Two separate reviews are conducted, one of the internal sources, the ITTTM tool content, and the external source independently identified by each student. All information, both as content provided in the courseware, and as external sources, are abstracted by users as part of the broader project portfolio.

Students analyze and critique their own and others' information and reflect on it to help demonstrate what is being studied for improvement. As the iterative dialogue increases around the ITTTM tool content, as well as external information, knowledge evolves, and students engage in reflection and analysis. The focus of all this activity, facilitated and guided by courseware, is the delivered project, reinforced by course outcomes. Over the years this has been one of the most positive elements in the courseware system. Students, pretty consistently reaffirm the use of systematic ways to review and document information appropriate to their

professional practices, although finding the appropriate balance between amounts and emphases of external and internal information has been a challenge at times.

QS course attribute 7: Portfolio Presentation Management Team Assessment (PPMTA). This assessment provides internal and external self-assessment systems designed to assist team members as they improve continuously. All members assess each other when each tool is completed, providing numerical ratings, and a grand mean average for the team. The team uses the same scale to assess all other teams in the course, and to provide feedback as a benchmark for improving its own work.

PPMTA is a best practice because these steps afford students the opportunity to improve continuously in documented ways. Also as each portfolio iteration is built toward phase reviews, like most SDAs and RCAs, this assessment provides opportunities for all students to review work processes and management being done by others and to consider how all of this fits together holistically. Both PPMTA systems, internal and external, are fairly tight and controlled criteria in spreadsheet form, which provide robust benchmarks to compare performance and to improve both individuals and teams. PPMTA also includes a "scorecard" to track performance, communicating total team performance as a means for improvement.

QS course attribute 8: Findings, Analysis, Conclusions, Recommendations (FACR). The courseware template provides an integrated research methodology, to be built on and modified per the team's project. Research methodology matures per the team's understanding and gain in knowledge of courseware. As part of PPARMP, the plan is documented and elaborated on, including findings, analysis, conclusions, and recommendations. As each SDA is completed, focused on individual parts of tool content, each person on the team reviews the applicability of the specific part of the tool being used in an FACR tabular format, poised against project objectives and what was found based on use of the tool. When all SDAs are completed via the discussion board, FACR information is compiled in a synthesized format for the portfolio.

FACRs are best practices because, in an increasingly organized manner, objectives are addressed and delivered in a project. This has emerged as a value-adding way to cause students to individually and collectively reflect on their work. As FACR comments grow, matured with each tool, cause and effect relationships emerge, and teams integrate this back into research methods as part of their learning around project objectives delivered.

QS course attribute 9: Portfolio Outcomes and Assessment Matrix (POAM). The syllabus precisely "nails down" course details to reduce ambiguity and increase clarity. Course outcomes are presented in the syllabus, as a POAM, focused on outcomes as key strategies. This matrix not only provides outcomes but also characteristics of course performance further detail behaviors developed and observed in portfolio documentation. Traditional information regarding readings, due dates and other structures of the course are provided in the syllabus, all completed around assessment, driving the course toward precise accomplishments.

This is a best practice because the overall context of the course is presented in a precise and detailed manner in the syllabus. POAM operationally and functionally describes not only outcomes to be achieved, but also characteristic behaviors to be developed and evidenced in courses by students. Courses under discussion do not use tests or exams, nor does the faculty lecture or use most other traditional earmarks of traditional teaching practices. It is asserted that by precisely documenting all work, which improves the portfolio over time around rubrics derived based on professional practice and values inherent in the university community, a true assessment is done. This is a best practice based on efficient use and management of information by all participants.

QS course attribute 10: Chat. Each main course assignment requires a single chat by the team (more are encouraged, and best teams typically discuss more than required). The instructor participates in many of these chats, particularly where it is clear that students are "not getting it" (e.g. work is not being posted, it is not posted in a timely manner, or the quality of the work posted is not up to par). Nine chats are required, each archived for review by team members and the instructor', gradually, the instructor does not, intentionally, participate. Teams develop a culture for decision making, the organization and conducting of meetings, and key communication systems, where students are empowered to

demonstrate positive behaviors that result in successful chats.

The chat is presented as a best practice because the actual behaviors of student teams are analyzed after the fact, both by the students and the instructor. Similar to conventional classes, when verbal discussion is completed, even where effective minutes may have been taken and later distributed, the use of chat provides a "real time" point of action and demonstrable, documented, participation. Interactively via discussion boards, as well as other general communication tools in courses, a chat provides a true opportunity for managing and communicating the culture of the work documented in the portfolio. Final outcomes documented in portfolio demonstrate and correlate to/with the level of quality and satisfaction managed in chats and discussion boards.

QS course attribute 11: Discussion board. The discussion board, instructor configured, further defines what should be completed, when it is due, and so on, reflecting teams' foci, detailed objectives and other expectations. Students on teams successfully post work, on a discussion board, congruent with what is defined and communicated in all course documentation, reinforced via announcements, emails, chats, use of examples, and so on. Individual postings by students, according to defined specifications, demonstrate that they are functioning and learning in appropriate professional ways. At a higher level, students must organize and manage their collective, collaborative affairs by constructing threads where all work is posted logically and precisely. This becomes the basis for one person to compile all work in the portfolio for presentation. The compiling function is generally completed by a team leader, designated on a rotating basis, so that all on the team are afforded this opportunity to lead the work of others.

Discussion board, like a chat, is a best practice because if a student is not present it is a clear, conspicuous signal of a lack of participation or engagement. Comments made in the discussion board are obvious, showing the kinds of participation, writing style, and quality of work, and so on, again clearly reflecting the nature and quality of engagement. Leadership attributes, by students, are traceable in ways related to numbers of messages posted, length of writing, and other detailed elements that can and should be noted by the instructor.

QS course attribute 12: FAQs, SOPs, examples. Frequently asked questions have been organized, written in a standard operating procedure (SOP) type format similar to the way in which SOPs are organized in industrial and technical work. The precisely written FAQs and procedures reflect the values of quality systems and "doing things the right way," detailed explanations, procedures, questions or issues, organized to guide students and others trying to navigate and/or understand the course. The information ranges from common questions to step-by-step work instructions, all developed based on those areas traditionally requested for further explanation over the years. FAQs are presented for all to access, and if used, can aid continuous improvement over time. Course examples provide a baseline of performance based on past best work done by others, acting as a general guide to teams as their portfolios mature.

FAQs, SOPs and examples are best practices, usually identified as a plus by students, regarded as effective and efficient ways to get answers. Instructionally, the time wasted by answering the same questions over and over is virtually eliminated, and instructors are freed up to facilitate a robust course. Moreover, providing information as key answers to issues and circumstances known to be problematic, and thus reducing problems up front, is a key to empowerment.

QS course attribute 13: Communication tools. Communication tools include email, announcements posted and updated routinely around completed tools, and general course information posted at the outset of the course (others are added as course information, for any long-term information needed). This is all conducted within the course shell, because this affords a controlled environment that generally will remain free from viruses and frivolous use. Currently, the changeover rate for most information is driven by the pace of startup, 6 tools, and 2 phase assignments, with diminishing announcements and support information being provided over time (heavy use at outset of course, light toward completion).

Communication tools, contrasted to more specific methods (chat and discussion boards) are important best practices for several reasons. Email and announcements assure that all students have access to the same information as a baseline. This communicates a general guide to

teams, recognizing they will have more questions, to be anticipated in announcements, or responded to in emails as they gain focus and knowledge. Controlled information, both posted and sent, is critical since the alternative is an impediment to timely and meaningful, non trivial focus on course outcomes.

QS Course attribute 14: Empowered team. Key attributes include leadership, empowerment, and management. The course systems, including courseware, Blackboard, and others, put much responsibility squarely on students in ways similar to professional environments. Students take a turn at leading for one of the main assignments, and all rotate through this eventually (thus, nine or ten persons per team). Leading requires configuring threads in the discussion board, organizing chats, and compiling the portfolio, among other responsibilities.

An empowered team is a best practice because this reflects talents that must be embraced by persons wishing to participate fully in the competitive professional workplace today and in the future. Conduct of these types of management and leadership functions in an electronic environment is even more compelling because this is the way teams will increasingly communicate. A empowered team has well-managed, highly organized collective behaviors, well documented to demonstrate best practices it has developed.

QS attribute summary. When all QS attributes are summarized and pulled out from the above presentation and discussion, a list of 14 attributes can be provided (Table 2).

PT and QS Relationships As Online Best Practices

The author identified and explained various attributes related to precision teaching (PT) and quality systems (QS) courses, all in a context of best practices for online delivery methods. Conducted primarily as a case analysis, focused on the author's courses and approach, biases were fairly conspicuous and not hidden. Attributes identified, both as PT and QS, were placed in Table 3. Attributes were used as the

Table 2. QS Course attributes, with value-adding best practices explained in summary form.

QS Attribute	Summary QS Attribute, Value Added As Best Practice
Startup	An overview of, and introduction to, all key course elements, team is built, infrastructure of the course explained
Custom Courseware	Instructor built courseware identifies course process, content, replacing traditional lecture and other elements
Courseware SDAs	forms applying content, examples of main principles, all done in a template which guides student engagement
Courseware RCAs	forms guiding reflective process, journaling comments showing improvement in demonstrable ways over time
PPARMP	Real or simulated team defined project, professional practices as research plan, assessed over time via portfolio
ROLDA	Review author generated readings, externally pursued topics by teams, support research objectives in project plan
PPMTA	Assessment, systematically and in disciplined ways, based on detailed feedback routinely by self, teams, instructor
FACR	Findings, analyses, conclusions and recommendations, research method in project, objectively assesses change
Syllabus, POAM	Syllabus details all key deliverables as POAM, portfolio outcome assessment matrix, showing assessment process
Chat	Chat done routinely, increasingly led by students, to address regularly provided assessment feedback and other
Discussion Board	Blackboard where student postings all work is configured to guide/facilitate team-based project, portfolioed
FAQs, SOPs, Examples	Documentation built over time, FAQs used as SOPs and example work from the past as baseline for improvement
General Communication	General communication in Blackboard course shell to enable all having same information, opportunity to learn
Empowered Team	Tools/information are provided, configured to enable all to learn, lead as they are increasingly able, empowered

basis for convergence of thinking around what became identified as "online best practice rubrics."

Analysis of attributes inherent in precision teaching provided a basis from which to establish legitimacy in methods developed for QS

Table 3. Convergence of PT and QS attributes around online best practice rubrics.

PT Attribute	QS Attribute	Online BP Rubrics	PT, QS Attributes' Relationships Analyzed, Leading To New Online Best Practice Rubric, Convergence
Charting data, documented	SDAs, RCAs, Courseware	Phased portfolio template, development	Charting in forms documents what is occurring, used as basis for decisions on method and work in team, ultimately at e-portfolio. Written documentation is key focus of virtually all functions incrementally developed and grown as knowledge.
Response rate, fluency	Startup, POAM, PPARMP	Course outcomes, syllabus rollout	Improvement in increased productivity and quality over time is documented, demonstrating course outcomes and related procedures in all functions. Based on regular feedback on schedule, systematically improve around phased iterations.
Writing, word precision	RCAs, SDAs, Courseware	Phased portfolio template, development	Documentation in e-portfolio templates, done with precision and accuracy over time, shows model writing and project deliverables. Applied tool theories and principles reflect improvement and learning over time, developed in demonstrable ways.
Form, format, fluency	Startup, PPARMP, SDAs, RCAs	Electronic leadership, management	Structure, in forms is designed to add value, better facilitate learning by example in formats modeling proper organization of information. Templates show research methods, how to follow through to manage and lead all work, as research plan.
Simple to complex, fluency	Team-based project, Startup, POAM	Phased portfolio template, development	Several phases move project deliverables and team as learners, designed from simple to complex based on establishing, analyzing, applying. Communication is precise, accurate, all reflected on systematically, engaged and documented in portfolio.
Functional definition, descriptors	POAM, FAQs, SOPs, examples	Course outcomes, syllabus rollout	Outcomes are addressed as action terms and deliverables evidencing changes, likely as knowledge learned. All information focuses and reflects outcomes for assessment in action-oriented ways, clearly communicating course and project deliverables.
Assessment	POAM, FACR, PPMTA	Research service, engagement, reflection	Systemic, scientific approach and problem solving applications, with documented evidence and learning integrated, readily assessed and tracked. Objective findings, conclusions in service and project clearly based on data, documentation, not opinion.
Engaged, direct teaching	Discussion board, chat SOPs, FAQs	Electronic leadership, management	Students engaged in relevant and meaningful instruction can learn, increasingly done electronically. Electronic support systems, gradually reflect engagement around applications, all information managed, as project to address desired outcomes.
Student knows best, action-base	Empowered team, SDAs, RCAs	Research service, engagement, reflection	Students do best in existing knowledge and experience, as positive service to others. Fluency comes over time, reflective of positive experiences, empowered leadership, other action orientations, demonstrating engaged research and service.

courses and curricula. Objectively, the parallels apparent in PT and QS went beyond interesting and intriguing, and approached astonishing for the author. Based on traditions at a fairly solid conventional university, the revelation that there was an entire field of thinking, a discipline, which had a high degree of similarity to what was being done in QS courses, delivered online, was quite interesting and professionally gratifying.

Convergence of thinking, developed around PT and QS attributes, led to four online best practice rubrics. These rubrics were identified and described in Table 3 around the following four areas:

- Phased portfolio template, development
- Course outcomes, syllabus rollout
- Electronic leadership, management
- Research service, engagement, reflection

The four rubrics deserve additional consideration, particularly for others who may deem them worthy. Based on relationships disclosed, it is suspected that reviews and exploration of other fairly well-established and accepted teaching and learning approaches can help educators to better understand online strategies and methodologies. Several important findings hold promise for improving the courseware and associated course attributes:

1. Use of existing software such as MS Project, integrated around and with the courseware, to make applications increasingly seamless is an important area to be studied.

2. Development of additional content emphasis, and actual tools, around the management and enhancement of information technology and communication systems management.

3. Additional integration of video and other systems and technologies that make the electronic and online world as close as possible to the actual face-to-face physical world.

4. Continued pursuit of one hardware platform, likely a laptop PC, to accommodate courseware and other attributes associated with QS online courses, enhancing wireless use.

Perhaps at a different level, findings and results of this work also appeared to open the doors for application of online courses, tools, and systems into other arenas. This aligned heavily with terms disclosed in the rubrics, and resulted in several additional questions for the future:

1. Are online courses actually superior to traditional face-to-face courses, beyond the obvious advantages of reduced brick and mortar costs and potential efficiencies, based on academic rigor and robustness in online delivery for enhanced quality in teaching and learning?

2. Why are educators not placing more emphasis on online enhancements and value added in general education, engagement and reflection, service learning, leadership and management, requiring some coursework to be done 100 percent online, perhaps in a learning community?

3. Why not use online strategies to add value into the educational environment, using teams of students to electronically analyze, lead, and manage change, with faculty, staff, and others?

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An Examination of the Starting Point Approach to Design and Technology

By Keith Good and Esa-Matti Järvinen

Abstract

This study examines the Starting Point Approach (SPA) to design and technology, which is intended to maximize creativity while being manageable for the teacher. The purpose of the study was to examine whether the children could do what the approach requires and in particular whether it promoted their innovative thinking. Data were collected during teaching sessions with 27 Year 6 children in London and rural Finland (ages 11-12). The theoretical framework of the study is qualitative in nature.

The participant researchers videoed sessions in their respective countries that were taught according to an agreed "script". This included guided brainstorming chaired by the researchers. Children were introduced to some technology and explored its use in the wider world. They were then shown how to make their own working example that was the starting point for their designing. After brainstorming, children went on to develop a wide variety of different projects of their choice.

In the UK and Finland, children in a specific class usually are required to design products with the same purpose. In this study, the *SPA* approach allowed children in the same class to design products with many different purposes. They developed the starting point to fit with their own experience and interests or the needs of others around them. One major advantage of the *SPA* is that it seems to reconcile the often-conflicting demands of teaching specific skills and knowledge while encouraging individuals to be as creative as possible. The common starting point was crucial to making this feasible.

Introduction

The importance of creativity in education has been highlighted in the UK by the National Advisory Committee on Creative and Cultural Education (NACCCE) report (1999). Numerous papers on creativity in design and technology have followed (Kimbell, 2001; Spendlove, 2003). The DATA International Research Conference 2004, focused on creativity and innovation. Creativity is sometimes associated with genius or exceptional achievement, but there are other interpretations. Benson (2004) states that while teachers may have a future Picasso or Freud in their classes, it is more likely that they will have children who have "an original idea or solution that is original to themselves and not necessarily totally original". This is what Craft (2002) calls little "c" creativity that is arguably within the reach of all children, especially when it is properly promoted. We should remember however that the students who Benson calls future "world-view changers" are in some classes *right now*.

The NACCCE report (1999, p.30) called the highest category of creativity "historic originality". The levels of creativity available to most children are nonetheless still worthy of development. We do not give up teaching children creative writing because we think they might never be capable of winning the Penguin Prize for Children's Fiction! The study described in this paper was based on the premise that all children are capable of a degree of creativity in identifying design problems and generating "original" solutions.

Technology has been described as human innovation and problem solving in action (ITEA, 2000; McCormick, Murphy,Hennesse, and Davidson 1996). Problem solving should relate to children's real-life environment, allowing them to make appropriate and meaningful connections (Schwarz, 1996). Moreover, this opportunity should enable them to explore and pursue their own needs and interests as well as those of others. Children should be encouraged to identify problems and deficiencies in their everyday environment; they should be given opportunities to apply technological knowledge and skills they have acquired in previous problem-solving situations (Adams, 1991).

This study arose out of the researchers' combined experience as technology educators. This experience indicated that the starting point approach (*SPA*) was an effective way of promoting creativity in a manner that would be manageable to teachers. The *SPA* approach had been used increasingly in their work with children, student teachers and teachers in the UK and

Finland. The *SPA* model was used by Good (1988) and developed further within his *Design Challenge* series of books (1999-2000), extending the scope and range of exemplar material. The use of strategies to promote design thinking is of course not unusual. A range of these have been used to enhance the creative and innovative activities of children based on models of problem-solving processes in technology (Kimbell, 2004, Layton, 1993; Sparkes, 1993).

Most primary schools in England follow the Qualifications and Curriculum Authority (QCA) (1998) scheme where the outcomes in a class are directed to have the same purpose, for example, the children are told to design a photograph frame or a pair of slippers. This situation is mirrored in Finland, which has a long tradition of handicraft education where pupils have traditionally made artefacts almost by recipe. However, during the recent revision of Finnish compulsory school framework curriculum, teaching technology was introduced as a cross-curricular theme called "Humans and Technology". One aim of the theme is to encourage children to develop technological ideas and be taught to evaluate them as they work. The new framework curriculum requires teaching technology across the curriculum.

The Starting Point Approach (SPA)

The Starting Point Approach, SPA, used in this study, is based on the model of technological problem-solving processes mentioned previously. However, it has specific features that distinguish it from other approaches which are characterised by outcomes with a common purpose (Suvillan, 2005).

In the *SPA* children are first introduced to specific technology and encouraged to explore the context in which it is used, how it is relevant to them, and how it can be applied in the wider world. They are then guided in making their own working example of the starting point that they were initially introduced to; in the process they gain knowledge, skills, understanding. This would include what English teachers would recognize as *focused practical tasks* and in the *SPA*, provides the starting point for their designing. Helped by brainstorming led by the teacher, children then develop a wide variety of different projects of their choice. Unlike the usual approaches in the UK and Finland, in the *SPA* children can, within reason, design "what they like". The starting point can be developed out of a need identified by the children themselves, reflecting their own experiences and interests or the needs of others around them. Typically many more ideas are proposed than it is feasible for the children to make in the time available. They have to select their favourite idea to actually make and evaluate in use. Sometimes two or more ideas are combined to make a new idea. The teacher may offer guidance regarding the child's choice. Some ideas might be less suitable than others when the available materials are considered, or there may even be safety or ethical issues! Even "unrealistic" ideas are not treated as "bad" or "stupid". Adult designers also work with constraints, and they usually have to narrow their ideas down to one that will be taken to the working prototype stage.

The *SPA* seems to reconcile the often conflicting demands of teaching specific skills and knowledge with encouraging individuals to be as creative as possible. The common starting point is intended to make this feasible.

Purpose of the Study

The purpose of the study was to examine whether the children could do what the approach required in particular and whether it promoted their innovative thinking in technology education. Moreover, it was hoped that an examination would bring aspects being done intuitively by the teacher/researchers to a conscious level. This would facilitate an analysis of the process and inform future teaching. The research also had the potential to identify ways to maximize the effectiveness of the *SPA* and give an insight into what happens when children generate ideas in this way. The analysis is ongoing, but some fundamental questions about the *SPA* are considered in this paper. Essentially, the authors asked whether the children could do what the approach asked of them and if it helped them to develop projects with different purposes within the group.

Methods of Inquiry

The theoretical framework of the study was qualitative in nature and based on interpretative skills and inductive analysis, whereby the researchers continually explored the relationship between data and emergent findings (Ritchie & Hampson, 1996). The study employed an open search for children's emerging ideas for ways to turn a pressure pad on. This is a pressure sensitive switch made in this case from three pieces of card and some aluminum kitchen foil (see

Figure 1). Even more important, the researchers wanted to see whether the children could apply this starting point in innovative and creative ways in their own living environment. The children's ideas were thereafter interpreted from the viewpoint of the research problems (Patton, 1990).

Figure 1. The Pressure Pad switch (Good, 2003, p. 12)

The UK children were from urban schools taking part in the Children's University at the University of Greenwich, Avery Hill Campus. There were 16 children in the group, ages 11-12. The Finnish children were from Karhukangas Primary School, a small rural school in Haapavesi Township. The head teacher Markus Tornberg, helped to set up and carry out the Finnish part of the study. All 11 children from classes 5-6 (11 –12 year olds) participated in the study. Cultural differences between the UK and Finnish sample were not considered to be significant in relation to the research.

Studies in UK and Finland were conducted following an agreed "script" that was believed to epitomize the *SPA*. The exemplar *starting point* for designing was a pressure pad switch, made from card and foil. Before starting, the children were given an overview of the session. It was seen as important that they knew from the outset that they would be asked for ideas for using the pressure pad. This was so that subsequent activities could be used as stimulus and to give maximum time for ideas to emerge.

Phase 1 - The basic concept of a switch was discussed. This was revision (i.e., review) for the Greenwich children who had covered this as part of their National Curriculum Science. The children were told that they would be shown a type of switch called a *pressure pad*, and they would be shown how to make one.

Phase 2- The children were shown a large pressure pad and how it worked. It was big enough for the entire class to see. The characteristics of pressure pads were discussed, for example that they are thin, take up little room and are tough. It was hoped that focusing on the special qualities might lead to ideas that were provoked by them. All of the children then followed instructions to make their own pressure pads. The children were given a copy of the basic pressure pad instructions from Keith Good's Zap It! book (English edition: Exciting Electrics, pp.12-13). The Finnish children were given a translated version. All the materials needed to make a working pressure pad and a circuit for it to control were provided.

Phase 3- The children were asked to think of where pressure pads were used in everyday life, and their ideas were recorded on a flip chart. This was intended to consolidate the concept of a pressure pad and allow one idea to provoke others. The teacher researchers then encouraged the children to brainstorm as many ways as possible to keep the pressure pad switch on (i.e., complete the circuit).

Figure 2. Children making pressure pads in Karhukangas Primary School, Finland

Phase 4 – During the final brainstorming session, the children were encouraged to generate many new ideas for using a pressure pad. Again, the flipchart was used for recording purposes. These ideas were intended to lead them to design and make projects of their own choice. The research was focused on the following questions:

1. Could children identify the existing uses of pressure pads in the world around them?

2. Could children generate ways to turn pressure pads on in different ways?

3. Could children find possible uses for their pressure pads?

It was assumed that multiple qualitative data collection would provide enough information relative to the research problems. Moreover this procedure was believed to enhance the motivation and relaxation of the pupils and thus to support their innovative and divergent thinking process. In this way the children did not need to be constrained by the traditional school evaluation practices (Duffy,. Fishman and Honebein 1992: 89 and Patton, 1990: 132;). The researchers assumed the role of participant observer. This procedure enabled them to be "inside" the study, true to the nature of qualitative research (Erickson, 1986).

Data were collected by various ways: brainstorming recorded on flip chart, video recordings, children's written notes and drawings, and photographs of the children's final outcomes. The children's responses were documented on a flip chart (in black pen). The researcher's input to the discussion was documented on the flip chart in green pen (to distinguish it from the pupil's input).

Video recordings from the brainstorming sessions can be regarded as a primary data source. Secondary data sources, such as the children's notes and drawings and photographs of the final outcomes also provided valuable information. They were used to supplement information in the search for emergent patterns in the data. To ensure validity and credibility of the research, multiple data collecting sources and strategies were employed, applying the concept of triangulation (Miles & Hubermann, 1994).

Analysis and Results

Verbatim transcriptions were derived from the video recordings. During the analysis process, irrelevant data were excluded. Care was taken to ensure that individual children could not be identified, thus pseudonyms were used. Parental and caregiver's agreements were also secured. All the collected data, both primary and secondary data sources, formulated a body of data, which was submitted for analysis.

During the first round of analysis, the researchers began to form an idea of the emergent phenomena relative to the theme of this study. In subsequent rounds of analysis, the data indicated that the children were creating ideas for their own projects. This prompted the researchers to further review of the data in order to specify those emerging features.

During the analysis process, the researchers were continually open to re-exploring the relationship between data and emergent findings and making corresponding revisions. They discussed and shared observations during a series of meetings in Finland and the UK. Data examples presented in this article were analyzed by both researchers individually and also in the collaborative discussion in which the final interpretations were developed (see Ritchie & Hampson, 1996). Finally, the researchers reached the stage where they considered that they had investigated the whole body of data sufficiently from the viewpoint of the research problem. From this point of "saturation" the researchers proceeded to present results.

The inductive interpretative analysis process used in this study enabled the results to be presented as empirical assertions, with supportive data (Erickson, 1986). Examples are referred to within the commentary in order to clarify the interpretative analysis process (see Järvinen & Twyford, 2000).

Empirical Assertion 1: The children were able to find existing uses for pressure pads in world around them

The Finnish children came up with the following examples:

1. Scales (weighing fruit, etc., in the supermarket)
2. Car radios
3. Cash register

4. Control panel for milking machine and feeding control in barn
5. Motor workshop –used to control engine hoist
6. Digital cameras
7. Cash point machines

The English children came up with these examples:

1. Cash machines
2. Light switch
3. Mobile phone
4. TV remote

Commentary

The above examples present the input of different (individual) children They demonstrate that the contributing children are able to find existing uses for pressure pads in the world around them. This is evident for example in the supermarket scales, mobile phone, and TV remote. These children are obviously familiar with these user interfaces which have become common in our everyday lives. They were able to transfer the concept and function of a cardboard pressure pad to real world pressure pad applications. This suggests that the basic idea of pressure pad was understood. However, not all the examples mentioned are used by the children themselves, like cash point machines and shop tills [American synonym?]. Interestingly, the child who refers to control panels of milking and feeding devices (example 4) has identified quite recent applications of pressure pads used in modern barns (his parents are farmers). The same child also refers to a pressure pad used in a control panel to control an engine hoist in the motor workshop of their farm. The child who identified the pressure pads in the family barn and motor workshop could see the importance of the technology he was being asked to design.. His understanding of the technology in his surroundings can also be said to have increased. Black box technologies of control panels, weighing scales and other everyday devices have become more understandable to the responding children, at least to some extent.

Empirical Assertion 2: The children were able to generate a wide range of ideas for turning the pressure pad on in different ways.

When asked to think of different ways to turn the pressure pad switch on, the Finnish children came up with the following ideas:

1. Turn it over
2. Step on it
3. Lean on it
4. Knock on it
5. Put something on it
6. Throw at it
7. Somersault on it
8. Blow on it
9. Drop something on it
10. Drive over it
11. Put a can on it, when rains fills it to a certain extent- the switch goes on
12. Put it between pages of a book

The English children came up with the following ideas:

1. Step on it
2. Sit on it
3. Squeeze it
4. Pinch it
5. Head butt it
6. Put some weight on it
7. Belly flop on it
8. Elbow it
9. Punch it
10. Touch it with your tongue
11. Expel gas on it
12. Flick it
13. Kneel on it
14. Kick it
15. Throw the pressure pad against the wall
16. Blow on it
17. Stamp on it
18. Drop something on it
19. Put some water on it (meaning squirt water on it)
20. Slap it
21. Run over it
22. Tiptoe on it
23. Close the window on it
24. Lay on it

These were added to the flip chart and acted out by the teacher researchers to repeat and reinforce the suggestions.

Commentary

The rich variety of ways generated to turn the pressure pad on suggests that the children felt relaxed and free to brainstorm in these sessions. These ideas did not rely on previous

knowledge or experience since this was a new situation for the children. They were already being creative as they came up with plenty of ways to close the circuit with the pressure pad. This is important as it gives a fertile basis for generating ideas for using the pressure pad later. Through this brainstorming session the children were establishing a basis for a wide variety of uses of pressure pads, including possibly novel and innovative ones. Some unusual or less obvious ideas came up, for example the Finnish child's: "*put a can on it, when rains fills it to a certain extent- the switch goes on*" and the English child's "*throw the actual pressure pad against the wall*," which show an interesting reversal of the normal pressing or throwing things onto the switch. The last child [Author's note- NOT *BOTH* CHILDREN]seems to have stumbled across a recognized strategy for generating innovative ideas. Michalko (2001) devoted an entire chapter to reversal in his text on idea generation.

Empirical Assertion 3: The children are able to find possible uses for the pressure pad switch in their own environment.

Due to the large amount of transcribed data from videotaped brainstorming session, Empirical Assertion 3 is not supported by presenting the whole data, but rather by using exemplars from the transcripts.

When asked to think of as many uses as possible for the pressure pad switch, the Finnish children came up with the following ideas:

(Extracts from the video transcript)

1. Doorbell
2. Burglar alarm
3. It could be used in a game – thrown at on a wall
4. Under bicycle tire (e.g., to warn of theft)
5. It could tell you it was raining, even if you were reading
6. A kind of wind meter
7. Put by the side of the bed to tell when you have fallen out
8. Could tell you when something was full
9. Put pressure pad in door handle (to warn of sleepwalking)
10. Knocking doorbell
11. Used inside the mailbox to tell when newspaper has arrived- indicates inside the house
12. Put pressure pad on bird feeder to tell when birds come
13. Warns that a car is at your gate and you need to go and open it or in the road (in rural Finland, often small roads off the main one lead to houses).
14. To control a torch

The English children came up with the following ideas:

15. Control a remote control car
16. Under the door mat to turn on a tape recorder to scare people at Halloween
17. Stand a glass on the pressure pad to keep a night light on if you're scared in the dark. You could easily find your drink and you could use it as a light to help you read
18. An automatic door bell that no one would need to ring it and you'd know people were there - hide it under the mat
19. Put a weight on it and it'd give you light to work in the garden at night, use the light as a signal, they used it in the war and out at sea
20. A car goes over it and the bulb come on instead of speed cameras
21. Use it to tell which model car has won as they roll down a slope
22. A game for children like a play mat
23. When they stop a lorry (truck), they might want the light on. When the car goes quiet.
24. If the driver was really tired there could be a buzzer to wake him when he drops off
25. A different burglar alarm so that if he comes in the window and the window shuts the buzzer would go on
26. When burglars put their hand in the mailbox and try and push the door then when the letter box shut the thing would go off
27. Detecting when a dog gets out of its basket when it has been told to stay in

Commentary

The above list of 27 examples seem to show that some of the children were able to combine the function/concept of a pressure pad and various ways to close the circuit to produce innova-

tive product ideas. Most important, the children's ideas can be regarded as innovative and novel applications of the pressure pad concept. This is in accordance with the definition of technology as "human innovation in action" (ITEA, 2000). It is important to notice also that many of the children's ideas are actually feasible and could be a basis for their realprojects in design and technology education. This was the purpose of the SPA from the start. Infrequently, ideas were discussed that could probably not be made to work, at least at first sight. This was often because the essential nature of the pressure pad had been forgotten. Other children quickly reminded the speaker that pressure was needed and an idea based on sound (for example) would not be practical. In such cases was needed careful handling to preserve the enthusiasm of the idea giver.

Making an apparently impractical idea feasible, was another chance for the adults and children to use their creativity. The children were encouraged not to dismiss ideas too readily. It must be realized that each idea listed could be the starting point for very many different designs.

The children went on to explore these through drawings, modeling, and discussion, which resulted in some of the ideas being made into finished artefacts.

In idea 11 above, the pupil applies the idea of the pressure pad to the context of a mailbox and remote sensing. In Finland it is common for mailboxes to be at the boundary of a property. This idea is a system where a pressure pad would be placed to the bottom of the mailbox and when mail, such as newspaper, arrives, it presses the pad and the circuit closes. This idea was clearly related to her needs and she connected two existing products in an innovative, divergent way. This is an example of combinational creativity. Michalko (2001) devoted a chapter in his book on idea generating strategies to making novel combinations. It seems that the "mailbox" did this naturally.

Significantly, most of the above ideas seem to occur as a response to the children's own needs, interests, and purposes, true to the nature of design and technology as it should be. It is of course also valid for the children to design products that may be needed by others. Indeed the English National Curriculum for Design and Technology (Key Stage 2, 7-11 year olds) requires that they "generate ideas for products after thinking about who will use them". When examining existing products, they have to think about the views of the people who use them, not just themselves.

This mailbox idea also illustrates the importance of the "audience". In this case, the Finnish teacher/ researcher, knowing the context for the idea, was able to fully appreciate it. We may sometimes need to get children to explain the context for their ideas if we are to appreciate them. Ideas otherwise might be dismissed.

Discussion

In this study an effort was made to add to the children's understanding of the human made environment, (i.e., pressure pad technology). This is close philosophically to the goals of most school subjects in teaching knowledge and understanding about the world at large. The data indicated that some of the children were able to make meaningful connections to a pressure pad by identifying existing uses of it in the human made world around us. This in itself has value, demystifying the technology by having the children build their own example. When they were making the pressure pads, the children acquired information and skills on basic issues in electricity (open/closed circuit, conductor, etc.).

Moreover, the study aimed to give children opportunities to apply their new knowledge in designing projects based on their own ideas. It was evident from the data that some of the children were able, at least to some extent, to apply the pressure pads in a creative and innovative manner as a response to the problems they identified in their own living environment. Here it is important to notice that it was not known beforehand what applications of pressure pads would emerge from the children's creative minds. This can be seen as being in line with the philosophy of technology as well (Niiniluoto, 1984). In this way the technological process did not aim just at discovery (as in science), but rather and more essentially, at children's innovations in action. In this regard, many of the children who took part in the study acted in accordance with the idea put forward by Adams (1993, p..87): "Successful inventors that I know are extremely problem-sensitive. They are tuned to the little inconveniences or hardships in life that can be addressed by the technology they know."

It is important to recognize that is in accordance with how the made environment has developed and continues to develop through human activity. Ingenuity, innovation and problem solving are part of the basic essence of technology (e.g., Järvinen, 2001; Sparkes, 1993;). This could also be crystallized in the definition: "Technology is human innovation, in action" (ITEA, 2000). Consequently, teaching technology should not be mere study of how technology works, as children need to be given opportunities for creative and innovative action.

The *SPA* facilitates children's creativity in technology education to a greater extent than the approach where the purpose of the project is specified by teacher. However it is not so open that children have to search for a need or problem to solve without any support. The making stage of the SPA is close to focused practical tasks in the English National Curriculum but these usually lead to projects with the same purpose within a class.

The authors do not claim that using the *SPA* is the only manageable approach to technology teaching nor that the applied method is the only way to foster children's innovativeness. There are actually some concerns which should be taken into account when applying the SPA, for example, using SPA should not hinder the ability of children to have an open and sensitive mind to identify needs and problems without the support of a starting point.

However, it seems to the researchers that the *SPA* offers a compromise between what the teacher and student can manage, what needs to be done, and what the student would choose to do. By making the most of opportunities for students to create their own ideas, the SPA seems likely to increase their perception of technology education as it is relevant to them. This approach is primarily aimed at maximizing creativity, but it may well also help motivation and behavior in technology. Working from the teacher's starting point students can still end up with a project with a different purpose from their peers, one over which they have ownership. However, less experienced teachers may feel more secure if they know the purpose of the children's projects in advance.

The SPA seems to offer a way of allowing individual children to identify their own design problems and for outcomes with different purposes to be designed and made within a class. All this is done while maintaining the sanity of the teacher.

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The Journal of Technology Studies

Plot Scale Factor Models for Standard Orthographic Views

Edward E. Osakue

Abstract

Geometric modeling provides graphic representations of real or abstract objects. Realistic representation requires three dimensional (3D) attributes since natural objects have three principal dimensions. CAD software gives the user the ability to construct realistic 3D models of objects, but often prints of these models must be generated on two dimensional (2D) standard-sized sheets. The transformation of 3D objects into 2D representations on standard-sized sheets requires one to use a proportional relationship called a scale, which is defined by a scale factor (*SF*).

Two mathematical models for a scale factor, one for reduction scaling and the other for enlargement scaling, are presented for standard orthographic views. The models are based on the sizes of standard drawing sheets and the principal dimensions of the object. The application of the models is demonstrated with two illustrative examples, one for reduction scaling and another for enlargement scaling. The scale factors selected on the basis of the models were used to prepare detail drawings for the examples. In each case, the scale factor appeared satisfactory.

It is shown that the models are tolerant of error in the only parameter that is assumed when applying them, suggesting that they are robust. This robust feature is an advantage, because in real design drafting situations, one must often make assumptions about sizes. The models can thus accommodate some erroneous assumptions.

Introduction

In a drawing context, scale refers to the proportional relationship between an image size on a drawing media (or plot size) and the design size. A design size may be the intended size of an object in a design project or the actual size of a manufactured object. A proportion is expressed as a ratio, and a drawing scale factor (Duggai, 2000; Madsen et al., 2002) is the ratio of proportion between a design size and the plot size. The plot size is the actual size of an image on a standard drawing sheet at printing or plotting time. A scale factor will depend on the design size, the level of detail information associated with the drawing views, and the sheet size chosen for plotting the drawing (Madsen et al., 2002). In design drafting, a plot scale is specified by indicating the scale factor value. The scale factor value is chosen as an integer that is greater or equal to unity. At full size, the plot size is equal to the design size and *SF* is 1.

CAD software can be used to design, visualize, and document product ideas clearly and efficiently (Shih, 2004; Shih, 2006). The work environments generally available in CAD software are known as model space and paper space (Madsen et al., 2002; Shih, 2004; Shih, 2006). CAD model space is a 3D environment with a three-dimensional (X-Y-Z) coordinate system. It is used to construct 2D and 3D graphic models of designs. Solid 3D models are the most realistic, and the applications can be used in design, visualization, analysis, manufacturing, assembly, and marketing (Bertoline & Wiebe, 2003). The 2D model space has a two-dimensional coordinate system. It is obtained from the 3D space by grounding one axis of the 3D model space. In CAD model space, objects are constructed at full size (Duggai, 2000; Madsen et al., 2002; Shih, 2004; Shih, 2006), thus, in this case, choosing a scale is not required. In board drafting, a scale is chosen before the drawing work is started because of the physical restriction imposed by standard drawing sheet. This physical restriction does not exsist in the electronic or virtual space in CAD software. As a result, solid object in model space can be viewed from different points in space. This makes it possible to generate any desired view of the solid object in either 3D or 2D representations.

CAD paper space is limited to a 2D coordinate system. This is an electronic planar surface where 3D models can be transformed into equivalent 2D representations using projection techniques. A 2D view of a 3D model can be either a pictorial view or an orthographic view, and one can generate as many views as desired of the model object by changing the viewing direction. When the model space object is modified, the view in paper space can be updated. These 2D views can be annotated with dimen-

sions and notes on electronic standard sheets, which are the equivalent of physical standard sheets. A scale factor is selected in CAD paper space when the views of a model are being placed on a chosen electronic standard sheet. A suitable scale factor will make any design graphic model fit into a selected drawing sheet.

This article is concerned only with standard orthographic view scaling. Orthographic views are used extensively in detail drawings, which are required for nonstandard parts in an assembly. Detail drawings can be prepared from sketches or generated from 3D CAD models. Orthographic views also are used in outline and layout sketches and drawings. In complex drawings, standard orthographic views may be supplemented with auxiliary views and section views. Though standard orthographic drawings show three views, often an isometric insert is added when 3D models are available.

Because standard sheets have fixed sizes, design graphic models must be scaled to fit into them at plotting or printing time. The selection of a plot scale factor is therefore one of the important skills design drafters must acquire (Madsen et al., 2002). In practice, selecting a scale factor is done largely by trial and error. Computers have made the selection process easier and faster, but the trial-and-error approach still persists. This seems largely due to the absence of a mathematical model to select the scale factor.

The objective of this article is to develop a mathematical model for a plot scale factor for standard orthographic or multiview drawings. Using a model to select a scale factor brings order to the selection process. Also, a mathematical model can help one to understand the nature and applications of scale factors in design drafting. In addition to these benefits, a mathematical model for plot scale factor can be a great teaching tool for training design drafters, architects, and engineers; it also can be a vital planning aid in design drafting practice.

Model Formulation

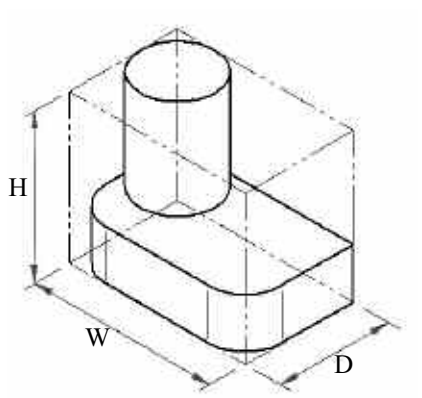
Projection techniques are used to create 2D images of 3D objects. In U.S. Standard or third-angle projection, the standard multiview drawings require three views of top, front and right side. Consider Figure 1a, which shows a 3D model with a box defining its volume requirement. This box is known as the bounding box (B-box). When one plots or prints the model in multiview, the projected size of the B-box to a 2D space must be accommodated by the space available on the chosen standard sheet when the scale factor is applied. Therefore, the B-box dimensions completely determine the views space requirement. This is important because there is no need to worry about the complexity of the form or shape of a component in evaluating the views space requirement. In Figure 1a, the principal dimensions (*W, H and D*) of the object are indicated. These are the limits of dimensions measured along the coordinate axes of the full size object in 3D model space.

Let:

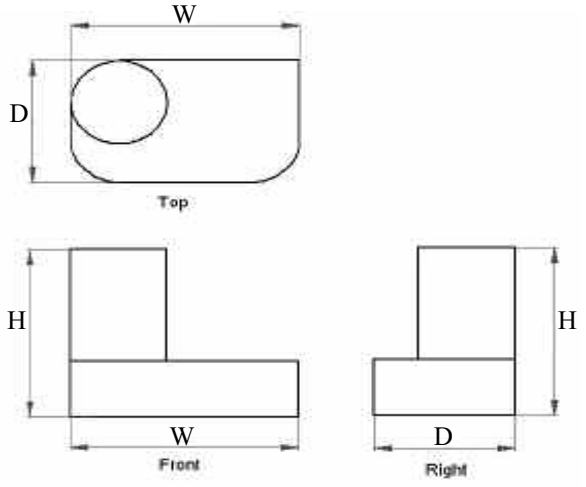
W_o = full size width of views space requirement

H_o = full size height of views space requirement

Figure 1 Multiview layout and principal dimensions



(a) Object



(b) Layout of standard orthographic views

From Figure 1b, neglecting the gaps between the views, the views space dimensions are:

$$W_o = W + D \quad (1)$$

$$H_o = H + D \quad (2)$$

If a 2D model is constructed instead of a 3D model, then W_o and H_o should be measured directly from the model space.

The technical space requirement consists of the space for drawing views and the space for annotations. The annotation space allowance will depend on the amount of details desired in a drawing. This space is used for the following: (1) views and edge gaps, (2) dimensions and tolerances, (3) local and general notes, and (4) bill of materials (for assembly drawings only). Note that clarity and readability are of prime importance in placing dimensions, tolerances, and notes on drawings [Earle, 1991; Madsen et al., 2002; Nee, 1983; Sexton, 2006). To properly document a design, some space must be available for both annotations and views. An annotation space allowance factor _ (greater than unity) will be used to account for the necessary space for annotations and multiview drawings. Because it is greater than unity, when used to multiply the views space, it enlarges the views space to accommodate for annotations.

Let:

W_m = full size model width requirement for views and annotations

H_m = full size model height requirement for views and annotations

_ = annotation space allowance factor (greater than unity)

Assume that:

$$W_m = \_\ W_o \quad (3)$$

$$H_m = \_\ H_o \quad (4)$$

It is not possible to accurately specify _ at the beginning of a drawing task because the actual space for annotations is not known at that time. At best, historical data and experience may be used to estimate its value. However, it will be subject to wide variations since it is associated with the view space dimensions and influenced by the chosen standard sheet size. Sometimes annotations are added to drawing views in 2D models. In such situations, no allowance is needed for annotations; that is, _ = 1 in these situations.

In general, engineering documents convey both technical and administrative information. Equations 3 and 4 take care of the technical information. The administrative information includes (1) margin space, (2) title block space, and (3) revision block space. The space for administrative information reduces the available space for the technical information on a standard sheet. To account for the space needed for administrative information, an administrative space allowance factor can be used.

Let:

W_p = horizontal dimension of standard sheet

H_p = vertical dimension of standard sheet

W_z = horizontal dimension of available space in standard sheet

H_z = vertical dimension of available space in standard sheet

_ = administrative space allowance factor (less than unity)

Assume that:

$$W_z = \_\ W_p \quad (5)$$

$$H_z = \_\ H_p \quad (6)$$

The factor _ is used to estimate the available working space of a standard sheet. It is evaluated only once for each standard sheet based on the chosen sheet format. If the size of the title block or revision block is changed, then will have to be reevaluated. Because companies generally decide on the format of standard sheets, it is possible to evaluate _ before creating drawings. Also ANSI guidelines may be used to create title and revision blocks so that _ can be evaluated.

As mentioned. there are two types of scaling: reduction (step-down scaling) and enlargement (step-up scaling). In the reduction case, the size of the graphic image is smaller than the design size. This situation is common in architectural, civil, mid-sized and heavy mechanical equipment design. In enlargement case, the size of the graphic image is larger than the design size. In micro- and nano-technologies, sizes of objects must be magnified for representation in macro scale. Enlargement scaling is therefore common in these fields. The two scaling situations will have different expressions for the scale factor.

The condition for scaling drawings is that the model space requirement (W_m, H_m) should

be at most equal to the working space available (W_z, H_z) on a standard sheet, after the scale factor is applied. In reduction scaling the area defined by (W_m, H_m) is greater than the area of (W_z, H_z), and in enlargement scaling the area of (W_m, H_m) is smaller than the area of (W_z, H_z). With *SF* as the scale factor for a drawing task, then for:

Reduction Scaling:

$$\frac{W_m}{SF} \le W_z \qquad \text{i.e.} \quad SF \ge \frac{W_m}{W_z} \quad (7a)$$

$$\text{and} \quad \frac{H_m}{SF} \le H_z \qquad \text{i.e.} \quad SF \ge \frac{H_m}{H_z} \quad (7b)$$

One can combine Equations 7a and 7b by noting that the larger ratio of the scale factor gives the desired value:

$$SF \ge \max\left(\frac{W_m}{W_z}; \frac{H_m}{H_z}\right) \quad (8)$$

Enlargement Scaling:

$$W_m x SF \le W_z \qquad \text{i.e.} \quad SF \le \frac{W_z}{W_m} \quad (9a)$$

$$H_m x SF \le H_z \qquad \text{i.e.} \quad SF \le \frac{H_z}{H_m} \quad (9b)$$

Combining Equations 9a and 9b, the smaller ratio gives the desire scale factor value:

$$SF \le \min\left(\frac{W_z}{W_m}; \frac{H_z}{H_m}\right) \quad (10)$$

Substituting Equations 3, 4, 5,and 6 into Equations 8 and 10, we have

Reduction Scaling:

$$SF \ge \frac{\beta}{\alpha} \text{ x } \max\left(\frac{W_o}{W_p}; \frac{H_o}{H_p}\right) \quad (11)$$

Enlargement Scaling:

$$SF \le \frac{\alpha}{\beta} \text{ x } \min\left(\frac{W_p}{W_o}; \frac{H_p}{H_o}\right) \quad (12)$$

The *SF* from Equations 11 and 12 should be rounded up to the nearest integer. The integer should then be compared with preferred values. The inequality sign guides the choice of the preferred value of *SF* for both reduction and enlargement scaling. Some judgment is inevitable when the estimate of *SF* is close to an integer. Normally the same scale factor is used for all standard multiviews of a model in a detail drawing. In addition, the top, front and right views must be placed in their relative positions required by the third- angle projection standard (USA) or first-angle projection standard (European).

Model Application

The application of the scale factor model involved three main tasks of modeling two components, selecting a scale factor for each component, and preparing a detail drawing for each component using the selected scale factor. Figure 2 shows the component used for reduction scaling, while Figure 3 shows the component used for enlargement scaling. The front view direction (FVD) is indicated in each case. The detail drawings were prepared and plotted on an A-size electronic sheet.

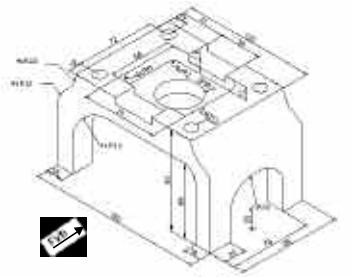


Figure 2 Cutting frame

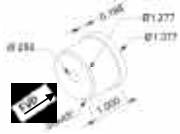


Figure 3 Roller pin

Component Modeling

Solid models of Figure 2 and Figure 3 were created in model space using Solid Edge v17 software. The main steps in the solid modeling task are to create sketches that were constrained to become profiles. The profiles were extruded or revolved to obtain the solids. Five profiles were used for the Figure 2 component, but only two profiles were used for the Figure 3 component. Holes and slots were created with the cutout tool.

Selection of Scale Factor

Step 1: *Select drawing sheet size (Wp and Hp).*

From Table A3 in the Appendix, English A-size sheet has dimensions 8.5" x 11" (279 mm x 216 mm). Assuming a landscape format (larger dimension is horizontal in layout), then:

Wp = 279 mm; Hp = 216 mm

Step 2: *Administrative space allowance factor*

This factor has been evaluated in the Appendix and is _ = 0.75. The estimated available working space (Equations 5 & 6) is defined by Wz = 209 mm and Hz = 162 mm.

Component 1 (Figure 2)

Step 3: *Choose FVD and determine the principal dimensions (W, H, D) of model.*

Based on the front-view direction chosen in Figure 2, the principal dimensions *W, H, D* are:
W = 160 mm; H = 92 mm; D = 96 mm

Step 4: *Evaluate W_o and H_o (Equations 3 & 4)*

$W_o = W + D = 160 + 96 = 256$ mm

$H_o = H + D = 92 + 96 = 188$ mm

Step 5: *Specify* _

Assume _ = 1.4

Step 6: *Estimate SF using Equation 11*

The model values for W_o = 256 mm and H_o = 188 mm are larger than the available working space of W_z = 209 mm and H_z = 162 mm. Therefore, this is a reduction scaling situation.

Reduction Scaling:

$$SF \geq \frac{\beta}{\alpha} \text{ x } \max\left(\frac{W_o}{W_p}; \frac{H_o}{H_p}\right) \quad (11)$$

$$SF \geq \frac{1.4}{0.75} \text{ x } \max\left(\frac{256}{279}; \frac{188}{216}\right)$$

$$SF \geq 1.87 \text{ x } \max(0.92; 0.87)$$

$$SF \geq 1.87 \text{ x } 0.92$$

$$SF \geq 1.72$$

Step 7: *Choose SF based on preferred values.*

The next integer above 1.72 is 2, and it is also a preferred scale factor (Table A2: Metric Scales; Appendix). Therefore, SF = 2.

Component 2 (Figure 3)

Step 3: *Choose FVD and determine the principal dimensions (W, H, D) of model.*

Based on the front-view direction chosen in Figure 3, the principal dimensions *W, H, D* are:

W= 1.377 in; H = 1.377 in; D = 1.0 in

Because this component is cylindrical, two of the standard orthographic views will be identical, and one will be redundant. Hence with the few features on the component, a two-view (front and right) detail drawing will be prepared.

Step 4: *Evaluate Wo and Ho (Equations 4 & 5)*

$W_o = W + D = 1.377 + 1.0 = 2.377$ in

$H_o = H = 1.377$ in (for front and right views only)

Step 5: *Specify* _

This is a relatively simple component with very few features, so a low _ is attractive.

Assume _ = 1.25

Step 6: Estimate SF using Equation 12.

The model values for (W_o; H_o) = (2.377 in; 2.57 in) are smaller than sheet available working area of (W_z; H_z) = (8.3 in; 6.4 in). This is an enlargement scaling situation.

Enlargement Scaling:

$$SF \leq \frac{\alpha}{\beta} \text{ x } \min\left(\frac{W_p}{W_o}; \frac{H_p}{H_o}\right) \quad (12)$$

$$SF \leq \frac{0.75}{1.25} \text{ x } \min\left(\frac{11}{2.377}; \frac{8.5}{1.377}\right)$$

$$SF \leq 0.60 \text{ x } \min(4.63; 6.66)$$

$$SF \leq 0.60 \text{ x } 4.63$$

$$SF \leq 2.8$$

Step 7: *Choose SF based on preferred values.*

The integers 2 and 3 (2.8 is close to 3) are candidate values for the scale factor. An SF of 3 will likely mean a crowded arrangement on the sheet, and it is not a preferred value. However, an *SF* of 2 will give more free space, and it is a preferred scale factor (Table A1 Appendix). Therefore, *SF* = 2 is selected.

Detail Drawing Creation

The detail drawing task involved the following steps:

1. Creating a drawing sheet template.
2. Creating an orthographic views template sheet, using selected scale factor from model.
3. Adding dimensions and notes.
4. Adding an isometric view insert.
5. Checking and printing drawings.

Using the chosen scale factors, detail drawings with isometric inserts were prepared. Figure 4 and 5 show the detail drawings for the components of Example 1 and Example 2 respectively. As can be observed from Figures 4 and 5, the drawing views and annotations are well accommodated in the drawing sheets, respectively. Thus the selected scale factors based on the estimates of the mathematic models are satisfactory. Therefore, the developed mathematical models appear to be realistic for reduction scaling and enlargement scaling. It can be concluded that the present common trial-and-error approach to plot scale factor selection needs to be replaced with systematic and consistent methods, and the models presented in this article offer some alternatives.

Influence of , on Scale Factor Model

Table 1 shows estimates of *SF* for different values of _ for Example 1. The value of changed by 42% from 1.2 to 1.7 before *SF* crossed the integer 2, the value selected for *SF* for Example 1. An error of 42% in _ would not have changed the selected value of the scale factor in this case.

Table 1: Influence of on scale factor of component 1

Trial	–	*SF*
1	1.2	1.47
2	1.4	1.72
3	1.6	1.96
4	1.7	2.09

Table 2: Influence of _ on scale factor of component 2

Trial	–	*SF*
1	1.2	2.9
2	1.4	2.5
3	1.6	2.2
4	1.7	2.0
5	1.8	1.9

Table 2 shows estimates of *SF* for different values of _ for Example 2. The value of changed by 50% from 1.2 to 1.8 before *SF* crossed the integer 2, which is the value selected for *SF* for Example 2. An error of 50% in would not have changed the conclusion about *SF*.

From Tables 1 and 2, the scale factor model appears not to be very sensitive to the value of _ This is certainly a good thing as it suggests a very robust model. It is worth noting that the inequality sign helps in choosing an appropriate scale factor. No doubt, there will be occasions where the design drafter may choose a scale factor value different from the calculated estimate. Good judgment will be necessary in such cases.

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APPENDIX: Administrative Space and Standard Scale Factors

Standard Scale Factors

Tables A1 and A2 give some commonly used scales (Duggai, 2000; Madsen et al., 2002; Sexton, 2006) in some disciplines. However, the available scale factors in a plotter setup scale list box should be chosen at plotting time.

Table A1 Common mechanical and architectural scales.

Mechanical Scales		Architectural Scales	
Scale	Interpretation	Scale	Interpretation
1” = 1”	Full size	1” = 1’ - 0”	12th size
_” = 1”	Half size	_” = 1’ - 0”	24th size
_” = 1”	Quarter size	_” = 1’ - 0”	48th size
1/8” = 1”	Eighth size	1/8” = 1’ - 0”	96th size
1/10” = 1”	Tenth size	1/16” = 1’ - 0”	192th size

Table A2 Common civil and metric scales.

Civil Scales		Metric Scales	
Scale	Interpretation	Scale	Interpretation
1” = 10’	120th size	1:1	Full size
1” = 20’	240th size	1:2	Half size
1” = 30’	360th size	1:5	5th size
1” = 50’	600th size	1:10	10th size
1” = 60’	720th size	1:20	20th size
1” = 100’	1200th size	1:50	50th size

Estimating Administrative Information Space

Table A3 shows both English and Metric standard sheet dimensions. A standard size sheet has a planar surface with width and height dimensions.

Table A3 Standard drawing sheets.

Metric Sizes (mm)		English Sizes (Inches)	
A4	210 x 297	A	8.5 x 11
A3	297 x 420	B	11 x 17
A2	420 x 594	C	17 x 22
A1	594 x 841	D	22 x 34
A0	841 x 1189	E	34 x 44

As mentioned previously, the space needed for administrative information on a standard drawing sheet includes (1) margin space, (2) title block space, and (3) revision block space. Figure A1 shows the conceptual layout of standard sheet. The left or top margin is usually larger than the others to provide room for filing or binding the drawing sheet. The title block contains pertinent information (e.g., like company name and address, drawing title, drawing record number, names of design drafter and checker). Changes to approved drawings are documented in the revision block. The change information may include name of person making the change request, description of change, reason for change, request date, and approval information (Bertoline & Wiebe, 2003; Earle, 1991; Madsen et al., 2002; Nee, 1983; Sexton, 2006). The space for the administrative information is not available for technical information. Referring to Figure A1:

LM = left margin space

RM = right margin space

TM = top margin space

BM = bottom margin space

RB = revision block width

TB = title block height

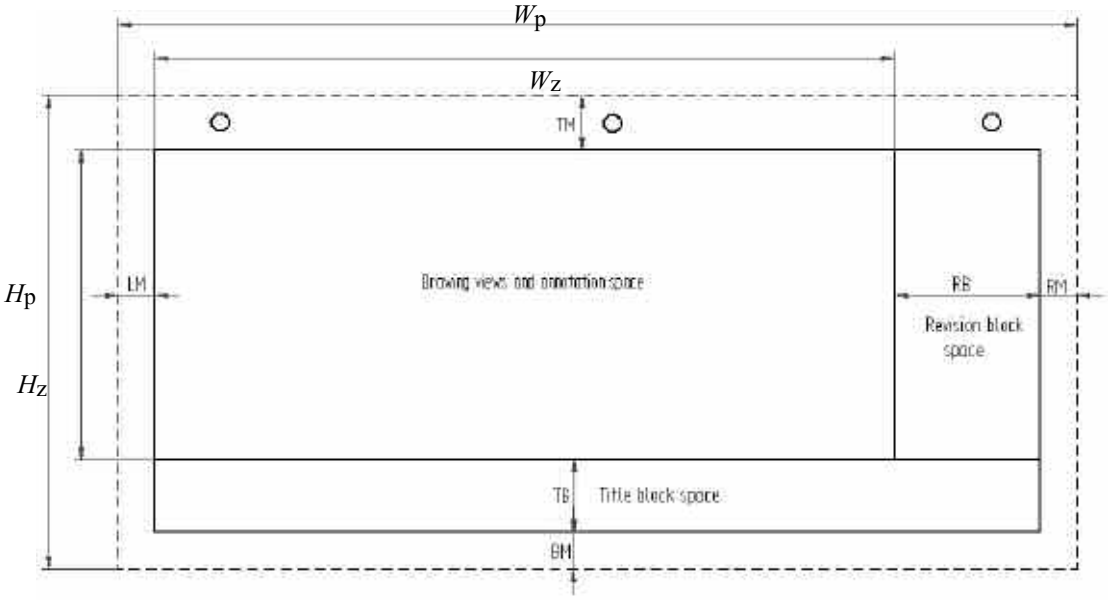
W_p = horizontal size of standard sheet

H_p = vertical size of standard sheet

W_z = adjusted sheet width size

H_z = adjusted sheet height size

Figure A1 Drawing sheet and administrative space.



Let:

W_A = width of administrative space allowance

H_A = height of administrative space allowance

_ = administrative space allowance factor

From Figure A1:

$W_A = LM + RM + RB$ (A1)

$H_A = BM + TM + TB$ (A2)

$W_z = W_p - W_A$ (A3)

$H_z = H_p - H_A$ (A4)

Conceptually, we can also express W_z and H_z as:

$W_z = \_ W_p$ (A5)

$H_z = \_ H_p$ (A6)

Then: $\_ = \sqrt{\frac{W_z H_z}{W_p H_p}}$ (A7)

Note that Equations A3 and A4 are based on physical dimensions. In fact W_z and H_zz can be measured directly from existing drawings. The physical values of W_z and H_z are used in Equation 7 to evaluate _. However, Equations A5 and A6 are abstract representations, but these ensure that the ratio

of the available working surface area to the standard sheet surface area is preserved. When _ is squared, it gives that fractional space of standard sheet available for technical information. Thus, it is an indirect measure of paper utilization.

Evaluating Administrative Space Allowance Factor.

For the illustrative examples in this article, the English A-size sheet was chosen for presenting the detail drawings. For this example, the title block height was chosen as

25 mm and revision block width as 80 mm. The top margin (TB) was taken as 12.5 mm, and the other margins (LM, RM, BM) were 7.5 mm each. The administrative space dimensions (Figure A2) are:

W_A = LM + RM + RB = 7. 5 + 7.5 + 80 = 95 mm from (A1)

H_A = BM + TM + TB = 7.5 + 12.5 + 25 = 45 mm from (A2)

The administrative space allowance factor is obtained as follows:

$W_z = W_p - W_A = 279 – 95 = 184$ from (A3)

$H_z = H_p - H_A = 216 – 45 = 171$ from (A4)

and $\_ = \sqrt{\frac{W_z H_z}{W_p H_p}} = \sqrt{\frac{184 \times 171}{279 \times 216}} = 0.722$ from (A7)

Use _ = 0.75

Adamson, Glenn (2005). *Industrial strength design: How Brooks Stevens shaped your world.* Cambridge, MA: The MIT Press. ISBN 0-262-51186-X, pb, $25.

Designed Brooks Stevens created thousands of ingenious and beautiful designs for industrial and household products – including a clothes dryer with a window in the front, a wide-mouthed peanut butter jar, and the Oscar Meyer Wienermobile. In 1954 he coined the phrase 'planned obsolescence,' defining it as 'instilling in the buyer the desire to own something a little newer, a little better, a little sooner than is necessary.' This book, the first publication to document his work, includes 250 illustrations of designs by Stevens and his firm, many in color, detailed studies of individual designs, interpretive essays, a description of the Brooks Stevens Archive at the Milwaukee Art Museum, and several key writings by Stevens himself.

Cobb, James C., William Stueck, Eds. (2005). *Globalization and the American South.* Athens, GA: University of Georgia Press. ISBN 0-8203-2648-8, pb, $19.95.

In 1955 the Fortune 500 list of America's largest corporations included just 18 with headquarters in the Southeast. By 2002 the number had grown to 123. In fact, the South attracted more than half of the foreign businesses drawn to the United States in the 1990s. The eight original essays collected here consider this stunning dynamism in ways that help us see anew the region's place in that ever accelerating transnational flow of people, capital, and technology known collectively as "globalization." Moving between local and global perspectives, the essays discuss how once faraway places including Latin America, Asia, Africa, and the Indian Subcontinent are now having an impact on the South. Indeed, global forces not only are reshaping the South also are adapting to and exploiting its peculiarities. Although the new ethnic food section at the local Winn-Dixie is one manifestation of globalization, so too is the wide-ranging export of such originally southern phenomena as NASCAR and Kentucky Fried Chicken.

Dutton, William H., Brian Kahin, Ramon O'Callaghan, Andrew W. Wyckoff, Eds. (2005). *Transforming enterprise: The economic and social implications of information technology.* Cambridge, MA: The MIT Press. ISBN 0-262-54177-7, pb, $32.

Innovators across all sectors of society are using information and communication technology to reshape economic and social activity. Even after the boom – and despite the bust – the process of structural change continues across organizational boundaries. Transforming Enterprise considers the implications of this change from a balanced, post-bust perspective. Original essays examine first the impact on the economy as a whole, and, in particular, the effect on productivity. Next, the role of information technology in creasing and using knowledge is considered, especially knowledge that leads to innovation. Finally, new organizational models, as seen in the interlocking and overlapping networks made possible by the Internet, are proposed. The authors also analyze structural changes in specific sectors, including the effect of information technology on the automotive industry, demand-driven production and flexible value chains in the personal computer industry, and new models of outsourced manufacturing in the electronics industry. The final essays examine the societal implications of the diverse ways that information technologies are used – across individuals, groups, communities, and nations, considering questions of access and the digital divide.

Ehrhardt, Kathleen L. (2005). *European metals in native hands: Rethinking technological change, 1640-1683.* Tuscaloosa, AL: University of Alabama Press. ISBN 0-8173-5146-9, pb, $29.95.

Kathleen Ehrhardt's research addresses the early technological responses of one particular group, the Late Protohistoric Illinois Indians, to the availability of European-introduced metal objects. To do so, she applied a complementary suite of archaeometric methods to a sample of 806 copper-base metal artifacts excavated from securely dated domestic contexts at the Illiniwek Village Historic Site in Clark County, Missouri. This group in a broad social context integrates Ehrhardt's scientific findings with observations from historical, archaeological, and archival

research to place metal use. In revealing actual Native practice, from material selection and procurement to ultimate discard, the author challenges acculturation perspectives on, and technocentric explanations of, Native material and cultural change at contact.

Fagan, Brian M. Ed. (2004). *The seventy great inventions of the ancient world.* New York: Thames & Hudson. ISBN 0-500-05130-5, hc, $40.

Drawing on modern science and the latest research, leading authorities explore some of history's most fascinating inventions, beginning with the basic technologies of stone and fire, bone and wood. Some of the most fundamental questions of the past are addressed. How and where did agriculture evolve? What were the first houses like and when did the stone arch come into use? How did Romans and others heat and plumb their dwellings? What was the impact of cooking, food preservation and fermentation on the development of ancient cuisine? How did the wheel and cart change human life and increase mobility? When did the first roads appear and when did long-distance seafaring begin? Packed with evocative photographs and information diagrams, maps and plans, this work is a unique guide to some of humanity's most remarkable inventions and a testimony to the brilliant ingenuity and opportunism of our forebears.

Fensel, Dieter, James Hendler, Henry Lieberman, Wolfgang Wahlster, Eds. (2005). *Spinning the semantic web: Bringing the World Wide Web to its full potential.* Cambridge, MA: The MIT Press. ISBN 0-262-56212-X, pb, $23.

As the WWW continues to expand, it becomes increasingly difficult for users to obtain information efficiently. Because most search engines read format languages such as HTML or SGML, search results reflect formatting tags more than actual page content, which is expressed in natural language. This book describes an exciting new type of hierarchy and standardization that will replace the current 'Web of links' with a 'Web of meaning.' Using a flexible set of languages and tools, the semantic Web will make all available information – display elements, metadata, services, images, and especially content accessible. The result will be an immense repository of information accessible for a wide range of new applications. This first handbook for the semantic Web covers, among other topics, software agents that can negotiate and collect information, markup languages that can tag many more types of information in a document, and knowledge systems that enable machines to read Web pages and determine their reliability. The truly interdisciplinary semantic Web combines aspects of artificial intelligence, markup languages, natural language processing, information retrieval, knowledge representation, intelligent agents, and databases.

Fetterman, David M., Abraham Wandersman, Eds. (2005). *Empowerment evaluation principles in practice.* New York: The Guilford Press. ISBN 1-59385-114-6, pb, $27.

This book presents the most current formulation of the ten principles of empowerment evaluation and provides the tools to put these principles into practice. Through case studies of diverse evaluation projects – including community health foundation initiatives, school district programs, and a $15 million corporate program aimed at bridging the digital divide – the founder and leading proponents of empowerment evaluation clarify key concepts and discuss important lessons learned. Coverage includes how to balance program improvement efforts with accountability requirements; how empowerment evaluation can be used to guide standards-based work; how to use empowerment evaluation in a learning organization; the differences among empowerment, collaborative, and participatory evaluation; and much more.

Foerst, Anne (2004). *God in the machine: What robots teach us about humanity and God.* New York: Dutton. ISBN 0-525-94766-3, hc, $24.95.

This unusual book looks at issues likely to arise as robots grow more like their creators and play a larger role in the world—a process whose first steps have already been taken. Anne Foerst,

theologian and research scientist, shares her discoveries from her days acting an in informal liaison between the Harvard Divinity School and MIT, during a time that she worked at both institutions. During this period she noticed similarities between the religious community as it struggled to comprehend God's will and obey divine laws, and the work of scientists struggling to understand how intelligence can be replicated and how self-aware machines can be constructed. She describes her encounters at MIT's Artificial Intelligence Laboratory with Cog, an imposing seven-foot robot representing the first stages of 'embodied AI,' that is, an intelligent machine capable of reacting to the physical world. Foerst also met the more humanlike robot Kismet, who responded to human visitors with recognizable facial expressions. She tells of how human observers surprised themselves with feelings of sympathy for Kismet; some of these people debated if it was right to have such sympathy for what was a 'lifeless machine.' God in the Machine takes a unique look at the impact technology will have on the way human beings regard themselves and their reasons for existence.

Fong, Yem S., Suzanne M. Ward (2004). *The changing landscape for electronic resources: Content, access, delivery, and legal issues.* Binghamton, NY: Haworth Information Press. ISBN 0-7890-2441-1, pb, $29.95.

This book shows how libraries using electronic resources can reduce costs and save transaction time for large and small public libraries as well as academic libraries. It also reveals recent initiatives related to open source software and core standards for resource sharing and interlibrary loan, such as the Bath profile and the NISO Circulation Interchange Protocol (NCIP). Special features of this timely book include figures, diagrams, references, and Web sites.

Ganor, Boaz (2005). *The counter-terrorism puzzle: A guide for decision makers.* New Brunswick, NJ: Transaction Publishers. ISBN 0-7658-0298-8, hc, $39.95.

This unique book deals with all relevant aspects of counter-terrorism and analyzes decision makers' main dilemmas. It is based on accumulated experience in the field all over the world, particularly in the State of Israel where the author has lived and worked for many years. The method of presentation is to portray the main dilemmas in each sphere of counter-terrorism – defining the threat and appropriate counter measures, evaluating intelligence, offensive and defensive action, legal and judicial issues, media coverage, international cooperation – and to analyze them in terms of Israel's accumulated experience, comparing them, in many cases, to the experience of other countries. The conceptual models used, and the indexed charts appearing at the end of the discussion of each respective dilemma, enable decision makers to think rationally without outside considerations, and employs cost/benefit considerations to resolve each dilemma most effectively. Considerations of various aspects of technology arise throughout the book.

Goodchild, Peter (2004). *Edward Teller: The real Dr. Strangelove.* Cambridge, MA: Harvard University Press. ISBN 0-674-01669-6, hc, $29.95.

One Nobel Prize-winning physicist called Edward Teller, 'A great man of vast imagination . . . [one of the] most thoughtful statesmen of science.' Another called him, 'A danger to all that is important . . . It would have been a better world without [him].' That both opinions about Teller were commonly held and equally true is one of the enduring mysteries about the man dubbed 'the father of the H-bomb.' In the story of Teller's life and career, told here in greater depth and detail than ever before, Peter Goodchild unravels the complex web of harsh early experiences, character flaws, and personal and professional frustrations that lay behind the paradox of the 'real Dr. Strangelove.' His biography draws on interviews with more than fifty of Teller's colleagues and friends. Their voices echo through the book, expressing admiration and contempt, affection and hatred, as we observe Teller's involvement in every stage of building the atomic bomb, and his subsequent pursuit of causes that drew the world deeper into the Cold War – alienating many of his scientific colleagues even as he provided the intellectual lead for politicians, the military, and presidents as they shaped Western policy.

Books Briefly Noted

Greenspan, Nancy Thorndike (2005). *The end of the certain world: The life and science of Max Born.* New York: Basic Books. ISBN 0-7382-0693-8, hc, $26.95.

Twenty years after Einstein laid the foundation for quantum theory, his close friend Max born broadened this theory with one of the most profound principles of the century, his theory of indeterminacy, only to have Einstein declare to him, 'God does not play dice.' Einstein and Born debated the nature of the universe –certainty versus uncertainty – until Einstein's death thirty years later, despite the Nobel Committee's support of Born's position when they awarded him the Nobel Prize in Physics in 1954. Born left his homeland when the Nazis forced him to immigrate to Great Britain. The subsequent explosion of the atom bomb inflicted a further blow. It was a cruel twist of fate that Born, a pacifist who lives science for its beauty, had educated the developers of the bomb. Robert Oppenheimer, Edward Teller, and Eugene Wigner, among others, had flocked to Göttingen, Germany, the 'font' of quantum knowledge, to work with Born. Among his physicist peers, Born was exceptional in his denunciation of what he saw as their dirty hands in the innumerable deaths in the devastation wrought by the atom bomb. Once he was awarded the Nobel Prize, he saw it as his duty to use his new platform to campaign against the development of nuclear weapons.

Grubb, W. Norton, Marvin Lazerson (2004). *The education gospel: The economic power of schooling.* Cambridge, MA: Harvard University Press, 2004. ISBN 0-674-01537-1, hc, $39.22.

In this incisive history of the 'gospel of education,' W. Norton Grubb and Marvin Lazerson reveal the allure, and the fallacy, of a longstanding American faith: that more schooling for more people is the remedy for all our social and economic problems and the central purpose of education is preparation for the workplace. They argue that the aptitudes developed in schools and universities and the competencies required in work are often mismatched. At least a third of all Americans are overeducated for the jobs they hold, while many others are undereducated for serious work. The race for personal advancement and the focus on worker preparation have squeezed out civic education and learning for its own sake. Paradoxically, the focus on schooling as a mechanism of equity has reinforced social inequity. The challenge now, the authors show, is to create learning environments incorporating both practical and civic goals, and to prevent the further descent of education in a preoccupation with narrow work skills and empty credentials.

Hamblin, Jacob Darwin (2005). *Science in the early twentieth century: An encyclopedia.* Santa Barbara, CA: ABC CLIO. ISBN 1-85109-665-5, hc, $85.

The first half of the 20th century was one of the most productive periods in science and technology. Great thinkers revolutionized science and technology and laid the foundations for the boom that followed. It was a time when both negative and positive effects of science and technology were evident. From relativity and quantum mechanics to antibiotics and insulin to Nazi racism and the atomic bomb, this volume provides coverage of the science and technology and scientists and engineers of this period.

Howells, John (2005). *The management of innovation & technology.* Thousand Oaks, CA: SAGE Publications. ISBN 0-7619-7024-X, pb, $39.95.

This book analyses a range of social contexts in which human decisions shape technology in the market economy. It comprises a critical review of both a select research literature and in-depth historical studies. Material is drawn from many social science disciplines to inform the reader of the reality of making decisions on innovation. Topics covered include: 1) the social context for acts of creative insight, technology development and the management of R & D, 2) the role of institutions of finance, technical education and intellectual property in innovation, and 3) an introduction to the role of the state in maintaining the innovative capacity of the private sector.

Jaffe, Adam B., Manuel Trajtenberg (2002). *Patents, citations & innovations: A window on the knowledge economy.* Cambridge, MA: The MIT Press. ISBN 0-262-60065-X, pb, $30.

This book, now issued in paperback, demonstrates the usefulness of patents and citations data as a window on the process of technological change and as a powerful tool for research on the economics of innovation. Patent records contain a wealth of information, including the inventors' identity, location, and employer, as well as the technological field of the invention. Patents also contain citation references to previous patents, which allow one to trace links across inventions. The book lays out the conceptual foundations for such research and provides a range of interesting applications, such as examining the geographic pattern of knowledge spillovers and evaluating the impact of university and government patenting. It also describes statistical tools designed to handle methodological problems raised by the patent and citation processes. The book includes a CD with complete data on 3 million patents with more than 16 million citations and a range of author-devised measures of the importance, generality, and originality of patented innovations.

Kaika, Maria (2005). *City of flows: Modernity, nature, and the city.* New York: Taylor & Francis. ISBN 0-415-94716-2, pb, $25.95.

Nature and the modern city are often perceived as opposites, separated by firm barriers. Through a history of water's role in the modern city, City of Flows shows that nature is in fact fully integrated into urban life despite our frequent inability to recognize its presence. Natural elements and processes permeate all facets of modern urban social life, even the most mundane. The vast and mostly hidden infrastructure of water – pipes, taps, underground pumps, aqueducts – has been crucial to urban development, and Maria Kaika's investigation into its workings dissolves any sense of a geographical divide between nature and the social.

Kleinman, Daniel Lee, Abby J. Kinchy, Jo Handelsman, Eds. (2005). *Controversies in science and technology: From maize to menopause.* ISBN 0-299-20394-8, pb, $24.95.

The essays in this collection are chosen to offer the reader a balanced discussion on the controversies surrounding issues such as genetically modified crops, overuse of antibiotics used on the farm and hormone replacement therapy, among others. Anyone who wants to engage with these issues in a thoughtful and intelligent manner will benefit from these essays and their comprehensive discussion. It offers the right amount of scientific discussion and data needed to allow readers to critically assess the issues that affect our current society.

Laughlin, Robert (2005). *A different universe: Reinventing physics from the bottom down.* New York: Basic Books. ISBN 0-4650-3828-X, hc, $26.

Robert Laughlin is Professor of Physics at Stanford University and 1998 Nobel Prize winner in Physics for his work on the fractional quantum Hall effect. He argues that the most fundamental laws of physics – such as Newton's laws of motion and quantum mechanics – are in fact emergent. That is to say we must step back and look at the patterns and interactions of everyday objects to discover the nature of our universe rather than thinking that more fundamental properties of matter adequately explain reality as we experience it. A Different Universe takes us into a universe where the vacuum of space has to be considered a kind of solid matter, where sound has quantized particles just like those of light, where there are many phases of matter, not just three, and where metal resembles a liquid while superfluid helium is more like a solid. We live in a universe teeming with natural phenomena still to be discovered. Laughlin proposes nothing less than a new way of understanding fundamental laws of science.

Lord, M. G. (2005). *Astro turf: The private life of rocket science.* New York: Walker & Company. ISBN 0-8027-1427-7, hc, $24.

This book is the inside story of the Jet Propulsion Laboratory in Pasadena, CA by a daughter of a former employee. Started in 1936 by Frank Malina and others, it was the central driving force

behind the design and successful launch of space vehicles. Lord humanizes the lives of rocket engineers, details their achievements and failures, and along the way also explains how the male dominated culture is slowly changing in the field of rocketry and space sciences.

Luhmann, Niklas (2005). *Risk: A sociological theory.* New Brunswick, NJ: Aldine Transaction, a division of Transaction Publishers. ISBN 0-202-30764-6, pb, $29.95.

The late Dr. Luhmann develops a theoretical program for sociological research on risk. His premise is that the concept of risk projects essential aspects of our description of the future onto the present. Risk is conceived as the possibility of triggering unexpected, unlikely, and detrimental consequences by means of a decision attributable to a decision maker. Luhmann shows how strongly and how differently the separate segments of modern society, such as politics, law, science and economy react to the hazardous situations to which they are exposed. His thesis is that the gap has been increasing between those who participate in decisions and those who are excluded from the decision-making process, but who nevertheless have to bear the consequences of decisions taken. It is a classic exploration of risk that will be valued by those interested in technology, communication, sociology, politics, and scientific research.

Lury, Celia (2004). *Brands: The logos of the global economy.* New York: Routledge. ISBN 0-415-25183-4, pb, $38.95.

The brand, a medium of exchange between company and consumer, has become one of the key cultural forces of our time and one of the most important vehicles of globalization. In a new approach that uses media theory to study the economy, Celia Lury offers a detailed and innovative analysis of the brand. Illustrated with many examples, the book argues that brands mediate the supply and demand of products and services in the global economy and frame the activities of the market by functioning as an interface. Brands communicate interactively, selectively promoting and inhibiting communication between producers and consumers. They operate as a public currency while being legally protected as private property in law. Brands introduce sensation, qualities and affect into the quantitative calculations of the market and organize the logics of global flows of products, people, images, and events.

Milner, Murray Jr. (2004). *Freaks, geeks, and cool kids: American teenagers, schools, and the culture of consumption.* New York: Routledge. ISBN 0-415-94830-4, hc, $27.50.

Freaks, Geeks, and Cool Kids argues that the teenage behaviors that annoy adults do not arise from hormones, bad parenting, poor teaching, or the media, but from adolescents' lack of power over the central features of their lives: they must attend school; they have no control over the curriculum; they can't choose who their classmates are. What teenagers do have is the power to create status systems and symbols that not only exasperate adults, but also impede learning and maturing. Ironically, parents, educators, and businesses are inadvertently major contributors to these outcomes. An absorbing journey that stirs up a mixture of nostalgia and dismay, Milner shows how high school distills the worst features of American consumer society and shapes how we relate to our neighbors, partners, and coworkers. It also provides insight into how schools and the lives of teenagers might be transformed.

Mitchell, Jack W. (2005). *Listener supported: The culture and history of public radio.* Westport, CT: Praeger. ISBN 0-275-98352-8, hc, $39.95.

National Public Radio's first employee, Jack W. Mitchell, examines the dreams that inspired those who created NPR, the all-too-human realities that grew out of those dreams, and the criticism public radio has incurred from both sides of the political spectrum. The first producer of NPR's legendary "All Things Considered," Mitchell tells the story of public radio from the point of view of an insider, a participant, and a thoughtful observer. He traces its origins in the progressive movement of the 20th century; and analyses the people, institutions, ideas, political forces, and economic realities that helped it evolve into what we know as public radio today.

Naftali, Tim (2005). *Blind spot: The secret history of American counterterrorism.* New York: Basic Books. ISBN 0-4650-9281-0, hc, $26.

Timothy Naftali, one of the foremost historians of intelligence, espionage and national security in the U.S., and whose research was drawn upon for the historical sections of the 9/11 Commission's report, explores our successes and failures in combating terrorism. In riveting prose, Naftali delivers an alarming picture about our real ability to fight terrorism, and explores the reasons why we have consistently been less well equipped to counter terrorists' efforts than we think. This is the first book to tell the full story of American counter-terrorism efforts – tying together confrontations with SS renegades in the wake of World War II to PLO hijackings in the 1970s to Hezbollah kidnappings in the 1980s to the duel with al Qaeda in the 1990s and beyond. Naftali eerily illustrates how intelligence agencies' failure to connect the dots about Zacarias Moussaoui – the so-called 20th 'hijacker' arrested in the weeks before September 11 – are emblematic of the failure to learn the lessons of the past.

Penrose, Roger (2004). *The road to reality: A complete guide to the laws of the universe.* New York: Alfred A. Knopf. ISBN 0-679-45443-8, hc, $40.

Physics certainly underlies the operation of technology, and Roger Penrose has written a brilliant 1,000+ page tour de force explaining the many ways in which physics accounts for the universe itself and the behaviors of much that lies within it. At the same time, the book engages contemporary controversies in physics, contends that while the theory of relativity looks reasonable secure that quantum physics is far less secure, and that there is an overwhelming beauty and mystery to the world and the cosmos. A deep humility permeates this volume from one of the most profound physicists of contemporary times.

Patterson, Kerry, Joseph Grenny, Ron McMillan, Al Switzler (2005). *Crucial confrontations: Tools for revolving broken promises, violated expectations, and bad behavior.* New York: McGraw-Hill. ISBN 0-07-144652-4, pb, $16.95.

Behind the problems that routinely plague families, teams, and organizations are individuals who either can't or won't deal with failed promises. Others have broken rules, missed deadlines, or just plain behaved badly. If anybody steps up to the issue, he or she often does a lousy job and creates a whole new set of problems. New research demonstrates that these disappointments are not just irritating – they are costly – sapping organizational performance by 20 to 50 percent and accounting for up to 90 percent of divorces. Drawn from over 10,000 hours of real-life observations, Crucial Confrontations teaches skills to increase confidence in facing tough issues including resolving failed promises and missed deadlines, transforming broken rules and bad behaviors into productive accountability, and strengthening relationships while solving problems.

Rhodes, Edwardo Lao (2003). *Environmental justice in America: A new paradigm.* Bloomington, IN: Indiana University Press. ISBN 0-253-34137-x, pb, $21.95.

This book presents a new approach to environmental justice and its equitable distribution. Edwardo Lao Thodes examines environmental justice as a public policy concern and suggests a new methodology for evaluating environmental justice problems. In Part I, he makes the case that race and class were not a major concern of environmental policy until the 1990s. In Part II, he looks at the public policy concerns and discusses methodological approaches to the issues. In Part III, he discusses a case of hazardous waste disposal, which leads to policy recommendations for sharing risk. Throughout, Rhodes links these issues to international environmental justice programs, to issues of national sovereignty and the paternalism of developed nations toward the underdeveloped world, and to notions of economic necessity.

Books Briefly Noted

Richmond, Jonathan (2005). *Transport of delight: The mythical conception of rail transport in Los Angeles.* Akron, OH: The University of Akron Press. ISBN 1-884836-94-1, pb, $39.95.

This unusual book develops a novel theory of myth to explain the construction of rail passenger transit in Los Angeles when it has little to offer the needs of a dispersed autopolis, whose urgent but dispersed public transportation needs could have been better served by developing the regional bus system. The author conducted interviews and performed the detective work necessary to reveal an unlikely logic that held together a network of symbols, images, and metaphors that together present powerful mythical beliefs in a guise of truth. A political analysis shows how consensus was reached to proceed with the light rail to Long Beach, but political explanations are ultimately found lacking, because they cannot explain why decision-makers would want to put the rail in place. It is only when provocative metaphors – of the need to connect communities and to restore a mythical balance to a dysfunctional transportation system – and symbols – of escape from the pressure cooker of poverty, of urban success, power, and indeed sexual acumen – are surfaced, that we realize that Los Angeles rail passenger transit is the result of the very human need to transcend complexity by providing mythical creations that appear to offer easy answers to society's deepest problems.

Roberts, John (2004). *The modern firm: Organizational design for performance and growth.* New York: Oxford University Press. ISBN 0-19-829376-3, hc, $27.50.

John Roberts, in this award-winning book, argues that there are predictable, necessary relationships among organizational designs, routines and processes, and corporate cultures that will improve performance and growth. The organizations that are successful will establish patterns of fit among the elements of their organizational designs, competitive strategies, and the external environment in which they operate, and will go about this in a holistic manner. The Modern Firm develops powerful conceptual frameworks for analyzing the interrelations between organizational design features, competitive strategy, and the business environment. Written in a non-technical language, the book is based on rigorous modeling and draws on numerous examples, from the eighteenth century fur trading companies to modern firms such as BP and Nokia. Finally, the book explores why these developments are happening now, pointing to the increase in global competition and changes in technology.

Rosner, Lisa, Ed. (2004). *The technological fix: How people use technology to create and solve problems.* New York: Taylor & Francis. ISBN 0-415-94711-1, pb, $25.95.

Most literally, the term 'technological fix' should mean a fix provided by technology – a solution for all of our problems, from medicine and food production to all the environment and business. Instead, technological fix has come to mean a cheap, quick fix using inappropriate technology that usually creates more problems than it solves. In cultures that pride themselves on their inventiveness and aptitude for technology (think America, German, and Dutch), people may be too eager to apply a technological fix as it has appeared throughout the twentieth century. Addressing such 'fixes' as artificial hearts, industrial agriculture and climate engineering, these essays examine our need to turn to technology for solutions to all of our problems. This newest addition to the Hagley Perspectives on Business and Culture series sets out the distinction between a technological fix and a true technological solution.

Sandler, Ronald, Philip Cafaro, Eds. (2005). *Environmental virtue ethics. Lanham, MD: Rowman & Littlefield.* ISBN 0-7425-3390-5, pb, $28.95.

Environmental virtue ethics is the area of environmental ethics concerned with character. It has been an underappreciated and underdeveloped aspect of environmental ethics. The selections in this collection, consisting of ten original and four reprinted essays by leading scholars in the field, discuss the role that virtue and character have traditionally played in environmental discourse and reflect upon the role that it should play in the future. The selections also discuss the

substantive content of the environmental virtues and vices and apply them to concrete environmental issues and problems. This collection established the indispensability of environmental virtue ethics to environmental ethics. It also enhances the breadth and quality of the ongoing discussion of environmental virtue and vice and the role they should play in an adequate environmental ethic.

Schacht, Steven P., Jeffery E. Aspelmeier (2005). *Social and behavioral statistics: A user-friendly approach.* Boulder, CO: Westview Press. ISBN 0-8133-4168-X, pb, $32.

In this newly revised text, the authors make use of their proven stress-busting approach to teaching statistics to self-described math phobic students. They use humorous examples and step-by-step presentations of statistical procedures to illustrate what are often complex and hard-to-grasp statistical concepts. Students and instructors will find this text to be a helpful, easy to interpret, and thoroughly comprehensive introduction to social and behavioral statistics.

Serlin, David (2004). *Replaceable you: Engineering the body in postwar America.* Chicago: University of Chicago Press. ISBN 0-226-74884-7, pb, $25.

After World War II, the United States underwent a massive cultural transformation that was vividly realized in the development and widespread use of new medical technologies. Plastic surgery, wonder drugs, artificial organs, and prosthetics inspired Americans to believe in a new age of modern medical miracles. The nationalistic pride that flourished in postwar society, meanwhile, encouraged many Americans to put tremendous faith in the power of medicine to rehabilitate and otherwise transform the lives and bodies of the disabled and those considered abnormal. Replaceable You revisits this heady era in American history to consider how these medical technologies and procedures were used to advance the politics of conformity during the 1950s.

Steele, Brett D., Tamera Dorland, Eds. (2005). *The heirs of Archimedes: Science and the art of war through the age of enlightenment.* Cambridge, MA: The MIT Press. ISBN 0-262-19516-X, hc, $55.

This collection of essays examines the emergence during the early modern era of a synthesis of scientific theory and military practice. It is the first collaborative scholarly assessment of these early military-scientific relationships, which have been long neglected by scholars both in the history of science and technology and in military history. The book begins with the innovation of gunpowder weaponry in both Christian and Islamic states of the late medieval and Renaissance eras. Other topics include the cultural resistance to scientific techniques; the relationship of early modern science and naval power, particularly the intersecting developments in mathematics and oceanic navigation; the efforts by early practitioners and theorists of chemistry to increase the power and consistency of gunpowder; and the application of advanced scientific knowledge and Enlightenment ideals within the military engineering and artillery organizations of the eighteenth century.

Swedin, Eric G. (2005). *Science in the contemporary world: An encyclopedia.* Santa Barbara, CA: ABC CLIO. ISBN 1-85109-524-1, hc, $85.

In 1950, no one had heard of quarks, no one knew the structure of DNA, and no manufactured object had left the gravitational pull of Earth. Now these are all commonplace. This work details the people and discoveries that brought disease eradication, desktop computers, close-up looks of outer space, and a sense of wonder at what the human mind can accomplish. This is the age of science and technology and this book through its hundreds of entries describes it well.

Szerszynski, Bronislaw (2005). *Nature, technology and the sacred.* Malden, MA: Blackwell Publishing. ISBN 0-631-23603-1, pb, $29.95.

This provocative and timely book argues that contemporary ideas and practices concerning

nature and technology remain closely bound up with religious ways of thinking and acting. Using examples from North America, Europe, and elsewhere, it reinterprets a range of 'secular' phenomena in terms of their conditioning by a complex series of transformations of the sacred in Western history. The contemporary practices of environmental politics, technological risk behavior, alternative medicine, vegetarianism and ethical consumption take on new significance as sites of struggle between different sacral orderings. Nature, Technology and the Sacred introduces a radically new direction for today's critical discourse concerning nature and technology – one that reinstates it as a moment within the ongoing religious history of the West.

Taper, Mark L., Subhash R. Lete, Eds. (2004). *The nature of scientific evidence: Statistical, philosophical, and empirical considerations.* Chicago: University of Chicago Press. ISBN 0-226-78955-1, pb, $30.

An exploration of the statistical foundations of scientific inference, this volume asks what constitutes scientific evidence (think of its prominence in the No Child Left Behind Act) and whether scientific evidence can be quantified statistically. Mark Taper, Subhash Lele, and an esteemed group of contributors explore the relationships among hypotheses, models, data, and inference on which scientific progress rests in an attempt to develop a new quantitative framework for evidence. Informed by interdisciplinary discussions among scientists, philosophers, and statisticians, they propose a new 'evidential' approach, which may be more in keeping with the scientific method. The Nature of Scientific Evidence persuasively argues that all scientists should care more about the fine points of statistical philosophy because therein lies the connection between theory and data. Though the book uses ecology as an exemplary science, the interdisciplinary evaluation of the use of statistics in empirical research will be of interest to any reader engaged in the quantification and evaluation of data.

Tomaiuolo, Nicholas G. (2004). *The web library: Building a world class personal library with free web resources.* Medford, NJ: Information Today, Inc. ISBN 0-910965-67-6, pb, $29.95.

With this comprehensive, eye-opening book and its companion Web site, Nick Tomaiuolo shows how anyone can create a comprehensive digital library using no-cost (where necessary, low cost) Web resources. And when Nick says 'library' he means a vast, rich collection of data, documents, and images that – if you follow his instructions to the letter – can rival the holdings of many traditional libraries. The Web Library is a readable, easy-to-use guide that puts hundreds of useful resources at your fingertips 24/7 while saving you time and money. You'll find a wealth of annotated URLs, more than 30 helpful figures and screenshots, and abundant examples of free, authoritative Web resources you can start using right away. Best of all, you'll discover techniques for finding and collecting new content as the Web evolves.

Tutton, Richard, Oonagh Corrigan, Eds. (2004). *Genetic databases: Socio-ethical issues in the collection and use of DNA.* New York: Taylor & Francis. ISBN 0-415-31680-4, pb, $43.95.

Genetic Databases offers a timely analysis of the underlying tensions, contradictions and limitations of the current regulatory frameworks for and policy debates about genetic databases. Drawing on original empirical research and theoretical debates in the fields of sociology, anthropology and legal studies, the contributors to this book challenge the prevailing orthodoxy of informed consent and explore the relationship between personal privacy and the public good. They also consider the multiple meanings attached to human tissue and the role of public consultations and commercial involvement in the creation and use of genetic databases. The authors argue that policy and regulatory frameworks produce a representation of participation that is often at odds with the experiences and understandings of those taking part. The findings present a series challenge for public policy to provide mechanisms to safeguard the welfare of individuals participating in genetic databases.

Van den Bergh, Jeroen C. J. M., Marco A. Janssen, Eds. (2004). *Economics of industrial ecology: Materials, structural change, and spatial scales.* Cambridge, MA: The MIT Press. ISBN 0-262-22071-7, hc, $50.

The thirteen chapters of this text integrate the natural science and technological dimensions of industrial ecology with a rigorous economic approach and by doing so contribute to the advancement of this emerging field. Using a variety of modeling techniques (including econometric, partial and general equilibrium, and input-output models) and applying them to a wide range of materials, economic sectors, and countries, these studies analyze the driving forces behind material flows and structural changes in a way that can offer guidance for economically and socially feasible policy solutions. After a survey of concepts and relevant research, the book presents historical analyses of structural change from statistical and decomposition approaches; a range of models that predict structural change on the national and regional scale under different policy scenarios; two models that can be used to analyze waste management and recycling operations; and, adopting the perspective of local scale, an analysis of the dynamics of eco-industrial parks in Denmark and the Netherlands. The book concludes with a discussion of the policy implications of an economic approach to industrial ecology.

Van Wyck, Peter C. (2004). *Signs of danger: Waste, trauma, and nuclear threat.* Minneapolis, MN: University of Minnesota Press. ISBN 0-8166-3763-6, pb, $19.95.

The Waste Isolation Pilot Project in Carlsbad, New Mexico began receiving shipments of government-generated radioactive waste in 1999. With a proposed closing date of 2030, this repository for nuclear waste must be secured with a sign, the purpose of which will be to keep people away for three hundred generations. In the official documents uncovered by Peter van Wyck, we encounter a government bureaucracy approaching the issue of nuclear waste as a technical problem only to find it confronting a host of intractable philosophical issues concerning language, culture, and history. Signs of Danger plumbs these depths as it shows us how the problem raised in the desert of New Mexico is actually the problem of a culture grappling with ecological threats and with questions of the limits of meaning and representation in the deep future. The reflections at the center of this book – on memory, trauma, disaster, representation, and the virtual – are aimed at defining the uniquely modern status of environmental and nuclear threats. They offer invaluable insights into the interface of where culture ends and nature begins, and how such a juncture is closely linked with questions of risk, concepts of history, and the cultural experience of time.

Von Hippel, Eric (2005). *Democratizing innovation.* Cambridge, MA: The MIT Press. ISBN 0-262-00274-4, hc, $29.95.

Consumers have never been completely happy. Despite the plethora of goods available on the market, there's always some need that available products can't fill or fill inadequately. But now emerging technologies arm users with the tools they need to create the products they truly want. Examples are plentiful – from the music industry, where inexpensive synthesizers allow users to create varied and high-tech sounds previously only available in expensive studies, to the sports arena, where snowboarders and windsurfers have completely revolutionized the equipment they use. The same trend is taking place in industry as well. Manufacturers like Texas Instruments and IBM used to design custom integrated circuits for their customers, but now those customers design them for themselves. This shift from manufacturer to user has profound implications for consumers and companies alike.

Von Hippel explains in detail how the process of user-centric, democratized innovation works. He explains why users are increasingly developing their own custom products, and why they then often freely reveal what they have developed. He shows how communities of users are actually becoming such powerful innovation engines that they increasingly drive manufacturers out of product development altogether – a pattern he documents in fields ranging from open source software to sporting equipment.

Books Briefly Noted

Winn, J. Emmett, Susan L. Brinson, Eds. (2005). *Transmitting the past: Historical and cultural perspectives on broadcasting.* Tuscaloosa, AL: University of Alabama Press. ISBN 0-8173-5175-2, pb, $22.95.

The essays in this collection represent some of the best cultural and historical research on broadcasting in the U.S. today. Each essay concentrates on a particular event in broadcast history – beginning with Marconi's introduction of wireless technology in 1899. Michael Brown examines newspaper reports in America of Marconi's belief in Martians, stories that effectively rendered Marconi inconsequential to the further development of radio. The widespread installation of radios in automobiles in the 1950s, Matthew Killmeier argues, paralleled the development of television and ubiquitous middle-class suburbia in America. Heather Hundley analyzes depictions of male and female promiscuity as presented in the sitcom Cheers at a time concurrent with media coverage of the AIDS crisis. Fritz Messere examines the Federal Radio Act of 1927 and the clash of competing ideas about what role radio should play in America life. Chad Dell recounts the highbrow programming strategy NBC adopted in 1945 to distinguish itself from other networks. And George Plasketes studies the critical reactions to Cop Rock, an ill-fated combination of police drama and musical, as an example of society's resistance to genre mixing or departures from formulaic programming.

Young, Christian C. (2005). *The environment and science: Social impact and interaction.* Santa Barbara, CA: ABC-CLIO. ISBN 1-5760-7963-5, hc, $75.

Drawing on the arts, religion, and the full range of sciences, The Environment and Science is an invaluable resource for all those who wish to understand the most pressing scientific and environmental issues facing humankind. This work explains in an accessible manner the complex interplay between scientific inquiry and public perceptions of the environment over the past 400 years. With scientists seemingly divided, many laypeople have struggled to understand environmental issues. Now this lively but scholarly work aims to bridge the gap, and provide an invaluable guide based on classic scientific texts and the very latest research.

Agar, Nicholas (2004). *Liberal eugenics: In defense of human enhancement*. Malden, MA: Blackwell Publishing. ISBN 1-4051-2390-7, pb, $21.95.

The author is a senior lecturer in ethics at Victoria University of Wellington in New Zealand. He focuses on three particular technologies that appear quite likely to offer the practical possibility of eugenics exercised by parents as they bring children into the world: cloning by somatic cell nuclear transfer, genomics, and genetic engineering. He argues forcefully for the legitimacy of both these technologies and their applications by parents and rejects arguments that have been raised against such procedures such as creating genetically designed stratified societies and a confining view of human excellence that consists of genetic perfection. The arguments are engaging and well argued although many will find them unconvincing.

Austerberry, David (2004). *Digital asset management: How to realize the value of video and image libraries.* New York: Focal Press. ISBN 0-2405-1924-8, pb, $49.95.

David Austerberry, the owner of a new media consulting group, presents the business case for digital asset management systems, demystifies assumptions about the technology, and provides a thorough introduction to the system components required such as ingest, indexing, searching, middleware, databases, and storage systems. Content and document management systems are core back office applications of the modern day enterprise, yet there is little information available on the deployment of these systems in media businesses. This book explains the potential for applying asset management to image and multimedia libraries, increasing efficiency in content creation and simplifying distribution over a variety of channels including television, iTV, the Internet, webcasting, mobile phones and wireless PDAs.

Baker, David P., Gerald K. LeTendre (2005). *National differences, global similarities: World culture and the future of schooling*. Palo Alto, CA: Stanford University Press. ISBN 0-8047-5021-1, pb, $13.57.

Using American schools as a reference point, this book provides a comprehensive, comparative description of schooling as a global institution. Each chapter develops a story about a particular global trend: continuing gender differences in achievement, new methods to govern schools, the increasing use of private tutoring, school violence, the development of effective curricula, and the everyday work of teachers. The authors draw on a four-year investigation conducted in 47 countries that examined many aspects of K-12 schooling. Baker and LeTendre present the results on the study in a nontechnical and accessible fashion, outlining the implications of current trends for both education policy discussions and theoretical explorations of the role of education in society.

Berlin, Leslie (2005). *The man behind the microchip: Robert Noyce and the invention of Silicon Valley*. New York: Oxford University Press. ISBN 0-19-516343-5, hc, $30.

This new biography shares the fascinating story of Robert Noyce, co-founder of Intel and Fairchild Semiconductor, and co-inventor of one of the most important technologies of the twentieth century: the integrated circuit, electronic heart of the high-tech revolution. Warren Buffet, Andy Grove, Steve Jobs, Gordon Moore, Arthur Rock – these were Noyce's friends and colleagues. Berlin, visiting scholar at Stanford University, has interviewed them all, and their recollections of Noyce, bolstered by the author's unprecedented access to Noyce's papers, make this book not only the first, but likely to be the definitive, story of one of the twentieth century's greatest inventor-entrepreneurs. It is also the story of the rise of Silicon Valley, a region best known for its plums and apricots when the 29-year-old Noyce arrived in 1956, and the epicenter of the high-technology universe by the time of his death in 1990.

Calaprice, Alice, Ed. (2005). *The new quotable Einstein*. Princeton, NJ: Princeton University Press. ISBN 0-691-12074-9, pb, $14.95.

Albert Einstein, one of the three greatest physicists of all time, is a source of endless fascination. This set of quotations including the well known and the obscure was compiled by a former Senior Editor of Princeton University Press who worked on the Einstein papers for twenty years. Eighteen sections of quotes are organized by topics with appropriate citation information for each quotation. Another section contains quotes attributed to Einstein and then there are a section of quotes from others about Einstein. The quotations are complemented by a foreword by Freeman Dyson, biographical information, a Q & A of common questions about Einstein, a few pertinent documents related to his life, black and white photos, bibliography, and a useful index. Of particular interest to JOTS readers is the chapter of quotations on science and scientists, mathematics, and technology, including the following one: "The main source of all technological achievements is the divine curiosity and playful drive of the tinkering and thoughtful researcher, as much as it is the creative imagination of the inventor." [August 22, 1930, in a radio broadcast in Berlin. Transcribed by Frederich Herneck in *Die Naturwissenschaften* 48 (1961), 33. Einstein Archive 4-044.]

Chan, Lois Mai (2005). *Library of Congress subject headings: Principles and applications*. Westport, CT: Libraries Unlimited. ISBN 1-59158-156-7, 4th edition, pb, $75.

Surely one of the greatest technological innovations for libraries was the decision by the Library of Congress (LOC) in the summer of 1898 to reconfigure its card catalog into dictionary form where title, author, and subject were interfiled in alphabetical order. The LOC began to compile a list of preferred subjects and standardization among libraries accelerated as others began to adapt or directly utilize this system. The subject headings have been maintained and are continuously revised following a set of guidelines and uses controlled vocabulary for headings

and subheadings. This fourth edition brings the LOC subject headings discussion up to date with important concepts, principles, and guidelines from an expert on LOC subject headings. Readers of JOTS are reminded that we use the LOC subject headings and subheadings for technology as one important guideline for authors of subjects of possible interest to JOTS. Additionally, familiarity with the LOC subject headings will aid any researcher in their bibliographic research.

Clyde, William, Andrew Delohery (2005). *Using technology in teaching*. New Haven, CT: Yale University Press. ISBN 0-300-10394-8, pb, $16.50.

A superb guide to using technology effectively in the university or college classroom by two experienced practitioners who teaching finance and English composition respectively at Quinnipiac University in Connecticut. Contrary to many books of this genre, the material is organized around specific goals, including communicating with students, promoting collaborative learning, clarifying course objectives, developing student research skills, collecting course materials, distributing course materials, learning through experience, improving student writing, using assessment and feedback, and identifying plagiarism. A CD-ROM that accompanies the text provides very useful examples across a range of subjects and all served up in an anecdotal and non-technical style that make it accessible to instructors with a wide range of abilities regarding technologies.

Collins, M. W., M. A. Atherton, J. A. Bryant, Eds. (2005). *Nature and design*. *Volume 1*. Billerica, MA: WIT Press, 25 Bridge Street, Billerica, MA 01821. ISBN 1-85312-852-X, hc, $213.

This is an extraordinary collection of essays by biologists and engineers in a new series on "Design and Nature" that provides current and breathtaking treatments of natural structures and seeks to learn from them design insights that can aid human understanding of their functions as well as inform current engineering practice. The opening chapter takes up the important question of "What is design?" This is followed by chapters that deal respectively with mathematics in the natural world, cell energy transfer as an example of applications of the laws of thermodynamics, robustness and complexity, growth and form in light of D'Arcy Thompson's contributions to the subject, design in plants, the tree as an engineering structure, a homeostatic model as a tool for the design and analysis of shell structures, adaptive growth, optical reflectors and antireflectors in animals, a medical engineering project in the field of cardiac assistance, Leonardo da Vinci, and the evolution of land-based locomotion and aerodynamics with reference to both animals and solar powered cars. The final chapter takes up the issue of creativity and nature. There is a considerable range of disciplines invoked in the prosecution of these essays including engineering, mathematics, physics, chemistry, biomimetics, history of science, and technology. Generous numbers of black and white photographs, diagrams, charts, tables, and graphs accompany the essays and greatly aid reader comprehension of key ideas. While the book is quite expensive, it is strongly recommended for library acquisition and for teachers of design. The ideas within its pages can stimulate new research ventures, enrich the teaching of many topics in design and technology fields, and serve as wonderful exemplars of interdisciplinary work related to design and technology.

Committee on Facilitating Interdisciplinary Research (2005). *Facilitating interdisciplinary research*. Washington, DC: National Academies Press. ISBN 0-309-09435-6, pb, $42. (also available as pdf for cheaper price).

A committee of the National Academies was established through the impetus of the Keck Foundation to review definitions of interdisciplinary research, identify current structural models of interdisciplinary research, analyze policies and procedures of various funding agencies and organizations that encourage or discourage interdisciplinary research, identify measures to evaluate the impact of interdisciplinary research among various constituencies, develop findings and conclusions on the state of interdisciplinary research, and provide recommendations as to how to better stimulate and support interdisciplinary research. This 300-page report summarizes the

results of their deliberations, research, convocations, and discussions with individuals, organizations, institutions, and government agencies concerning this important topic. Technology professionals will find much to consider within these pages, especially as so many successful applications and projects in technology require interdisciplinary approaches for success to be realized.

Conant, Jennet (2005). *109 East Palace: Robert Oppenheimer and the secret city of Los Alamos*. New York: Simon & Schuster. ISBN 0-7432-5007-9, hc, $26.95.

109 East Palace, Santa Fe, New Mexico was the "office" of the top secret team of over 5,000 scientists, technicians, troops, and support personnel working in the desert at nearby Los Alamos. Jennet Conant, granddaughter of James Conant, uses this "location" as a vantage point to describe the social, cultural, and scientific life of the Los Alamos community through the eyes of Dorothy McKibbin, a civilian who worked at 109 East Palace as the project's gatekeeper. The book is based on extensive interviews, voluminous records, and the author's own personal family encounters with the secrecy and then terror of the atomic bomb invented at Los Alamos. This is a story superbly told with vivid anecdotes, humor, pathos, history, science, and technology. It very nicely complements the much longer and earlier award-winning book by Richard Rhodes, *The Making of the Atomic Bomb*.

DeGroot, Gerard J. (2005). *The bomb: A life.* Cambridge, MA: Harvard University Press. ISBN 0-674-01724-2, hc, $27.95.

Gerard DeGroot, a historian at the University of St. Andrews in Scotland, tells the story of this once unimaginable weapon that – at least since 8:16 AM on August 6, 1945 – has haunted our dreams and threatened our existence. The Bomb has killed hundreds of thousands outright, condemned many more to lingering deaths, and made vast tracts of land unfit for life. For decades it dominated the psyches of millions, becoming a touchstone of popular culture, celebrated or decried in mass political movements, films, songs, and books. DeGroot traces the life of the Bomb from its birth to turn-of-the-century physics labs of Europe to a childhood in the New Mexico desert of the 1940s, from adolescence and early adulthood in Nagasaki, Bikini, Australia, and Kazakhstan to maturity in test sites and missile silos around the globe. His book portrays the Bomb's short but significant existence in all its scope, providing us with a portrait of the times and the people – from Oppenheimer to Sakharov, Stalin to Reagan – whose legacy still shapes our world.

Denzin, Norman K., Yvonna S. Lincoln, Eds. (2005). *The SAGE handbook of qualitative research*. Third edition. Thousand Oaks, CA: SAGE Publications. ISBN 0-7619-2757-3, hc, $130.

The earlier editions of this handbook were hailed by friends and critics alike as rich sources of ideas in the qualitative research tradition. This tradition continues with this new edition of a classic in qualitative research methods. All researchers in technology will benefit from reading and considering the varied methods advanced in this reference work as they seek to answer practical evaluation and research questions about technical education in all its varied dimensions. The first set of chapters describes the origins and import of qualitative research. Further sections consider paradigms and perspectives (frequently contested), strategies of inquiry, methods of collecting and analyzing empirical materials, and the art and practices of interpretation, evaluation, and presentation. Not surprisingly, there are frequent examples in this text of the marked and sometimes strong disagreements that exist within this field of research methods and the final three chapters give some consideration about why this is true in the present and will likely remain true in the future. SAGE and the editors are to be congratulated for updating this worthwhile reference work. Scholars will want to keep the prior editions of this handbook, however, as almost two-thirds of the contributors were new to this edition and many topics discussed in prior editions are not represented in the new volume – a reflection of the ferment and divergent viewpoints within the world of qualitative research.

Books Briefly Noted

Dreyfus, Hubert L., Mark A. Wrathall, Eds. (2005). *A companion to Heidegger.* Malden, MA: Blackwell Publishing. ISBN 1-4051-1092-9, hc, $124.95.

Martin Heidegger is certainly one of the most influential philosophers of the twentieth century. This handbook is part of the series of Blackwell Companions to Philosophy. It surveys the life and influence of Heidegger and takes a chronological approach to his work organized into three main sections: his early work, *Being and Time*, and his later work. Each section contains essays by leading experts on standard philosophical topics such as logic, phenomenology, temporality, language, realism, hermeneutics, and truth and his contributions to these topics as well as consideration of more general areas such as philosophy of science and analysis of key aspects of his voluminous writings. JOTS readers should become conversant with Heidegger and the chapter on "Technology" by the philosopher of technology, Albert Borgmann, is particularly worthy of readers' attention as it succinctly describes Heidegger's views concerning technology – many quite controversial at the time – now considered commonplace. Many other ideas of Heidegger are pertinent to ruminations about technology in general and life in our postmodern time.

Georges, Thomas M. (2003). *Digital soul: Intelligent machines and human values*. Boulder, CO: Westview Press. ISBN 0-8133-4057-8, pb, $16.95.

This book serves up an excellent introduction to artificial intelligence from a former research scientist at the National Bureau of Standards, Institute for Telecommunication Sciences, and NOAA. It addresses fundamental questions concerning intelligence, consciousness, machines that think, robotics, moral problems, electronic democracy, the strengths and limitations of smart machines, the covenant between science and society, and a final chapter that considers the author's own views concerning the implications of AI regarding human conceptions of god(s) – he thinks such concepts will be discarded.

Gershenfeld, Neil (2005). *FAB: The coming revolution on your desktop – from personal computers to personal fabrication*. New York: Basic Books. ISBN 0-465-02745-8, hc, $26.

Acclaimed technoprognosticator Neil Gershenfeld, Director of MIT's Center for Bits and Atoms, outlines the new frontier of technology: experiments at the vanguard of a new science and a new era that will let people create objects they desire and thus make the kind of world they want to live in. The practical applications, as Gershenfeld points out, permit people in developed nations to create highly customized devices that would never occur to a team of 'product designers.' Moreover, Gershenfeld vividly details the powerful benefits that will accrue to developing nations. Many of his examples are from labs in India, Costa Rica, Ghana, and Norway, where people are solving local problems in surprisingly successful ways. Fab labs are situated at the boundary of computer science and physical science, where digital fabrication is building with logic. It is the perfect marriage of theory and practice to produce local development and local prosperity.

Gertler, Mark, Kenneth Rogoff (2005). *NBER macroeconomics annual 2004*. Cambridge, MA: The MIT Press. ISBN 0-262-57229-X, $35.00.

The *NBER Macroeconomics Annual* presents pioneering work in macroeconomics by leading academic researchers that is addressed to a broad audience of public policymakers as well as to the academic community. Each paper is followed by comments and discussion to give a more complete context for the views expressed. The 2004 edition features a range of papers aimed at providing coherent and informative answers to such important questions as the effect of federal government debt on interest rates; the stochastic dimension of the American economy; the role of technology as a source of economic fluctuations; and the interaction of capital flows, fiscal policy, and monetary policies in developing countries, emerging markets, and OECD countries.

Ghosh, Rishab Aiyer, Ed. (2005). *CODE: Collaborative ownership and the digital economy*. Cambridge, MA: The MIT Press. ISBN 0-262-0726-2, hc, $37.50.

CODE looks at the collaborative model of creativity – with examples ranging from collective ownership in indigenous societies to free software, academic science, and the human genome project – and finds it an alternative to proprietary frameworks for creativity based on strong intellectual property rights. The contributors to CODE, from such diverse fields as economics, anthropology, law, and software development, examine collaborative creativity from a variety of perspectives, looking at new and old forms of creative collaboration and the mechanisms emerging to study them. Discussing the philosophically resonant issues of ownership, property, and the commons, they ask if the increasing application of the language of property rights to knowledge and creativity constitutes a second enclosure movement – of if the worldwide acclaim for free software signifies a renaissance of the commons. Two concluding chapters offer concrete possibilities for both alternatives, with one proposing the establishment of 'positive intellectual rights' to information and another issuing a warning against the threats to networked knowledge posed by globalization.

Hall, J. Storrs (2005). *Nanofuture: What's next for nanotechnology*. Amherst, NY: Prometheus Books. ISBN 1-59102-287-8, hc, $28.

Hall, a leading researcher on the frontiers of nanotechnology as Chief Scientist at Nanorex, Inc. and a Fellow of the Molecular Engineering Research Institute, describes this extremely active emerging field in a manner accessible to the general public. He explains the history of nanotechnology, how it fits within the broader fabric of the development of technology and technical systems over time, and projects what the future will look like as the range of applications increase and mature. He squarely faces the ethical issues and inevitable tradeoffs that nanotechnology presents in a manner that enlightens and stimulates thought. This book is thoroughly recommended for a comprehensive tour of this exciting area of technology research and development.

Hillstrom, Kevin, Laurie Collier Hillstrom, Eds. (2005). *The industrial revolution in America. Volume 1: Iron and steel. Volume 2: Railroads. Volume 3: Steam shipping.* Santa Barbara, CA: ABC CLIO. ISBN 1-85109-620-5, hc, $185 for set.

These are the first volumes of a nine volume series on the Industrial Revolution in America. Organized along identical lines, each volume focuses on the story of a particular industry's impact on America in a series of chapters that consider the origins and development of the industry, innovations and inventions, major entrepreneurs and companies, the lives of the workforce, labor organizations and reform movements, environmental impact, the interaction between the specific industry and immigration, the societal impact of the industry, Gilded Age art and literature influenced by the industry, and the industry in the modern era. Period black and white photographs accompany the 300 page narratives and comprehensive indices enables readers to quickly locate relevant materials. The remaining volumes in the series will explore textiles, mining and petroleum, automobiles, agriculture and meatpacking, communications, and an overview of the industrial revolution. This is an excellent resource series for technology professionals, students, and libraries.

Hughes, James (2004). *Citizen cyborg: Why democratic societies must respond to the redesigned human of the future.* Cambridge, MA: Westview Press. ISBN 0-8133-4198-1, hc, $26.95.

Two major coalitions have emerged with the United States in regards to human capability to alter and enhance human beings via technological means. The one group opposes one or more technologies such as in vitro fertilization, stem cell research, life extension, and genetic manipulation. The other group argues that human beings should be guaranteed freedom to control their own bodies and brains, and to use technology to transcend human limitations. While considering the views of both of these groups, bioethicist James Hughes, argues for a third way, which he

calls democratic transhumanism. This approach argues that we will achieve the best possible posthuman future when we ensure technologies are safe, make them available to everyone, and respect the right of individuals to control their own bodies. This is a groundbreaking work of social commentary that illuminates the technologies that are pushing the boundaries of humanness – and the debate that may determine the future of the human race itself.

Jaffe, Adam B., Josh Lerner, Scott Stern, Eds. (2005). *Innovation policy and the economy*. Volume 5. Cambridge, MA: The MIT Press. ISBN 0-262-60064-1, $30.

The economic importance of innovation brings with it an active debate on the impact public policy has on the innovation process. This annual series, sponsored by the National Bureau of Economic Research, brings the work of leading academic researchers to the broader policy community. This volume considers such topics as the implications of software outsourcing for American technology leadership; the complementary roles of large corporations and entrepreneurs in developing innovative technology; city-level policy and planning that establishes a 'jurisdictional advantage' in the value of local resources; the effect of taxes on entrepreneurship; and how to incorporate innovation into the analysis of business mergers. These papers highlight the role economic theory and empirical analysis can play in evaluating policies and programs regarding research, innovation, and the commercialization of new technologies.

J. E. Lendon (2005). *Soldiers & ghosts: A history of battle in classical antiquity.* New Haven, CT: Yale University Press. ISBN 0-300-10663-7, hc, $35.

J. E. Lendon, a historian at the University of Virginia, argues that the most successful armies in the ancient world were those that made the most effective use of cultural tradition rather than those with the most advanced technologies. Ranging from the Battle of Champions between Sparta and Argos in 550 BC through Julian's invasion of Persia in 363 AD*, Soldiers and Ghosts* brings to life the most decisive military contests of ancient Greece and Rome. Lendon places these battles, and the methods by which they were fought, in a sweeping narrative of ancient military history. On every battlefield, living soldiers fought alongside the ghosts of tradition – ghosts that would inspire greatness for almost a millennium before ultimately coming to stifle it. Cultural traditions, the memory of the heroes of the past and their deeds, and the intense desire to emulate them and be seen by one's contemporaries, as being their rightful heirs, are the true innovations that sustained the military might of successful ancient armies.

Lesk, Michael (2005). *Understanding digital libraries*. San Francisco, CA: Morgan Kaufmann. ISBN 1-55860-924-5, pb, $49.95.

This fully revised and updated second edition focuses on the challenges faced by both librarians and computer scientists in a field that has been dramatically altered by the growth of the Web. At every turn, the goal is practical: to show you how things you might need to do are already being done, or how they can be done. The first part of the book is devoted to technology and examines issues such as varying media requirements, indexing and classification, networks and distribution, and presentation. The second part of the book is concerned with the human contexts in which digital libraries function. Here you'll find specific and useful information on usability, preservation, scientific applications, and thorny legal and economic issues.

Mertens, Donna M. (2005). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods.* Second edition. Thousand Oaks, CA: SAGE Publications. ISBN 0-7619-2805-7, pb, $59.95.

The first edition of this textbook was an international bestseller among academic books of its kind. This text covers four major paradigms for research: postpositivist, constructivist, transformative, and pragmatic. Within this broader set of paradigms, the author explains quantitative, qualitative, and mixed methods approaches with a particular focus on how to plan, conduct, explain, and utilize research in culturally complex communities. Sample studies and abstracts of

research illustrate the various concepts discussed in each section of the book and the entire research process is carefully explained and illustrated by examples. Each chapter contains an outline of topics, a summary of specific research studies, delineated process steps, a feel for controversies and alternate perspectives on the topic at hand, and questions and activities to aid student comprehension. An appendix provides a useful outline for preparing a research proposal that is suitable for execution of a thesis or dissertation. This book is recommended for those preparing to conduct research in technical education that need a reliable and up-to-date refresher or for those teaching others how to do plan and conduct research.

Nuechterlein, Jonathan E., Philip J. Weiser (2005). *Digital crossroads: American telecommunications policy in the internet age*. Cambridge, MA: The MIT Press. ISBN 0-262-14091-8, $40.

Keeping track of the changing telecommunications landscape – let alone the economic and technology forces that are driving these changes – is difficult even for the regular reader of the business pages. More difficult still is the challenge of understanding how and why the government regulates competition in this industry. Most available discussions are either superficial or laden with inaccessible jargon. Digital Crossroads provides a welcome break from this tradition. In this important new book, telecommunications lawyers Jonathan Nuechterlein and Philip Weisner, offer a clear, balanced, and highly readable analysis of competition policy issues in the telecommunications industry. After giving a big picture overview of the field, they present sharply reasoned analyses of the major technological, economic, and legal developments confronting communications policymakers in the twenty-first century.

Orey, Michael, Jo McClendon, Robert Maribe Branch, Eds. (2005). *Educational media and technology yearbook 2005. Volume 30*. Westport, CT: Libraries Unlimited. ISBN 1-59158-207-5, hc, $80.

The American Association of School Librarians and the Association for Educational Communications and Technology jointly sponsor this annual volume that contains essays pertinent to educational media and technology. This year's volume provides many essays of interest to JOTS readers including learning through design, creating online environments for learning, multicultural perspectives on web-based learning, intellectual freedom after 9/11, electronic reference services, profiles of two leaders in the profession (Betty Collis and M. David Merrill), an overview of organizations and associations in the field, and a survey of graduate programs. Essays are by leading scholars with bibliographies and have been carefully edited. This is a valuable annual resource for technology professionals.

Palladino, Grace (2005). *Skilled hands, strong spirits: A century of building trades history*. Ithaca, NY: Cornell University Press. ISBN 0-8014-4320-2, hc, $36.

This is an excellent history of the Building and Construction Trades Department of the AFL-CIO that sets the origin and evolution of the Department within the context of American business and industry. It chronicles the role of the Department in building new structures that transformed the urban environment, the introduction and use of new building methods and new building materials, improving safety standards, promotion of unionized construction, and the intricacies of forging a sense of common goals and identity among up to nineteen autonomous and highly diverse affiliates of the Department reflecting the diversity of trades and specializations within building and construction. One of the valuable contributions of the book is its promotion of a balanced understanding of the positive contributions of unions to construction and the history of business and industry. A variety of archival materials, personal interviews of leading figures, and government records are combined for the first time in an engaging look at building trades in the United States.

Petrovich, Janice, Amy Stuart Wells, Eds. (2005). *Bringing equity back: Research for a new era in American educational policy*. New York: Teachers College Press. ISBN 0-8077-4576-6, hc, $26.

This set of essays by 24 contributors argues for the restatement and reinstatement of equity issues at the center of educational reform. Two opening chapters describe the current terrain of education policy in America with a particular focus on urban schooling and a strong argument for bringing equity back into the center of educational policy making. Four studies look at how equity-minded policies have fared in the era of educational excellence through careful analysis of tracking in desegregated schools, the use of mandates as a policy tool, testing and diversity in college admissions, and Advanced Placement courses in California high schools. The remaining six chapters take up issues around whole school reform, school choice, charter schools, vouchers, and adequacy litigations. The data, analyses, and conclusions presented are pertinent to considerations about equity as they impact education within technology professions.

Scott, Mona L. (2005). *Dewey Decimal Classification: A study manual and number building guide*. 22nd edition. Westport, CT: Libraries Unlimited. ISBN 1-59158-210-5, hc, $75.

The Dewey Decimal Classification (DDC) system confronts most public library and K-12 school media center users, as it is a widely used system for book classification, particularly for the smaller library. This trusted guide brings the changes to the DDC to the attention of readers and explains how it was updated, detailed lists of the changes, and a comprehensive overview of the DDC. Chapter 11 focuses on Class 600 with the DDC, the Applied Sciences segment. This includes many areas that fall within the purview of technology although users of DDC should be alert to the fact that many topics that are germane to technology are not found in the 600s of the DDC but are scattered through other classes. Time spent with this guide is well spent if you or your students are likely to utilize libraries that employ the DDC as it will place your bibliographic searching on a much firmer footing.

Snell, Daniel C., Ed. (2005). *A companion to the ancient near east.* Malden, MA: Blackwell Publishing. ISBN 0-631-23293-1, hc, $124.95.

Part of a growing series of Blackwell Companions to the Ancient World, this recent addition surveys the history, economy, culture and heritage of the Ancient Near East through a series of 32 chapters by acknowledged experts. Another section focuses on methods. Of particular interest to JOTS readers are chapters on "Money and Trade" by Christopher Monroe, "Working" by David A. Warburton, "Warfare in Ancient Egypt" by Sarah Melville, "Transmission of Knowledge" by Benjamin Foster, and "Ancient Near Eastern Architecture" by Sally Dunham. An up-to-date sixty pages of references and a good index allows for easy access to insights within the volume and among other materials. The editor has done a fine job keeping the text crisp and clear.

Standage, Tom (2005). *A history of the world in 6 glasses*. New York: Walker & Company. ISBN 0-8027-1447-1, hc, $25.

Tom Standage, technology editor of The Economist, demonstrates how the most significant beverages of humankind – beer, wine, spirits, coffee, tea, and cola – developed hand-in-hand with the great epochs in history. Through each of these drinks has been written about in isolation, he argues that it is crucial to understand their relationship to each other – not as interesting cultural artifacts, but as important technological advances that reflected the societies that produced them and frequently altered the political and economic landscape of the times. Beer was first brewed in the Fertile Crescent and by 3000 BCE was so significant to Mesopotamia and Egypt that it served as currency. Wine became the major import in ancient Greece's vast seaborne trade, and a primary conduit for spreading Greek culture abroad. Spirits such as brandy and rum fueled the Age of Exploration, fortifying sailors on long voyages and oiling the pernicious slave trade. Coffee stoked revolutionary thought, as coffee houses became centers of intellectual exchange in Europe

during the Age of Reason. Tea, though Chinese in origin, captivated the English, with far-reaching effects on the British Empire. And carbonated soda, despite being invented in 18th century Europe, stands as a 20th century phenomenon and globalizing force under the banner of brands like Coca-Cola.

Stratton, Julius A., Loretta H. Mannix (2005). *Mind and hand: The birth of MIT.* Cambridge, MA: The MIT Press. ISBN 0-262-19524-0, hc, $55.

The title of this book is taken from the motto on the seal of the Massachusetts Institute of Technology. Julius Stratton was a student, faculty member, provost, chancellor, and president of MIT and starting writing this history upon his retirement. Loretta Mannix, his administrative assistant, continued his work upon his death and the MIT Press has now brought this fine work to the attention of readers throughout the world. All people interested in the history of technology in America and the growth and power of research universities, particularly those who emphasize the sciences and technologies, will find much in this book to admire, learn from, and consider. The text very clearly grapples with the age-old dilemma familiar to all those in technical fields about the tensions between "mind" and "hand," as well as the rivalries among Harvard, Vassar, MIT, and Yale, the impact of the Land Grant Act of 1862, and the influence of European technical education on the founders of MIT. This is an excellent overview of the birth of an excellent world icon of technical innovation and achievement that will be of interest to all technologists.

Verbeek, Peter-Paul (2005). *What things do: Philosophical reflections on technology, agency, and design*. University Park, PA: The Pennsylvania State University Press. ISBN 0-271-02539-5, hc, $65.

This book focuses on how technologies mediate our actions and our perceptions of the world. Peter-Paul Verbeek develops this innovative approach by first distinguishing it from the classical philosophy of technology formulated by Jaspers and Heidegger, who were concerned that technology would alienate us from ourselves and the world around us. Against this gloomy and overly abstract view, Verbeek draws on and extends the work of more recent philosophers of technology such as Don Ihde, Bruno Latour, and Albert Borgmann to present a much more empirically rich and nuanced picture of how material artifacts shape our existence and experiences. In the final part of the book he shows how this 'postphenomenological' approach applies to the technological practice of industrial designers. This is an excellent book that ground philosophical reflections in actual artifacts and those processes and uses that make them what they are.

Viswanathan, Madhu (2005). *Measurement error and research design.* Thousand Oaks, CA: SAGE Publications. ISBN 1-4129-0642-3, pb, $44.95.

Most researchers acquired their knowledge of methods and research design in courses that are highly technical in nature but that often pay little attention to theory. Separate courses are then undertaken that deal with theory but provide little in the way of understanding its interaction with methods and research design. The end result is that much executed research suffers from these former students' inability to creatively and successfully negotiate the many nuances that occur when theory, methods, and research design interact in the context of actual studies. This book by a professor at the University of Illinois at Urbana-Champaign is designed to address this theory-methods gap. Several chapters take up the nature of measurement error and its sources. Subsequent chapters deal with pinpointing the types of errors and correcting them. It then goes into a very wide ranging discussion of measures and measurement across various disciplines and the interactions between measurement error and research design and analysis. There are very few books that address the types of issues that this book considers in the helpful manner by which it proceeds. Researchers in technology will produce better research if the lessons distilled in this book are taken to head, heart, and hand.

Books Briefly Noted

Beset, Joel (2004). *More damned lies and statistics: How numbers confuse public issues.* Berkeley, CA: University of California Press. ISBN 0-520-23830-3, hc, $19.95.

In this sequel to the acclaimed Damned Lies and Statistics, Joel Best continues his straightforward, lively, and humorous account of how statistics are produced, used, and misused by everyone from researchers to journalists. Underlining the importance of critical thinking in all matters numerical, Best illustrates his points with examples of good and bad statistics about such contemporary concerns as school shootings, fatal hospital errors, bullying, teen suicides, deaths at the World Trade Center, college ratings, the risks of divorce, racial profiling, and fatalities caused by falling coconuts. This book encourages all of us to think in a more sophisticated and skeptical manner about how statistics are used to promote causes, create fear, and advance particular points of view.

Bremer, Manuel, Daniel Cohnitz (2004). *Information and information flow. An introduction*. Frankfurt, Germany: Ontos Verlag. ISBN 3-937202-47-1, pb, $34.95.

This book is an introductory text into the theory of syntactic and semantic information, and information flow. Syntactic information theory is concerned with the information contained in the very fact that some signal has a non-random structure. Semantic information theory is concerned with the meaning or information content of messages and the like. The theory of information flow is concerned with deriving some piece of information from another. The main part of the book considers situation semantics as a foundation of modern approaches in information theory. It gives a brief overview of the background theory and then explains the concepts of information, information architecture and information flow from that perspective.

Dew, John Robert, Molly McGowan Nearing (2004). *Continuous quality improvement in higher education*. Westport, CT: Praeger. ISBN 0-275-98389-7, hc, $39.95.

Dew and Nearing have found a solid, enormously valuable body of knowledge for leaders in varied higher education settings regarding continuous quality improvement. They provide a wide variety of effective practices that campuses can use for strategic planning, self-assessments, benchmarking, building a collaborative culture, engaging in team activities, using measurement systems, and applying CI concepts to teaching and learning.

Dunham, William (2005). *The calculus gallery: Masterpieces from Newton to Lebesgue*. Princeton, NJ: Princeton University Press. ISBN 0-691-09565-5, hc, $29.95.

This book charts the growth and development of calculus by sampling from the work of some of its foremost practitioners, beginning with Isaac Newton and Gottfriend Wilhelm Leibniz in the late seventeenth century and continuing to Henri Lebesgue at the dawn of the twentieth century. Dunham lucidly presents the definitions, theorems, and proofs. Collectively, these selections document the evolution of calculus from a powerful but logically chaotic subject into one whose foundations are thorough, rigorous, and unflinching – a story of genius triumphing over some of the toughest, subtlest problems imaginable.

Hanson, Susan, Genevieve Giuliano, Eds. (2004). *Geography of urban transportation*, 3rd edition. New York: The Guilford Press. ISBN 1-59385-055-7, hc, $60.

A highly successful text and professional resource, this classic work is now in a fully revised and restructured third edition. Leading geographers and urban planners present the foundational concepts and methodological tools that readers need to understand to engage with today's pressing policy issues. Covered are such key topics as passenger and freight dynamics in the American metropolis; the urban transportation planning process, including the use of GIS; and questions related to public transit, land use, energy, equity, environmental impacts, and more. Updated throughout with a heightened emphasis on policy – and featuring over 100 maps, charts, and photographs – the third edition contains new chapters on intercity travel and transportation finance.

In addition, a new concluding chapter integrates key themes and provides some practical approaches to solving urban transportation problems.

Kenney, Daniel R., Ricardo Dumont, Ginger Kenney (2005). *Mission and place: Strengthening learning and community through campus design*. Westport, CT: Praeger. ISBN 0-275-98123-1, hc, $ 49.95.

Taking a holistic approach that connects landscape, buildings, and people, the authors clearly develop the notion of 'placemaking' as a creative, educational activity. Passionate yet down-to-earth writers and thinkers, they link concrete and familiar topics and specific examples with broad, insightful, and persuasive convictions: learning is a practice that takes place in communities; well-designed forms can lead function and strengthen community; and a rigorous planning process can empower academic leaders to exercise agency and vision.

Krug, Gary (2005). *Communication, technology and cultural change*. Thousand Oaks, CA: SAGE Publications. ISBN 0-7619-7201-3, pb, $29.95.

Communication and the history of technology have invariably been examined in terms of artifacts and people. Gary Krug argues that communication technology must be studies as an integral part of culture and lived experience. Rather than standing in awe at the apparent explosion of new technologies, this book links key moments and developments in communication technology with the social conditions of their time. It traces the evolution of technology, culture, and the self as mutually dependent and influential.

O'Harrow Jr., Robert (2005). *No place to hide*. New York: The Free Press. ISBN 0-7432-5480-5, hc, $26.

Award-winning *Washington Post* reporter Robert O'Harrow, Jr. lays out in unnerving detail the post 9/11 marriage of private data and technology companies and government anti-terrorist initiatives to create something entirely new: a security-industrial complex. Drawing on his years of investigation, O'Harrow shows how the government now depends on burgeoning private reservoirs of information about almost every aspect of our lives to promote homeland security and fight the war on terror.

Oravas, Gunhard A.E. (2004). *Lectures on the history of technology and engineering*. New York: Georg Olms Verlag. ISBN 3-487-11744-4, hc, 2 volumes, 148 Euros for set.

This monumental 1140 page study, completed over the course of over 30 years and a true magnus opus, traverses the history of technology and engineering from ancient times to the present. The earliest chapters treat separately developments in ancient Sumer, Egypt, Persia, Greece, and Rome focusing on discrete topics and discussing each of them in considerable technical detail. The author then moves on to consider medieval technology in over 100 pages of text with a focus on industrial power, mechanical clocks, and Gothic cathedrals. The chapter on the Renaissance period focuses on engineering as a practical art. The Baroque period looks at the ascent of modern science, scientific technology, and engineering while a chapter on French engineering delves into considerable details concerning the rise of engineering sciences. Next within the author's purview is British technology as three chapters consider manufacturing and textile industries, the industrial revolution, the rise of power technology (steam), and the advent of industrial technology and engineering. The remainder of the volumes are then organized thematically and consider in turn manual and machine tools, ship propulsion systems, railroads, metal industries, telecommunications, internal combustion engines, turbines, electric power, electric illumination, electronics in space, and electric and electronic transmission of vision including phototelegraphy and television. Typical of many European academic tomes, there are no illustrations and the indices are limiting. But the volumes contain much useful information, some not readily attainable elsewhere.

Books Briefly Noted

Schwartz, Robert, John Mayne, Eds. (2005). *Quality matters: Seeking confidence in evaluating, auditing, and performance reporting*. New Brunswick, NJ: Transaction Publishers. ISBN 0-7658-0256-2, hc, $59.95.

This pioneering study analyzes practices for assuring the quality of evaluation, performance auditing, and reporting in the face of political, organizational, and technical obstacles. A final chapter addresses the extent to which quality assurance systems become bothersome rituals or remain meaningful mechanisms to ensure quality control. This well-structured volume will be of particular interest to policymakers and adds much to the literature on program evaluation and performance auditing.

Van Dijk, Jan A. G. M. (2005). *The deepening divide: Inequality in the information society.* Thousand Oaks, CA: SAGE Publications. ISBN 1-4129-0402-1, pb, $34.95.

At the end of the 1990's, a critical issue appeared to block the widespread benefits of computers and the Internet: the digital divide. Usually defined as the gap between those who have access to computers and the Internet and those who do not, the digital divide is the subject of debate and widespread media attention. Jan van Dijk reframes and expands this concept, examining the digital divide as a social and political problem, not merely a technological one. Taken from an international perspective, the book offers full coverage of the literature and research on this topic and a theoretical framework from which to analyze and approach the issue.

The 2005 Paul T. Hiser Exemplary Publication Award Recipients

Keith V. Johnson & Elwood D. Watson
"A Historical Chronology of the Plight of African Americans Gaining Recognition in Engineering and Technology"

The 2006 Paul T. Hiser Exemplary Publication Award Recipients

Benjamin K. Sovacool
“Reactors, Weapons, X-Rays, and Solar Panels: Using SCOT, Technological Frame, Epistemic Culture, and Actor Network Theory to Investigate Technology”

The Board of Editors of The Journal of Technology Studies and the Board of Directors are pleased to announce the recipients of the Paul T. Hiser Exemplary Publication Award for Volume XXXI, 2005 and XXXII, 2006.

The Board of Directors established this award for deserving scholars. In recognition for his exemplary service to the profession and to the honorary as a Trustee and Director, the award bears Dr. Hiser’s name. It is given to the author or authors of articles judged to be the best of those published each year in this journal.

Selection Process

Each member of the Editorial Board recommends the manuscript that he or she considers the best of those reviewed during the year. The editor forwards copies of nominated manuscripts to the members of the board for their evaluation against the criteria. A majority vote of the editors is required for the award to be made. The honor society’s Board of Directors renders final approval of the process and the award.

Criteria

1. The subject matter of the manuscript must be clearly in the domain of one or more of the professions in technology.

2. The article should be exemplary in one or more of the following ways:
   - Ground-breaking philosophical thought.
   - Historical consequence in that it contains significant lessons for the present and the future.
   - Innovative research methodology and design.
   - Trends or issues that currently influence the field or are likely to affect it.
   - Unique yet probable solutions to current or future problems.

A $300 award recognizes the recipient(s) for the year and is presented during an Epsilon Pi Tau program at an annual professional association conference.

GUIDELINES FOR
The Journal of Technology Studies

A refereed publication of Epsilon Pi Tau the international honor society for professions in technology.

The Journal of Technology Studies (JOTS) is the flagship, peer-reviewed journal of Epsilon Pi Tau, an international honor society for technology professions. Two print issues per year are mailed to all members of the society as well as to academic and general libraries around the globe. These printed issues, plus additional issues available only in electronic format as well as past issues, are available free on-line at scholar.lib.vt.edu/ejournals/jots.

SUBJECT FOCUS

The JOTS welcomes *original* manuscripts from scholars worldwide focused on the depth and breadth of technology as practiced and understood past, present, and future. Epsilon Pi Tau, as perhaps the most comprehensive honor society among technology professions, seeks to provide upto-date and insightful information to its increasingly diverse membership as well as the broader public. Authors need not be members of the society in order to submit manuscripts for consideration. Contributions from both academics and practitioners are equally welcome.

A general guide to the breadth of topics of potential interest to our readers can be gained by consideration of the 17 subclasses within "Technology" of the classification scheme of the Library of Congress, USA <lcweb.loc.gov.catdir/cpso/lcco/lcco_t.pdf>. This includes engineering and allied disciplines, informatics in its many manifestations, industrial technology, and education in and about technology. Authors are strongly urged to peruse this list as they consider developing articles for journal consideration. In addition, JOTS is interested in manuscripts that provide:

- brief biographical portraits of leaders in technology that highlight the difference these individuals made in distinct fields of technology or its wider appreciation within society,
- thoughtful reflections about technology practice,
- insights about personal transitions in technology from formal education to the work environment or vice versa,
- history, philosophy, sociology, economics, and anthropology of technology,
- technology within society and its relationship to other disciplines,
- technology policy at local, national, and international levels,
- comparative studies of technology development, implementation, and/or education,
- industrial research and development,
- new and emerging technologies and technology's role in shaping the future.

Within this immense diversity of technology, its applications and import, authors must communicate clearly, concisely, informatively, and only semi-technically to readers from a diverse set of backgrounds. Authors may assume some technical background on the part of the reader but not in-depth knowledge of the particular technology that is the focus of the article. Highly technical articles on any field of technology are not within the purview of the journal. Articles whose subject focus has been extensively explored in prior issues of the journal are only of potential interest if they: 1) open up entirely new vistas on the topic, 2) provide significant new information or data that overturns or modifies prior conceptions, or 3) engage substantially one or more previously published articles in a debate that is likely to interest and inform readers. Syntheses of developments within a given field of technology are welcome as are metanalyses of research regarding a particular technology, its applications, or the process of technical education and/or skill acquisition. Research studies should employ methodological procedures appropriate to the problem being addressed and must evince suitable design, execution, analysis, and conclusions. Surveys, for example, that exhibit any or all of the following characteristics are of no interest to the journal: 1) insufficient awareness of prior research on this topic, 2) insufficient sample size, 3) improper survey design, 4) inappropriate survey administration, 5) high mortality, 6) inadequate statistical analysis, and/or 7) conclusions not supported by either the data or the research design employed. The journal is neutral in regards to qualitative, quantitative, or mixed method approaches to research but insists on research quality.

GUIDELINES FOR The Journal of Technology Studies (Continued)

GUIDELINES FOR SUBMISSION

Articles must conform to the most current edition of the Publication Manual of the American Psychological Association. All articles must be original, represent work of the named authors, not be under consideration elsewhere, and not be published elsewhere in English or any other language. Electronic submissions in either rich-text format or Microsoft Word formats are encouraged, although submission of three printed copies and a diskette containing the article are also permissible. E-mail submissions should be sent to the editor, Dr. Dennis Cheek, at jots@bgnet.bgsu.edu. Paper submissions should be mailed to:

Editor, Journal of Technology Studies
Epsilon Pi Tau, Technology Building
Bowling Green State University
Bowling Green, Ohio 43403-0305

Manuscripts should be no more that 25 pages, double spaced, including references. Typescript should be *Times New Roman* or a close approximation of font and 12 point. Only manuscripts in the English language will be accepted and they should conform to American usage. Figures, tables, photographs, and artwork must be of good quality and conform to APA form and style.

REVIEW PROCESS

Articles deemed worthy by the editor for consideration by Authors who submit an article that does not merit review by the editorial board are informed within approximately two weeks of receipt of the article so that they may explore other publishing venues. A rejection may be based solely on the content focus of the article and not its intrinsic merit, particularly where the topic has been extensively explored in prior JOTS articles. Articles that exhibit extensive problems in expression, grammar, and spelling are summarily rejected. Authors of articles that have been peer-reviewed are informed within about three months from the date of submission of the article. Anonymous comments of reviewers are provided to authors that are invited to submit a revised article for either publication or a second round of review. The editor does not automatically provide reviewer comments to authors whose articles have been rejected via the peer review process but makes a judgement based on whether the feedback might prove beneficial to the authors as they pursue other publishing opportunities.

PUBLICATION

Authors whose articles have been accepted, will have their final products published in the on-line version of the journal. Selected articles from the on-line edition of the journal may also appear in two print issues that are issued per calendar year. All authors will receive a pdf version of their published article and co-retain rights to that article along with Epsilon Pi Tau. The editor will supply when requested information about an accepted article that has not yet appeared in print for faculty undergoing tenure review.