The Journal of Technology Studies

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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 apothe-cary . . . 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 increas-ing, 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, curry-ing, and saddlemaking. Metal trades included smithing of all sorts, while the wood and con-struction 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 migra-tion 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.
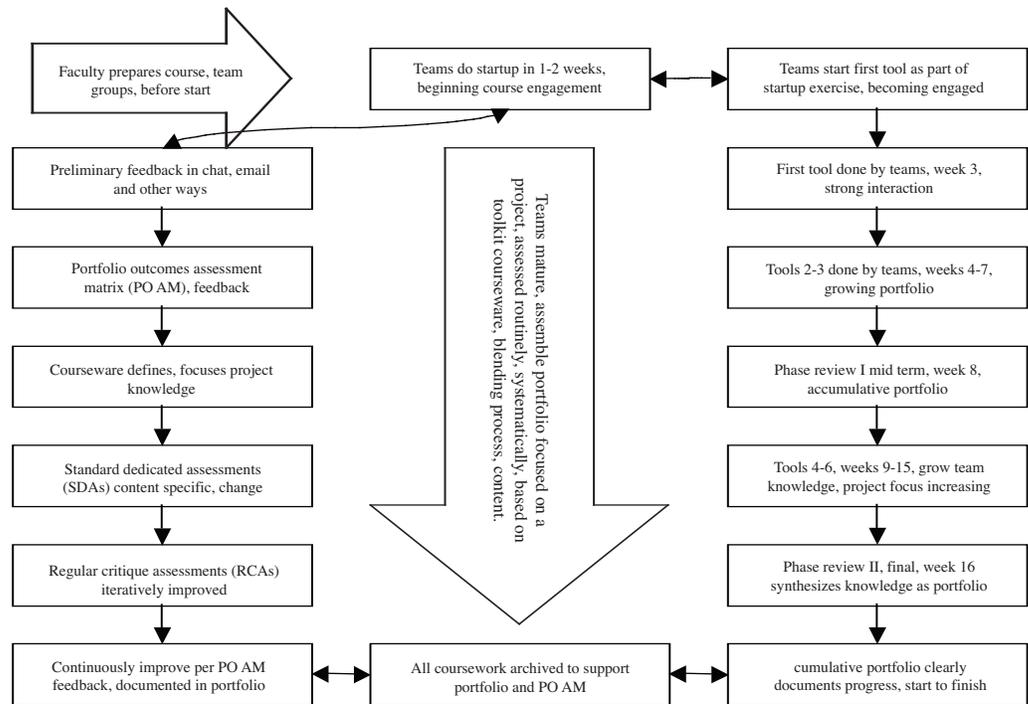
engaged, communicating via email in the course shells (required). The instructor typically will study this interaction and determine how and when to assist. As startup winds down, a first tool is started. The objective is to have startup done in 1.5 to 2 weeks, and a first tool finished within 3 weeks. 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)
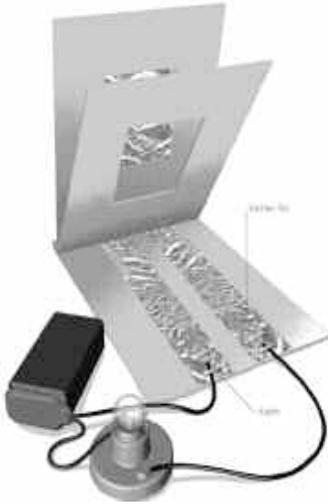
The UK children were from urban schools taking part in the Children's University at the University of Greenwich, Avery Hill Campus. There were 16 children in the group, ages 11-12. The Finnish children were from Karhukangas Primary School, a small rural school in Haapavesi Township. The head teacher 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 card-board 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 sur-roundings 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 pres-sure 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 rein-force 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 ses-sions. 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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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 <u>model space</u> and <u>paper space</u> (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
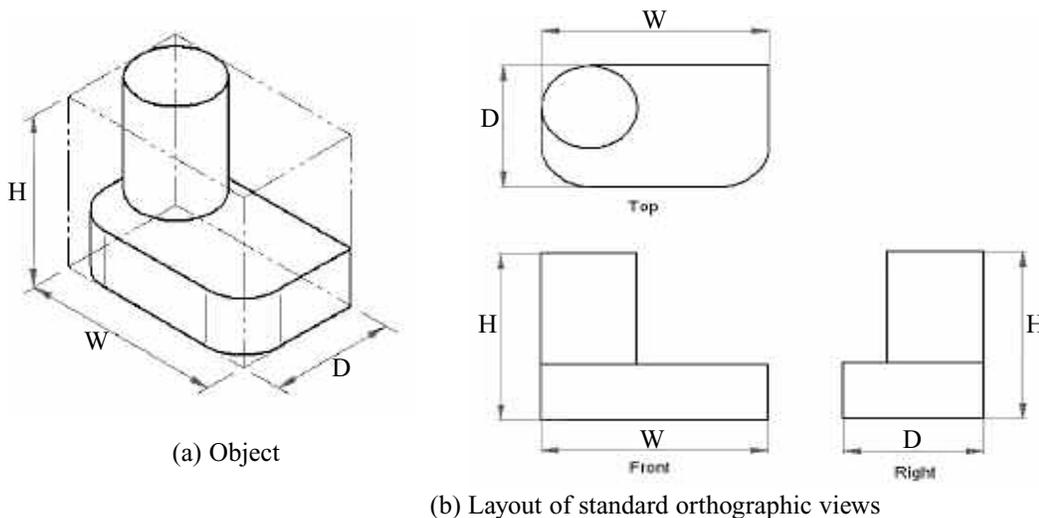
From Figure 1b, neglecting the gaps between the views, the views space dimensions are:

$$W_o = W + D \quad (1)$$
$$H_o = H + D \quad (2)$$

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:

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

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

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

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

Enlargement Scaling:

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

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

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

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

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

Reduction Scaling:

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

Enlargement Scaling:

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

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.
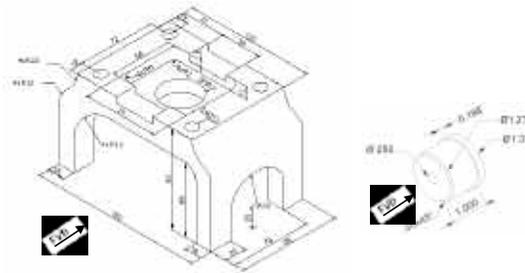
Figure 2 Cutting frame   Figure 3 Roller pin

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:

$W_p = 279$ mm; $H_p = 216$ 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 $W_z = 209$ mm and $H_z = 162$ 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:

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

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

$$SF \geq 1.87 \times \max(0.92; 0.87)$$

$$SF \geq 1.87 \times 0.92$$

$$SF \geq 1.72$$

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:

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

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

$$SF \leq 0.60 \times \min(4.63; 6.66)$$

$$SF \leq 0.60 \times 4.63$$

$$SF \leq 2.8$$

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.
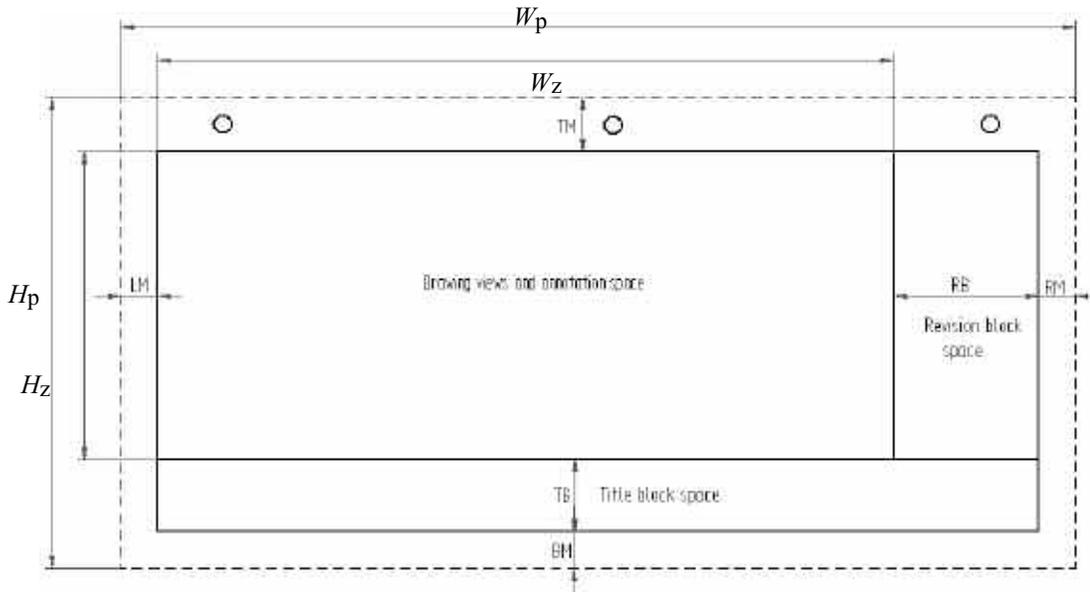
Let:

WA = width of administrative space allowance

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

Use _ = 0.75

Books Briefly Noted

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.

Books Briefly Noted

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

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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.

Books Briefly Noted

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 reason-able 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 observa-tions, Crucial Confrontations teaches skills to increase confidence in facing tough issues includ-ing 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 pro-grams, to issues of national sovereignty and the paternalism of developed nations toward the underdeveloped world, and to notions of economic necessity.

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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

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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

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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.

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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.

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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

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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

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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.

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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.

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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 human-ness – 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 com-munity. This volume considers such topics as the implications of software outsourcing for American technology leadership; the complementary roles of large corporations and entrepre-neurs in developing innovative technology; city-level policy and planning that establishes a 'juris-dictional 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 regard-ing 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 mili-tary 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 inno-vations 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 librari-ans 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 diver-sity 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, transfor-mative, 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

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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.

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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.

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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.

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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.

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The Journal of Technology Studies
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