

Developing End-User Technology Skills

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Five exemplary postsecondary schools and one exemplary technical high school were the sites for a total of 46 student, teacher and employer interviews to determine effective software teaching practices. Questions were raised about how schools balance the need by students for three types of knowledge: 1) how software operates; 2) how business concepts and practices relate to software use; and 3) understanding the social business contexts in which software is used. Further, programs were examined to see whether teaching practices could be characterized as systematic, step-by-step instruction in contrast to minimalist, discovery-oriented instruction. Findings showed that, for initial software instruction, systematic instructional practices dominated. Further, teaching software operations dominated over the need for business content. This was true even though business examples provided the necessary framework for software tasks. Based on multiple on-site visits and critical incident interviews, discussion was provided about the contexts that supported effective teaching and recommendations were made for further research.

Effectively teaching applications software at the postsecondary level is important. This is particularly true for general-purpose business software such as word processing, spreadsheets, databases, graphics presentation, and telecommunications. If 95% of all employed workers will need to use some portions of such software, clearly, large numbers of people need to learn to use general business applications software (Oblinger & Maruyana, 1996; Oblinger & Rush, 1997; Schiller, 1999). Most importantly, they need to transfer their knowledge from the learning setting to business settings, and they need to be able to continue to learn as versions change and new software displaces old.

The dynamic nature of software results in questions about what content to teach. Much attention has been given in the literature as to what technologies businesses are using and the employment competencies students need to work in such settings. Less attention has been given to how to teach technology skills effectively for employment purposes. This project focused on teaching practices.

A general outline of a yearlong study (Lambrecht, November, 1999) will be presented first. Next, the specific questions of the study will be developed within the framework of the assumptions that were made initially about the requirements for effective software instruction.

These included assumptions about what students need to learn about using technology in the broadest sense and the two major teaching approaches from which teachers may choose. Given these assumptions, the research procedures will be described and the findings of the study will be discussed with implications for further research.

Research Question, Purpose and Scope of the Study

The main research question was to identify the teaching practices that characterize computer instructional programs that have been judged to be exemplary. Such practices may be ones that other schools can emulate. Further, identification of teaching practices in exemplary schools can provide a basis for examining fundamental assumptions about teaching and asking how these assumptions affect planning and teaching practice. From these findings, further research may be developed to examine social and institutional factors that may constrain or support effective teaching.

To narrow the scope of the study to a manageable, yet significant use of workplace

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technology, those applications used most by “computer end users” are the focus of attention. These common applications software programs include word processing, desktop publishing, spreadsheets, databases, presentation graphics, and telecommunications software (Regan, 1996). All of these software applications are used increasingly within networked, telecommunication-intensive business environments. To maintain a focus on end-user applications, teaching practices in Office Technology (also called Administrative Support or Office Systems Specialist) programs were investigated. This excluded other school programs that also teach applications software, such as Computer Information Systems and several other business areas that incorporate software, such as Accounting and Marketing.

Following a description of the research procedures, the key findings are presented. These findings are discussed from the perspective of understanding the basis for the effective practices and suggesting avenues for further research.

Research Procedures

The researcher solicited nominations for exemplary schools from state- and national-level vocational education professional staff. The six schools identified were characterized as innovative in the variety of program scheduling options made available to students and their responsiveness to diverse students’ needs. In fact, several schools won awards for their innovative program practices and their strong links to the business community that lead to successful job placement for their graduates.

The critical incident technique (CIT), a qualitative research approach, employs the interview method to obtain “an in-depth analytical description of an intact cultural scene” (Borg & Gall, 1989, p. 387). According to Gay and Diehl (1992), behavior occurs in a context, and an accurate understanding of the behavior requires understanding the context in which it occurs. For example, the culture of an organization can have a direct influence on the behavior of the employees. Therefore, having an understanding of that culture can lead to a better understanding of the employees’ behavior. As a result, qualitative

methodology is an appropriate method for understanding real-world job settings. The critical incident approach, in particular, is an appropriate tool that can be used to analyze jobs in the social context in which they occur.

In five technical/community colleges and one technical high school, at least three students, at least three (or all) teachers, and, except in one instance, three employers were interviewed over the course of a six-month time period. A total of 46 interviews were conducted with teachers, students and employers of program interns. Each school was visited one to three times to observe classes and talk with these three groups. A critical-incident approach was used to identify particularly noteworthy program aspects.

Following are guidelines that focused the interview guide development for each set of interviewees:

- *Teachers*: rationale for business technology program organization with regard to outcomes anticipated for students, student prerequisites for program entry, sequencing of courses, instructional laboratory arrangements, choice of instructional materials and teaching strategies, student assessment practices, program integration with internship or cooperative settings, and program follow-up evaluation.
- *Students*: initial business technology program expectations, prior preparation for business program coursework, program experiences, perceived inter-relationship between business content coursework and technology-related instruction, perceived relationship between in-school and work-site expectations and learning opportunities, and personal judgment about learning outcomes.
- *Employer/Supervisors*: student preparation for available technology-related job assignments, and relationship between in-school business technology program and work requirements with particular focus on those aspects of instruction best provided by either in-school or work-site experiences.

Pilot testing of the interview protocol showed it was easiest for teachers and students to think about

challenging software aspects to teach/learn. When a challenging topic or software feature was identified, it was then possible for interviewees to talk about the teaching practices that were effective in dealing with this problem. Employers were able to talk either about critical incidents related to learning opportunities for students on the job or special projects that student/interns were asked to complete. These interviews were the basis for understanding the teaching settings and practices and for developing program development guidelines.

Related Literature

The related literature section is divided into two sections: content drivers and the social context.

Content Drivers. Using technology, and using it well, requires knowing more than merely how particular software tools operate, though this is a significant part of the learning expectations. Many software users today make minimal use of the computing capabilities and features of popular packages (Cooper, 1999; Gibbs, 1997; Landauer, 1996; Nardi, 1993; Norman, 1998). Effective instructional programs are able to engage students in learning a wide range of software features that have important employment applications.

Beyond knowing how software operates, any particular instance of effective technology use requires understanding two additional crucial dimensions. One dimension is understanding the human or business purposes served by the tool, or the subject-matter content necessary to understand why a particular technology is useful (Nardi, 1993, 1996; Nardi & O'Day, 1999). This means that specific software features need to be coupled with the content knowledge or domain in which the software meets some important need. Computer users need to know why particular types of documents are used in an office, why certain kinds of accounting information is maintained so that it is both accurate and current, and the meaning of the customer information stored in local databases.

Work-related competencies developed in most school settings are to be used outside of school in ways that cannot be anticipated with precision. Much of students' job success comes from their ability to transfer and adapt what they have learned

in school to different settings—to continue to learn on the job. There continue to be concerns about fundamental “skills gaps” and mismatches between educational attainments and employment requirements. Even so, there is also growing agreement about two key concepts related to what students should be taught (Bailey, 1990; Bailey & Merritt, 1995; Glick, 1995; Hart-Landsberg, Braunger, Reder, & Cross, 1992; Merritt, 1996; Raizen, 1989; Stasz et al., 1990; Stasz et al., 1992; Stasz et al., 1996; Thomas, Anderson, Getahun, & Cooke, 1992). First, there are likely to be generic skills and dispositions developed in schools that can transfer to a variety of out-of-school settings, including employment settings. Very broadly, these include such capabilities as problem solving, teamwork, communications, and dispositions and attitudes. Second, these generic skills and work-related dispositions are not just features of individuals or specific jobs; rather, these skills are a feature of the workplace as a social system.

The Social Context. A second dimension, in addition to subject-matter knowledge, needs to be considered for effective software use: an understanding of the broader social context in which the software is being used. This means interpreting the expectations of a particular social context, such as a school setting, a business work site, or another institutional setting in which technology use is part of a job (Glick, 1995; Scribner, 1986; Strassmann, 1997). How a student or an employee decides what to do, and whether, in fact, computing software is to be part of a job task, depends on interpreting and answering several key questions—many of which will be answered tacitly. Tacit questions don't get raised explicitly because everyone in the particular social settings thinks the answers are self-evident. These questions include:

- what is the learner's role in the context of a school or work setting
- what is to be accomplished
- which tools can be used
- how are the tools to be used
- how *well* work is to be done, or the work standards

- who makes this decision
- who can be asked for assistance

If students' use of software is not to be limited to what they can do in a school setting, they need to understand the ways in which their in-school preparation relates to later work expectations. They need to know how to build upon their basic skills and understandings after they become employed so they can become real contributors to a work unit in business and industry. A deep level of understanding is necessary in order to recognize when the technology might be useful in a new setting—transfer of learning—and to understand the inter-relationship of different technologies and their various applications (Bransford & Schwartz, 1999; Thomas, Anderson, Getahun, & Cooke, 1992). In short, students need to understand software well.

Teaching Practices

Teachers have a choice between two markedly different teaching practices when providing applications software instruction (Lambrecht, Jan.-Feb., 1999). One might be called the well-structured approach, or “systematic” approach, in that the specific concepts to be learned are specified beforehand and explicit, step-by-step instruction is provided to assist students in understanding and using particular software (Gagné, 1985; Gagné & Medsker, 1996). This approach is based on information-processing assumptions about learning. This direct instruction approach has been common for both school-based technology instruction and industry-based computer training. Industry trainers have labeled this approach “The Sagamore Design Model,” though they do not explicitly identify the theoretical base implied in their teaching recommendations (Masie, 1989; see also Brandon et al., 1996; Clothier, 1996).

A contrasting approach is called “minimalist” in that it incorporates a discovery orientation to software learning based on the goals, current understandings, and expectations of the learners (Carroll, 1990, 1998). Learning software operation is necessary to accomplish the purpose, and, therefore, unavoidably becomes the object of instruction. Implicit in this approach is the

expectation that learners understand the needs of a particular problem, such as a business problem requiring a computer solution. Few prescriptions are possible about how to design instruction, other than making available a wide variety of resources to support learning and providing prompting and guidance in response to student errors. This approach is, thus, supportive of the position that students learn through mistakes encountered.

Since employment success in technology-related jobs is the goal, student experiences in work settings need to be included in teaching practices. Including school programs that incorporated internships or cooperative-education placements in technology-related jobs allowed examination of such teaching practices. These work experiences also provided information about problems at work, or possible examples of both transfer successes and failures.

Some aspects of information technology may be better learned in employment settings than in school classrooms. Examining teachers', students', and employers' perspectives about technology-related learning experiences both in-school and on-the-job allowed some of these aspects to be identified.

Interview Analysis

The researcher conducted interviews with teachers, students, and employers. When possible, these interviews were recorded with the permission of the interviewee. When recording was not possible because of the spontaneity to engage in the interview or interviewee request, notes were taken in shorthand by the interviewer, allowing verbatim recording of segments of responses. The researcher transcribed all of the shorthand notes. A graduate assistant transcribed all taped interviews. A second graduate assistant read all of the interviews and transferred them into segments representing complete thoughts on a single question or topic. This allowed three people to read all the interviews and contribute to the development of interview themes, within the context of the original study questions.

Transcripts of the un-coded interviews were mailed to the participating teachers and employers for their review. Students were not invited to

review their transcripts because they were generally not easily contacted after the end of the school year. While several of the employers and teachers acknowledged receipt of the interview transcripts, none asked to make changes in what had been recorded.

The researcher did the initial theme coding of all interviews independently. One graduate student reviewed all coded interviews. A second graduate assistant reviewed an early portion of the coded interviews. When there was not agreement on a code, the decision was discussed in order to achieve consensus. If an existing code was not appropriate, additional themes were added when they were considered to be better descriptors of the interview segment. The transcribed interviews were coded using themes that coincided with the major question areas. The seven broad areas of the themes are listed below. A total of 105 specific themes within these broad categories were identified.

Main Interview Themes

- A. Needs/background for successful course participation or internship success
- B. Student and teacher program expectations in relation to employment
- C. Student learning problems in class or on the job
- D. Program issues
- E. Competencies best learned in school
- F. Competencies best learned on the job
- G. Effective teaching practices

The decision was made to create separate, specific themes for the employer interviews even when students or teachers had mentioned the same idea. This would keep visible the circumstance that employers were responding to different questions than those raised with teachers and students. Students and teachers had a more similar frame of reference in talking about school experiences, and the same theme code was used when they talked about similar events.

In all interviews, the text that represented each theme was marked as a block. In order to permit counting and sorting of the themes, all interview text was transferred into a spreadsheet and the

themes represented by numbers. By placing each block of text and its identifying number into a spreadsheet, pivot tables could be created to allow summary counting of each theme. Pivot tables made it possible to tell how many different themes were present—mentioned at least once—in a single interview. Pivot tables also allowed a tally of the total number of times a theme occurred within each group of interviewees. Finally, spreadsheet format allowed similarly coded themes to be sorted together, thus allowing examination of text from all interviews representing a single theme.

A theme may have occurred several times within an interview, but, for purposes of analysis, a theme was counted only once per interview. If a group of students or teachers were interviewed as a group, this was counted as one interview. A total of 46 interviews was used for this tally. Several school interviews included two or more teachers or students; these groups were counted as one interview. There were a total of 16 teacher interviews, 19 student interviews, and 11 employer interviews.

Out of the total of 105 themes within the seven broad question categories, students mentioned a total of 65 different themes; teachers, 70 different themes; and employers, 47 themes. Table 1 ranks the top 20 themes mentioned by teachers, and compares them with rankings by employers and students. Table 2 shows the top 20 themes identified by employers, compared with teachers' and students' rankings.

While sorting themes by frequency of mention is efficient for viewing a portion of the themes and examining the differences between the groups, it is not presented as a form of data analysis. The results from qualitative research, such as critical incident interviews, are not well represented by either frequency counts or statistical analysis of possible differences between the groups. While such summary presentations can be helpful, they do not represent an attempt to generalize beyond the chosen sample nor to establish importance by finding statistical significance. Themes mentioned only once by participants can provide special insight into instructional practices that work well or institutional characteristics supportive, or not, of students' learning.

Table 1: Total Times a Theme was Mentioned Sorted by Teachers

Theme Category	Theme	Teachers N= 16	Employers N= 11	Students N= 19
G	Student focus/student-teacher contact	15	2	15
G	Instructional materials	12	1	13
G	Independent practice/self-pacing	11	1	17
C	Specific software features	11	0	15
G	Business focus/"real-world" focus	11	1	6
B	Business requirements	10	0	13
G	Structure/schedule for students	10	0	7
A	Software skills	9	0	3
G	Course diversification (different type of course for different student audience)	9	1	1
G	Course accommodation (different types of students in same course)	8	0	0
A	Keyboarding	8	0	8
G	Feedback/constant evaluation	8	0	8
G	Open-ended problems/ exercises	8	0	8
G	Teacher demonstration	8	0	6
G	Faculty cohesion	6	0	0
D	Academic "credit"	5	0	3
B	Computer requirements	5	1	13
C	Computer phobia	5	3	4
G	Other students	5	0	9
G	Performance exams	5	0	0

- A. Needs/background for successful course participation or internship success
- B. Student and teacher program expectations in relation to employment
- C. Student learning problems in class or on the job
- D. Program issues
- E. Competencies best learned in school
- F. Competencies best learned on the job
- G. Effective teaching practices

The integrity of qualitative research comes from a conscientious effort to look for recurring evidences of common understandings, such as might be revealed when all three groups of interviews report similar experiences. Further, judgments about instructional features that work well can be confirmed when observations of classroom settings, examination of instructional materials, and conversations with participating students, teachers, and employers all reinforce common ideas about what is expected and what is happening. Interpreting these products is necessarily affected by the background and expectations of the researcher as she tries to understand what people are saying about their teaching and learning experiences. There are no neutral bystanders here! The researcher is as

steeped in teaching computing skills as the teachers who participated.

Key Findings and Discussion

Two key findings were the largely decontextualized teaching of introductory software use, even when business examples framed the textbook presentations, and the dominance of systematic teaching practices over more discovery-oriented minimalist teaching practices. This means that initially the content of business was not as dominant as the teaching of software features. The strongest links to business contexts came at the advanced level within Office Technology programs. A third unanticipated finding of this study was concern about the image of various employment fields, particularly the contrast between "office

Table 2: Total Times a Theme was Mentioned Sorted by Employers

Theme Category	Theme	Employers N= 11	Teachers N= 16	Students N= 19
E	Computer skills	10	0	2
E	Attitude/work ethic	8	3	2
F	How to get assistance	7	0	2
F	Interpreting expectations/priorities	7	0	1
F	Specific software	7	1	2
F	Specific work procedures	7	0	3
E	Communications/written English	6	1	0
E	Keyboarding	6	0	0
F	Dependability	6	0	1
F	Business environment/motives/profit	5	0	0
E	Telephone/voice mail	4	0	1
F	Accepting work assignments	4	0	0
F	Attention to detail/task orientation	4	0	1
F	Initiative	4	0	0
F	Specific computer systems	4	0	2
C	Computer phobia	3	5	4
G	Employer/work involvement	3	2	7
F	Teamwork	3	0	2
A	Communication/written English	3	1	0
C	Personal situations	2	3	2

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technology” and “information technology.” This image affects whether programs will be offered, who will teach them, and how they will be taught.

The first two findings will be more fully described, including discussion about why relatively de-contextualized, systematic teaching approaches are effective. The finding about the image of Office Technology programs will then be discussed.

Software-focused, systematic instruction. Instruction in software operation dominates. Teachers saw themselves primarily as software instructors. This is especially true in the beginning stages of instruction.

Business content becomes prominent in advanced courses that explicitly focus on office operations and the use of technology as a support tool. The primary employment use for technology was that of facilitating office communications. This

means that if there were any prerequisite knowledge or skills students needed, they were keyboarding skills and basic written English communication skills.

With regard to the second key finding, the question about specific teaching practices, the teaching assumptions implicit in the most popular instructional materials showed the most prominent approach to be a systematic, step-by-step process that engage students in comprehensive software instruction. The alternative supported by research, largely in industry settings, is the minimalist approach to teaching software. While it was expected that minimalist teaching might be observed in exemplary school settings, it was conspicuously reserved for the most advanced levels of instruction, if it was present at all.

According to the interviews with all three groups, students, teachers, and employers, the

open-ended office tasks encountered in the advanced coursework were also those likely to be encountered on the job. Realistic, work-like projects reinforced the “basic skills” that businesses say they expect schools to develop—computing skills, attitude and the work ethic, written and oral communications, keyboarding, handling telephones and voice mail, using basic equipment such as copiers and fax machines, and handling mail services. Even as employers expect students to come to entry-level jobs with these skills, they also recognize that students will be learning specific work procedures once employed. The challenge for students as employees is to be responsive to these learning opportunities.

Image of the office employment field. While examination of program identity was not an initial purpose of this study, it became apparent in conversations with teachers that at least three kinds of influences might be responsible for image problems in programs teaching introductory computing skills. One was the identification of some courses as “vocational,” “customized,” or something other than regular collegiate-level coursework. A second stemmed from the dominance of a self-pacing orientation in computer-intensive instruction. The third was related to enrollment changes matching job-market changes away from careers that carry sexist labels, such as “secretarial” and even “office.” This identity problem has led to questions, perhaps disagreements, about which faculty group is best qualified to teach the basic computing skills required for employment.

The first source of the image problem, non-regular courses, stems from the effort of schools to engage in “course diversification,” or to provide a wide variety of course lengths and enrollment options to meet different students’ needs. Sometimes students did not think that their preparation was sufficiently rigorous or respectable if they learned computing skills in courses that were not regarded as “counting” for transfer credit (transfer to four-year institutions).

A second source of the image problem stems from the offering of self-paced instruction. A positive benefit for students can be turned to the program’s disadvantage when self-paced looks like “less demanding.” If introductory computing

classes were taught in open labs or with flexible, student-paced patterns, they were sometimes not regarded as academically rigorous. The content was judged as “skill-based” with little cognitive or problem-solving content. “Academic content” was sometimes regarded as requiring a lecture-format with in-depth technical content, such as might be considered part of programming instruction. In fact, “technical training” was often regarded as different from “computer training.” A primary difference was a lecture format and instructional focus more directly on the internal operations of computing systems (Clothier, 1996). Desktop computing, using programs like Microsoft Office, was thought to be characterized by more well-defined, routine skills. When this assumption was held, reservations could be raised about whether regular, licensed teachers were needed in computing labs, or whether unlicensed tutors or technical aids could satisfy students’ needs for assistance.

A third source of an image problem stems from enrollment declines. The Office Technology area as a whole has suffered from enrollment declines within the last decade because of perceptions about the clerical support field. Some people think the field is disappearing because others now assume many of the tasks commonly performed by secretaries and other administrative assistants. Sometimes the tasks have been automated and taken over directly by computers, such as the use of voice mail. In other instances, professionals and executives do the work themselves, or provide their own support, since they do not have access to a secretary (Berryman & Bailey, 1992; Carnevale & Rose, 1998; Rifkin, 1995). Together with the perception that office jobs are shrinking (though this is still a large employment field), salaries are less attractive than those available for information technology jobs directly linked to technical support, systems development, and network maintenance (Office of Technology Policy, 1997).

The field of Office Technology—by whatever label may be more appropriate—might be rightfully identified as one in which “invisible work” crucial to a business’s existence is undervalued (Bowker & Star, 1999; Nardi & Engestrom, 1998). Work can become invisible when it contains large components of interpersonal elements, communication skills,

and competencies considered to be generally available in the population. Judgments about “little skill” overlook the underlying awareness, perhaps tacit knowledge, possessed by experienced support staff about expectations within a given work setting. Office staff who understand the history of an organization and the importance of certain relationships are able to perform tasks in a way not possible by less acculturated employees. Such essential understandings may be the very skills that disappear when businesses themselves eliminate support positions or move to greater reliance on temporary staff (Sennett, 1998). Such is the dilemma of educational programs—how to defend the offering of instructional programs when rapid changes are occurring in work settings themselves.

There is no doubt that office employees need to possess, among several competencies, high levels of computing skill, especially in word processing. The question is not whether these skills should be taught, but rather whether students will be enrolled in the advanced Office Technology specific courses where such skills are directly linked to office practices. Further, there is a question of who should teach the introductory computing courses required by all students, courses with a very weak link, if any, to any previous business competencies. One of the exemplary programs included in this study has actually made itself distinctive by extending instruction beyond traditional office support areas into end-user support and multimedia development. They did this while still remaining separate from technical programs that are more formally developed to these fields, such as Computer Information Systems and Graphic Design.

Research Recommendations

Three avenues for future research are implied by these circumstances—a strong preference for introductory software instruction requiring few or no prerequisite skills or content knowledge, to be taught in a direct, systematic manner, with the content having an uncertain career focus.

1. Investigation of the possibility of introducing problem-, project- or case-based software instruction sooner than is now done in order to

engage students in more realistic uses of software.

2. Investigation of the use of online, computer-supported learning settings for teaching software skills.
3. Investigation of the nature of office and technical support occupations to determine actual job needs, career paths, and appropriate program labels for instructional settings.

Problem-based learning. Project-based learning is being recommended more generally as a way to ask for active problem solving on the part of students in order to integrate relevant content areas, basic skills, and the context of a work setting. In current instructional settings, if students do not choose to take more advanced technology-related coursework, they might not ever be asked to bring their own business or personal problems to technology use. This means that many students may not become engaged in work that asks them to independently develop problem solutions. If students do not participate in internships, they will be particularly deprived of an opportunity to confront the difference between a school-based discourse for learning and the discourses of a work setting.

While these research sites provided insights into exemplary teaching practices, additional research is needed to more fully explore the nature of learning sites where more minimalist approaches are used. Schools that are responding to the increased interest in case-based learning and project-based learning are the likely places to look (Duffy & Cunningham, 1996; Schank, Berman, & Macpherson, 1999; Schank & Cleary, 1995; Steinberg, 1998; Vickers, 1996). Advocates of scenario-based or project-based learning claim involvement in realistic activities is essential to gaining the types of understanding that will transfer outside of school settings. A key premise is that learning is facilitated when the outcomes of realistic activities are different from what learners expected—*expectation failure*. On the job, such learning can be costly. In a school setting, solving problems can be controlled to build on what students already know.

Businesses have begun to realize the benefit of simulated learning settings, and computing skills

are being taught with commercial computer-based software that asks students to engage in case-based learning (Schank, 1997). While merging the terminology of *simulations*, *cases*, *projects*, and *problems* overlooks key distinctions, as if they represented the same kind of instructional model, they are all quite different (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991; Jonassen, 1999; Kolodner, 1993; Kolodner et al., 1997; Yorks et al., 1999). The main point is to embed students' learning in a work setting in a way that asks for engagement in both tool use and thinking about the purpose for its use. Key questions are *when* to introduce more realistic problems into instruction in software use, and *how to balance* the need for both contextual examples of software use with the understanding of general software functionality.

Online learning tools for software. As has been suggested with respect to case-and problem-based learning, much of the basic instruction about how to use software tools effectively is becoming available in a computer-based format. One of the schools participating in this project had already tried such software with varying degrees of satisfaction. Major commercial vendors offer a variety of computer-based instructional options for learning software use. More schools are likely to explore these options as they attempt to deal with the regular changes in software versions and the accompanying need to purchase new textbooks. Such textbooks, with their plentiful use of color and illustrations, are expensive. Schools are giving serious evaluative attention to the option of purchasing access to on-line instructional materials that can be more easily updated than paper textbooks. This is especially the case when the school rather than the student buys the textbooks. The effectiveness of such software in traditional school settings needs to be assessed both as a stand-alone system and in conjunction with other classroom-based or problem-based activities.

Related to the adoption of computer-based instructional tools is the desire by some schools to use such software for online evaluation of students. Several schools in this project were offering students the option of certificates to verify their learning accomplishments and provide a credential that was valued by potential employers. While

individual schools created some of these certificates, major software vendors also offer certificates. Such "commercial" certificates frequently require that testing be done with online software. The validity of such testing in relation to actual on-the-job accomplishments has yet to be demonstrated.

Nature of end-user computer use. As schools attempt to provide career direction for students, they need to regularly reassess actual employment needs. Previous attempts to provide this essential updating of the state of the field have depended in large part upon task analytic approaches that generally result in lists of behaviors for curriculum development (Lambrecht & Sheng, 1998). If teachers are to have a fuller understanding of the work settings in which office staff do their work, more holistic approaches to curriculum development and work standards may be more effective (Bailey & Merritt, 1995; Merritt, 1996). These include work analysis approaches, called "professional" approaches, which are more ethnographic in their study of work settings. These more holistic approaches attempt to understand the broader work environment, not just the job tasks assigned to a particular job title.

Such professional approaches, in contrast to task analytic approaches, have the potential to capture more of the subtleties of how work is organized and accomplished. The primary difference between the task analytic and professional approaches is that an attempt is made with the professional approach to situate the tasks and worker competencies within a work setting. Hart-Landsberg et al. (1992) provide an example of how such workplace analyses might be carried out through case-based methodology. They have characterized the process of learning to work by actually doing work as "learning the ropes" within a specific job context.

The concept of sensitivity to working relationships was a prominent finding in this study. Both employer interviews and the characterization of office work by Raizen (1989) conveyed the importance of "reading the work environment." Students and teachers need better understandings of what it means to interpret expectations and assess priorities, of what it means to come to understand the business culture, the profit motive,

the need for standards of a certain type, and interpreting standards which may change depending on the circumstances. This is not a new insight for business educators. But what this language actually means in real work settings is yet to be fully developed. In particular, teachers need models of how such cultural understandings might be conveyed to students prior to their participation in an actual work setting.

As software continues to become easier to use, it is also likely to become more specialized, well suited to specific tasks (Cooper, 1999; Norman, 1998). Task-specific technology is also likely to become easier to learn and less the object of instruction in and of itself. As software becomes more specialized and easier to learn, the challenge for business employees in a variety of support positions will be to understand the business purposes of their employment so that they can choose appropriate technology tools and use them effectively. Research is needed to understand the nature of these business work settings.

Learning more about what computer end users do, the variety of ways in which support staff will continue to use technology, and then presenting these career options to students in an attractive way, will lead to the continued vitality of technology-related programs. Greater understanding about the broad field of “end-user computing” has the potential to revitalize programs now labeled Office Systems and Office Technology.

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