Integrating technology into learning and working: A promising future

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ABSTRACT
In this concluding synthesis article, I summarize and discuss the papers that comprise both parts of this special issues. Two organizing frameworks are provided to facilitate readers to assimilate of the scope and depth of the contributors’ ideas, theories and constructs: (1) activity theory; and, (2) instructional design.

Keywords
Activity theory, Instructional design, Technology integration

Introduction
This synthesis paper provides a brief summary of papers included in the issue. I shall take a retrospective view of the whole editing process, beginning with the selection criteria. I then discuss the diversity of the papers included. Two organizing framework – activity systems and instructional design - will be provided to facilitate readers in synthesizing these papers. A look back over both parts is well worth the effort, and those in a position to include these papers in their courses will find the access and availability of papers in Education, Technology and Society an enormous bonus. Finally, I shall conclude with issues raised by many authors that might prompt further investigation and scholarly work.

Selection Process
One of the editorial challenges first faced by the co-editors was selecting qualified papers, since we received more than 150 proposals in response to the call (see the introduction to the first part of this special double issue for more details on the overall response, Spector & Wang, 2002). The criteria we used to make selections included: innovative ideas and applications, quality of research, clarity of the conceptual framework, and diversity in terms of context, content and perspective.

Collectively, the papers in this two-part issue represent different settings (business/academia/K-12), different regions of the world, different academic and social cultures, various categories (conceptual, empirical and case studies), and different perspectives (including traditional as well as post modern). An ongoing concern of the co-editors in working on this double issue has been to integrate diverse content, context and thinking into a coherent collection around meaningful themes. We eventually decided to organize this issue into two parts. Part One focuses on learning and Part Two on working. Just as we stated in the our introductory paper to Part One (Spector & Wang, 2002), our intention was not to blindly accept the traditional distinction between learning and working. It is our notion that the papers in general represent the fuzziness of that traditional distinction. This second part of the two-part issue explicitly addresses the disappearing distinction between learning and working, and the first part included several papers that made reference to work environments and one paper that also addressed this boundary. Both of the full papers in this issue consider learning and working together implying that the boundary is fluid and somewhat arbitrary, albeit useful for a variety of reasons. Delacey and Leonard focus on the relationship of communities of practice to business education. Koszalka emphasizes the development of career choice in middle school children. Many of the short papers also illustrate how blurred the boundary between learning and working is. Wherever or however one draws a boundary between learning and working, it is evident that learning and working are intimately connected in a variety of ways and are perhaps best treated together in many cases.

There are many ways to synthesize and assimilate the diverse concepts and findings in all of these papers. I shall present two frameworks, one based in activity theory and the other based in instructional design, as these established frameworks perhaps capture the breadth views represented and can be used to show that these are not positions at war but rather are nicely complementary in understanding how technology is effecting society. On the one hand, they are two different frameworks that arose from different academic traditions; on the other hand,
there are overlapping concerns and issues. Together they make a powerful combination in promoting understanding of the effects and challenges in integrating technology into learning, working and living.

Activity Theory

Activity theory provides a unique lens for analyzing learning process and outcomes. It was adapted as a framework for analysis and understanding of papers in the first part of the two-part special issue (Spector & Wang, 2002). As it happens, activity theory can be used for synthesizing the entire issue. A quick review of activity theory is helpful to demonstrate how this theory supports the structure of the issue.

![Activity Theory Diagram]

Activity theory (see Figure 1) focuses on activities in which people are engaged, the instruments they use, the social and contextual relationships of collaborators, the goals and intentions that drive activities, and objects or outcomes of those activities. It offers the possible integration of many human computer instruction theories and concepts, thus helping to maintain conceptual integrity in terms of design, evaluation and usage (Nardi, 1996).

The subject of any activity is the individual or group of actors engaged in the activity. The subject (intelligent agent or actor) is the central, driving character in defining an activity. Papers in this issue address various actors and their roles in technology integration. Cope and Ward describe the different perceptions that high school teachers had about learning technologies. Kirby et al. assess students’ perceptions of learning and their preparation for the workspace. Diericks-O’Brien and Sharratt discuss how expectation and belief of academics, educational advisors, and multimedia producers impact on design and integration of technology. All of these papers illustrate the importance of considering educators’ perceptions of technology, and suggest that a collaborative process among all the actors is needed in order to successfully integrate technology into learning and working experiences.

The object of the activity is the physical or mental products that are transformed. Objects may be quite varied and are generally transformed in the course of an activity, so objects should not be considered as fixed or constant. Objects embody the intentions that motivate activities.

Instruments can be anything used in the transformation process (physical, such as computers, or non-physical, such mental models or theories). Edmonds and Pusch introduce an instructional knowledge management system and how it is used. Sagias discusses Virtual Blackboard, an extensible system that provides a wide range of interaction capabilities. Maestro-Scherer et al. describe the use of technology to enhance an experiential adult learning process. Eseryel examines a number of different models for the evaluation of training. She argues that there is a need for a unifying model of evaluation theory, research and practice that will account for the collaborative nature and complexities in training. Avelli and Finkelstien propose a scheme to annotate educational multimedia. They suggest the scheme could be used to improve the current evaluation tool. All of
these are instruments. The richness of this collection of instruments represent one measure of the diversity of perspectives in these papers.

The activity consists of goal-directed actions to accomplish the object – the tasks, actions, and operations the transform objects. Again, these papers indicate a wide variety of activities used by a variety of agents to achieve various purposes.

The three primary components – subject, object and community – do not act on each other directly. Rather, their interactions are mediated by other factors. Instruments mediate the relationship between subjects and objects; rules mediate interactions between a subject and the community; roles mediate the relationship between community and objects. These rules and roles may be expressed as culturally accepted norms for behavior. Artifacts are a result of and result from the interaction of the primary components in an activity system.

The two full papers in this issue nicely activity systems. Delacy & Leonard take into account the culture of education at Harvard University, including the use of technology in representing cases and how communities of practice are play a major role in the process. Koszalka makes explicit several relationships that influence the development of career interest in middle school children. The activity system that emerges from her paper is especially rich in terms of actors and relationships involved.

**Instructional Design**

Another way to look at these papers is to look at common themes and implications involving instructional design, broadly conceived. Instructional design is basically about the planning and implementation of environments and systems that facilitate learning or improve performance.

Figure 2 represents many of the various dimensions associated with instructional design. The interactions among these items are dynamic and ongoing, but often vague and uncertain due to the inherent complexities of learning and working situations (Spector & Anderson, 2000).

A few examples will serve as a starting point to integrate these papers around an instructional design framework. In term of learners, individual differences and cultural considerations are well addressed in this issue, as they were in the first part. People with learning or physical disabilities are considered in Luke’s paper. He argues that it is imperative for courseware manufacturers and instructors to take accessibility into consideration when designing online courses. Babaeva and Voiskounsky address how individual intelligence, social skills and
personality traits might be used to develop IT-giftedness in children and adolescents. The contributors provide insights into cultural considerations of technology integration from various angles, e.g., breakdown social and cultural barriers (Hughes et al.), support multicultural setting (Slay) and understand organizational culture (Ali et al.).

Almost all aspects of learning and working (see Figure 2) have been addressed in this issue. Papers in this second part well represent the diversity of learning and working situations. Gemeinhardt reports best practices in American business education. She argues that the amount of resources in terms of time, money and effort to develop and implement technology-mediated learning is usually underestimated. Suggs et al. discuss how communication technologies, such as email, teleconferencing and videoconferencing, have been used in a health setting to assure effective communications with a dispersed volunteer group. They suggest that only flexible and cost effective technologies are continually employed, while others are abandoned. Folkman illustrates a case in Telenor Customer Services of Norway where learning initiatives have been integrated into work processes. The findings in this study further verify that when learning is closely integrated into the work situation, the division between work and learning becomes blurred, which is one area well worth additional investigation.

Several papers emphasize the convergence in learning and working. Radcliffe presents a case that illustrate how one can integrate formal engineering education program into a work environment. They suggest that it is essential that the design approach of learning programs and the assessment approach of outcomes in relation to professional development in workspace are integrated and coherent. Kirby et al. argue that performance in educational programs and at work is affected by students’ and employee’s conception of learning and inclination toward lifelong learning. Different conceptions of learning seem to be associated with different perceptions of learning environment, different perceptions of learning needs and skills, and with different perceptions of the demands in the workplace. They suggest these differences may present challenges for instructional design. Lytras et al. expand the traditional consideration for technology supported learning to a three-dimensions model: the knowledge management dimension, the technology-supported learning and pedagogy dimension, and the application integration dimension. They suggest that such a model could be used as a methodological tool for developing technology-supported learning.

Learning goals are explicit in some papers and implicit in others. Brink et al. investigate a case where employees have been encouraged to participate in an online learning module on finance. The learning goals in this situation were to develop understanding of the company’s financial performance and management skills of their personal finances. Schreck exams a Web-based distance education program in Russia to provide corporate training on business. Bitter-Rijpkema reports an electronic Delphi study. In this scenario, 16 experts participated in the study to reach agreement about critical success factors for collaborative knowledge elicitation in asynchronous distributed working teams. Maestro-Scherer et al. describe a case in which employees of a city took on the task of examing and understanding their work environment. Although learning goals are not the emphasis in these papers, how technology is used to help achieve these learning goals is well addressed. For example, Schreck concludes that technology and connectivity is not always reliable in Russia, and this led the design team to created both Web and CD-ROM versions. Maestro-Scherer et al. concludes that in using interactive technology participants receive immediate feedback that stimulates excitement and heightens interest, which in turn facilitates employee understanding of their environment.

The technologies discussed in the papers in this two-part issue include methods and techniques as well as tools and equipment. Bianchi examines how one of a traditional technology, radio, has been successfully integrated into instruction. He suggests that focusing on educational needs and maintaining a human touch when technology was integrated into learning are the major factors that influenced the successful integration of technology. Saunders and Quirke describe the problems associated with integrating laptop technology into a Middle Eastern university. They discuss issues such as culture, gender, infrastructure and support, ultimately suggesting guidelines to help faculty cope with new workloads and learning paradigms. Rountree et al. investigate the effectiveness of virtual artifacts in teaching university students and how digital images could mediate focus and support development of visual literacy. Sampson et al. propose a knowledge-on-demand paradigm. They argue that the paradigm could be used for developing enabling technologies to meet requirements of front-end users who are interested in accessing learning material, applications and services, and back-end users who are interested in providing these materials, service or applications. Avellis and Finkelstein develop a scheme for capturing and analyzing non-functional requirements in the domain of multimedia educational software. Each paper helps to develop a more complete picture of specific technology use: technology as a social tool, technology as a source of influence in educational change and professional development, and technology as a technique for analysis of information. As a whole, these papers provide a wider understanding of the breadth and depth of opportunities and issues related to integrating various
technologies into learning and working. Well-designed technology interventions can support and encourage learning and working process, and provide means to analyze and assess learning and working, simultaneously.

**Concluding Remarks**

Numerous issues have been addressed in this two-part special issue, including: contexts to be considered (generally more broad than traditionally understood), implications for design and development (again more broad with emphasis on dynamic aspects), frameworks for making effective use of new and emerging technologies (much emphasis on users and their contexts), and cultural and social issues involved with new technologies. I have proposed two frameworks (activity theory and dynamic instructional design) to assimilate the diverse concepts and ideas presented in this two-part issue. An area worth further investigation is how these frameworks fit together and might impact the planning and deployment of instructional and performance solutions. Another work investigation is just how much technology is impacting traditional boundaries between learning and working. We and many of the authors have suggested that the impact is substantial and likely to continue. It is hoped that this two-part special issue has addressed and raised the primary concerns surrounding the integration of technology into learning and working, which was the goal of the co-editors.

**Acknowledgements**

When I was asked by Spector if I would co-edit an international referred journal, I doubted whether I could accomplish this since I did not have any experience editing an international journal. I became involved in the editing process in April 2000 after much reassurance from Spector. When I look back on the year spent editing this special double issue, I am amazed how much I have learned by reviewing proposals, commenting on the drafts, editing papers and communicating with all the authors, all of whom have been very cooperative.

The editing process itself has become a wonderful learning experience for me as a doctoral student at Syracuse University. Working with Spector is an unforgettable experience – his sense of humor, his diligence, his intellectual ability and his seriousness about the quality of our editing work have made a profound impact on my attitude toward future career and academic work. From reviewing and editing all of these high quality papers, I have gained an understanding of the kinds of research and methodologies conducted by a wide variety of scholars. I would also like to thank Koszalka for her role in synthesizing the issues that emerged from the first part of this two-part issue. I owe special thanks to Spector and Kinshuk for this wonderful opportunity from which I have learned so much.

**References**

