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An Industrial Technologist's Core Knowledge: Web-based Strategy for Defining Our Discipline

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Technological work is distinguished by the application of special tools within a framework of problem-solving and continuous improvement. This frequently involves functioning in a cross-disciplinary environment, where a technologist will work with others from a wide range of departments or functional areas. Recent work at Bowling Green State University (Olson and Sinn 1999) suggested that this requires a practitioner to be adept at applying technological tools, technically competent in a chosen specialization, and conversant in a range of related disciplines.

What industrial technologists do and how they should be taught are fundamental issues. There are as many views on content, curriculum, and instruction as there are industrial technology programs. While it is not the intent of this paper to delve into a debate on instructional philosophy, it is informative to understand the issue. Herschbach (1998) provided a good discussion that can help readers to see the importance of careful attention to curriculum and instruction.

This paper focuses on core knowledge for industrial technologists, ultimately inviting users to participate in a tutorial for raising and addressing issues related to technological work. The goal is to collaboratively refine a set of documents, *The Industrial Technologist's Toolkit for Technical Management* (Sinn 2000), and to ultimately propose that it be accepted as the body of knowledge for technical management within the National Association of Industrial Technology (NAIT). This paper operates on the premise that technology is a discipline, its boundaries and contents must be defined, and that real-world application is a necessary element of the learning environment. Adherence to this premise can fit into the educational theories and practices of a wide range of professionals. Live, evolving content that is applied in similar, yet varied methods can both identify the common threads of a discipline and mold itself to the needs of various learners and organizational users.

The authors will present a web-based strategy for refining the *Industrial Technologists' Toolkit for Technical Management (Toolkit)*, via application by students and instructors in the course of applied research projects. The *Toolkit* contains technological tools, discussion that evokes contextual thinking, and a framework for application that can be adapted to various environments. The refinement strategy is intended to invite participation from professionals and practitioners from a variety of locations using WebCT, a web-based courseware system, as a vehicle for the process. A system for doing so is presented later in the paper.

Collecting, collaboratively editing, and disseminating core knowledge in an electronic environment is a key element in defining technological content and practice. The wealth of technological systems tools and the methods for applying them is continuously evolving. Similar tools and approaches can work best for any

particular organization when they are applied in unique ways, adapted for individual needs. Thus any set of tools, methods, and competencies would be, by its very nature, a framework.

Any given organization or group of practitioners would need to capture this knowledge and add insights as needed, changing the way information is stored, accessed, and used to fit individual needs. An electronic format is ideally suited to such a purpose, allowing interested parties to both tailor a set of core knowledge to their own needs, and to interact with others who could add needed perspectives, as the following tutorial is designed to do. John Seely-Brown, et al. (1996), supported this idea. They discussed the emergence of electronic documents, which have blurred the distinction between author and consumer. The mutability of electronic documents can facilitate the true purpose writing, which is to negotiate meaning rather than put an end to negotiation.

Electronic collaboration should be a well-planned process with clear objectives. Gunawardena et al. (1997), studied the efficacy of computer mediated communications in constructing new knowledge. After establishing a framework for judging the level of knowledge creation in an on-line conference, they analyzed the proceedings of two such events. One was an informal interaction, the other an organized debate. Their analysis suggested that the presence of structure and purpose greatly enhanced the level of knowledge construction. Thus, the authors propose to follow a user's group approach that will guide participants from a variety of locations through the process of constructing knowledge as it co-authors the next generation of the *Toolkit*.

The Technologists' Core Knowledge: Web-based Strategy and Objectives

The *Toolkit* is a set of electronic documents, distributed on CD-ROM, which is posted within an on-line forum for the purpose of the proposed collaboration. These documents are based upon the authors' conception of NAIT core knowledge for technical management. They are organized into five functional domains, with each set containing eight tools (individual documents). Each tool, in turn, presents a subset of technical methods for solving problems and for engaging in continuous improvement. These are presented along with discussion, examples, and sample templates for learner use. The organization is as follows:

1. Primer Tools
2. Cultural Tools
3. Data Tools
4. Documentation Tools
5. Synchronous Tools

The ultimate goal is to validate the content and establish it as a basis for technical management core knowledge. This includes both process and content through three objectives. The objectives are to assess:

1. Context and organization of core knowledge.
2. Process of instruction as relevant to core knowledge.
3. Implications of core knowledge on professional and general preparation of technologists.

Several basic questions about content and process are addressed online in the tutorial, and later in an extended user's group process. Key questions follow, based on objectives:

Objective 1: Assess context and organization of core knowledge. Three questions are asked:

1. Is the "Toolkit Infrastructure Change Model" an appropriate conceptual model for providing the context for technical management core knowledge?
2. Are the five toolkits: primer, cultural, data, documentation and synchronous leader, appropriate for organizing core knowledge for technical management?
3. Is the eight-tool topical approach in each of five toolkits appropriate for organizing technical content, aimed at providing five courses focused on technical management?

Objective 2: Assess process of instruction related to core knowledge. Two questions are asked:

4. Is the short and long form, digitized, "electronic" process, in various formats and media, an appropriate way to deliver technical management core knowledge?
5. Is the applications orientation, and team-based technical problem solving orientation an appropriate way to deliver technical management core knowledge?

Objective 3: Assess implications of core knowledge on professional and general preparation. Two questions are asked:

6. Are there implications for program levels (i.e., two year, four year and graduate programs) based on technical management core knowledge in the Toolkit?
7. Are there implications for professional and general education preparation based on technical management core knowledge identified in the Toolkit?

Validation is to follow a two-part system: The tutorial provides an overview and introduction, then user's groups are formed to facilitate a longer term dialogue for evolving the core knowledge in a disciplined manner, to be explained in the remainder of the paper.

Explanation of the Industrial Technologists' Toolkit for Technical Management

The *Toolkit* is a five-part series for introducing and developing technical problem solving systems for ongoing improvement in quality and productivity. Selected features include:

1. Long Forms: offering detailed discussion of the tools
2. Short Forms: presenting the content in condensed, bulletized format (Power Point)

3. Flexible Tools: usable individually or in tandem, depending upon project demands
4. Technically Oriented: addressing quality, productivity, and team-based problem solving
5. Train the Trainers: tools general in format, being customizable for user needs
6. Kaizen: focused on incremental improvements to systems and processes
7. Participation: application helps users to see technical and organizational relationships for global competition.

The model for the *Toolkit* has developed over the past twenty years. It is the result of working with hundreds of industrial clients to address technical projects. This provides three inner circles related to data, documentation and synchronous functions, a model for technological change.

The five focus areas in the *Toolkit* series: Primer Tools; Cultural Tools; Data Tools; Documentation Tools; and Synchronous Tools are represented graphically in the model. Each of the separate 8 tool sets are focused on specific functions, designed to be articulated throughout a broader curriculum for growing talent and doing change via technical problem solving and improvement.

Primer Tools (1-8): *Technology Systems and Industrial Technology Introduced.* This introduces and overviews the entire toolkit system based on problem solving and team building.

Cultural Tools (9-16): *Core Values for Technological Empowerment and Change.* This helps us see why we must change and how best to do it within a technological infrastructure.

Data Tools (17-24)*: Statistical Process Control Improvement Systems.* This provides statistical definitions and concepts, focused on gathering and assuring solid data for improvement.

Documentation Tools (25-32): *Technical Management Systems-Kaizen In Action.* Built on data and cultural tools, this is analysis and assessment of documentation for Kaizen.

Synchronous Tools (33-40): *Leadership For Kaizen And Quality Planning.* This grows talent for leading new product development and robust quality systems for the future.

Tool implementation can be lead by one or more persons in teams, in a formal course, or by individuals. Use of the tools is accommodated electronically within the tutorial. Completion of the tutorial will provide overview for the *Toolkit* and bring interested users together to help further develop the discipline of Industrial Technology around technical management issues and concepts.

WebCT Web-based Delivery Courseware, Teaching and Learning System

WebCT is a software shell used to organize and deliver several courses at BGSU (WebCT 2000). The WebCT shell provides a protected environment, a hierarchical folder structure, and configurable, collaborative tools (i.e., chat, bulletin board, calendar, email, etc.). The system requires Internet access and operating proficiency. Users should have sufficient computer skills to navigate the courseware when provided with some support and documentation.

After configuring with proper hardware for Web interaction, further information will be sent electronically by the author. This includes startup documentation on course mechanics, startup procedures, presenting, uploading, reviewing, downloading, and chat. This enables getting inside the system, including accessing tools for review and use. All information from this point, for the tutorial and the broader user's groups, is located in WebCT. The tutorial appears as a flow chart as shown in figure 2.

The broader user's group appears a bit differently, but is consistent with completion of the tutorial. The ongoing

Figure 1. The Technological change model.

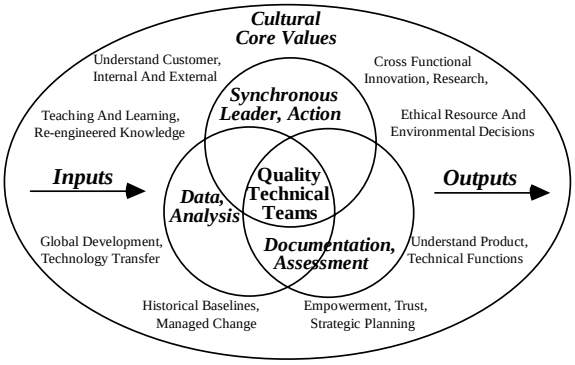


Figure 2. Flow chart for tutorial.

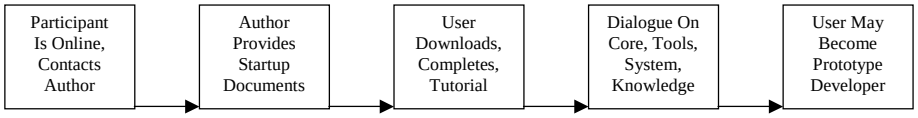
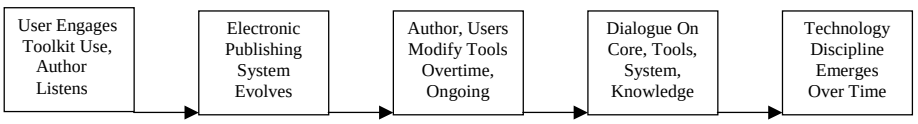


Figure 3. Flow chart of ongoing user's groups.



user's group appears as a flow chart as shown in figure 3.

The authors posit that knowledge is derived by combining information and experience. For example, highly experienced individuals may lack information, and therefore, not have true knowledge. Individuals with much information may lack experience, and again not have sufficient knowledge.

Projects are central to the system. They are conducted in a combined team effort, employing mentors to guide students through the process. Collaboration is done largely in the electronic environment. The information within each tool is provided in long and short forms (long forms being the complete text and short forms being presentation-style summaries). Concepts within the tools are applied through the performance of a project, conducted in phases. Activities are reported via written reports and regular presentations. Deliverables are evaluated, both formatively and summatively, by peers and the instructor. A final presentation synthesizes everything studied and learned throughout the course as depicted in figure 4.

This is the functional system, delivered in an increasingly empowered and autonomous, automated manner. The goal is to have electronic, fully transportable courses for team functions organized at various locations to test and further develop the tools in a user's group.

More On The Tutorial And User's Group

The tutorial is a 6-8 hour workshop. It is designed to be conducted electronically, in a traditional manner, or in a combination of the two. It overviews the entire system, introducing the user to all core knowledge and to the user's groups. User's groups are designed around the five areas in the *Toolkit*, all focused on core knowledge evaluation. The extended user's group is designed to provide an opportunity to continue the validation process started in the tutorial. This happens at multiple sites where users apply one or more of the eight-tool sets. As they are used questions begun in the tutorial will be explored, and users will be asked to provide feedback for ongoing improvement in the system.

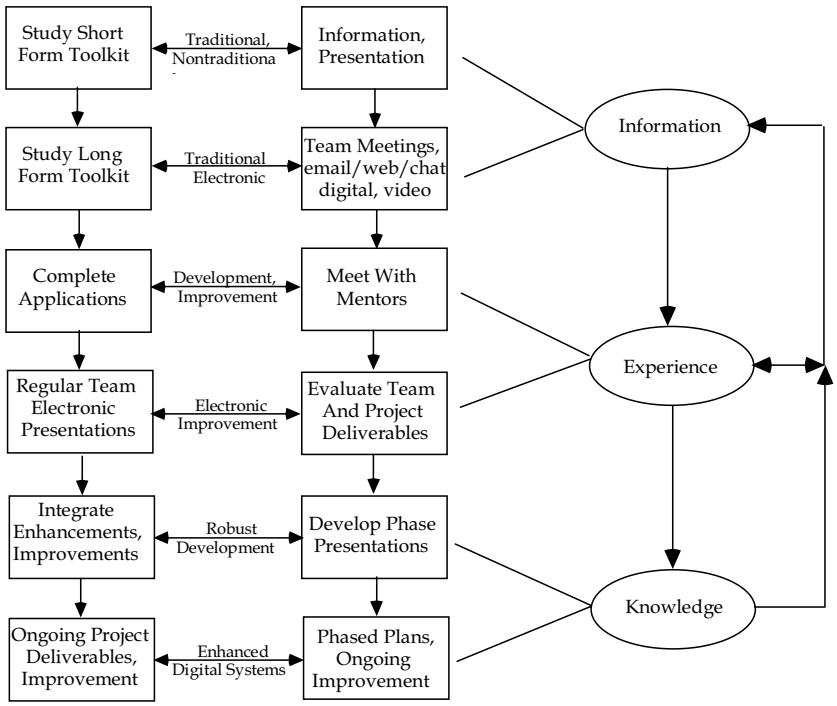
What users get from the extended project is a relevant and timely electronic text series which can be used as part of their teaching and learning system. The core knowledge provides universal content and processes for teaching and learning, as well as for conducting projects interactively. Users also gain a sense of ownership since their feedback will directly influence future directions. Part of eventual royalties generated by the system at sites may also be given to faculty users and NAIT.

The tutorial and user's groups are designed to help faculty and industrial leaders better understand and evolve technical management core knowledge. Tutorial participants should possess a basic understanding of quality and productivity in the workplace, and have a broad understanding of Industrial Technology. General familiarity with data and documentation systems commonly applied for improvement will be reinforced, evaluated, and further developed. This should be done by cross-functional teams. The tutorial is an introductory, start-up point for exploring and growing core knowledge over a multi-year project. The user's group is designed as the longer-term commitment for developing the system. Consideration for participation should be given to:

1. Extent of flexibility and willingness to change current approaches used in instruction.
2. Usage and development of electronic systems over a distance.
3. Desire to engage in innovative teaching and learning systems.
4. Collaboration in the development and usage of "high end" courseware.
5. How to do projects interactively, and "hands on", with organizations.

The purpose of establishing a user's group is to obtain peer review and critique of the material contained in the *Toolkit*. The authors invite interested parties to visit the tutorial web site and participate in the peer review process. To do so, please visit the following URL: http://webcourse.bgsu.edu. This will require either the Netscape browser

Figure 4. The electronic classroom in action, on regular, systematic, disciplined basis.



(version 2.0 plus), or Internet Explorer (version 4.0 plus). The AOL browser is not compatible with some WebCT functions. WebCT generally works best with a Pentium-based PC system running Windows 95 or later, with 32 MB of RAM and Netscape. Macintosh systems using G2 processors (or higher) are adequately powerful, but in the author's experiences, the MAC operating system has exhibited compatibility problems with WebCT file transfers.

The URL listed above will navigate to the Bowling Green State University front page for WebCT, and users will be redirected to the main menu. From there, scroll down to and select the College of Technology link. All of the course shells for the college will appear on the next menu. Scroll down to and select the link for TECH 702 – Sinn. A login dialog box will appear. In this box, use the word guest as both a login name and a password.

At this point, users will be presented with a welcome page and two links. The bulletin link will take users to a bulletin board shell, within which the necessary documents are posted. The first link offers attachments overviewing WebCT operations and the toolkit system. The next link contains the toolkits in short form, meaning that each one is summarized in a Microsoft PowerPoint file. The next link contains each tool in Microsoft Word format. The final link contains documents for use in evaluating the toolkits.

Please visit the site and participate in the validation process. The authors invite feedback and are available to assist users who have any comments or questions regarding the contents or the process of evaluation. John Sinn can be reached at jwsinn@bgnet.bgsu.edu, and Darren Olson can be reached at olsondc@bgnet.bgsu.edu.

Conclusion

The authors intend to work with interested professionals across the country to collaboratively define a core of knowledge for technical management, and to propose that it be used by NAIT to better define certification and accreditation standards. This is an important step in establishing a basis for the practice of technical management in industrial settings because it can help to build a common framework for academic preparation. It can also help educators to build stronger programs, to better prepare students to understand and apply management tools when entering the work force, and to push knowledge in the field to new heights through focused, applied research.

These objectives can be achieved best through the combined efforts of leaders in the profession. Groups of educators and students from various locations and environments can coordinate their efforts using a common framework, with the current version of the *Toolkit* as a baseline. They can collectively construct a new, stronger set of tools that is also more likely to be applicable across a variety of industries and service areas.

References

Gunawardena, C. N., Lowe, C. A., & Anderson, T. A. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. The Journal of Educational Computing Research, 17 (4). P. 397-431.

Herschbach, D. R. (1998). Reconstructing technical instruction. Journal of Industrial Teacher Education, 36 (1). P. 36-61.

Olson, D., & Sinn, J. (1999). An update on Applied Quality Science at Bowling Green State University and the instructional use of student-based applied research as a technology transfer mechanism: A critical element of education for technologists. Journal of Industrial Technology, 15 (4) [On-line Journal]. Available: http://www.nait.org/jit/Articles/olso0999.pdf

Seely-Brown, J., Duguid, P., & Dyson, E. (1996). The social life of documents. First Monday, 1 (1) [On-line Journal]. Available: http://www.firstmonday.dk/issues/issue1/documents/

Sinn, J. W. (2000). The Industrial Technologist's Toolkit for Technical Management [CD-ROM]. Dublin, Ireland: Ericsson Online Wireless Learning Solutions. Available: http://learning.ericsson.net

WebCT 2000. General information available online: http://about.webct.com. Accessed April, 2000.