# Conceptual Frameworks of the Exemplary Technology-Supported Schooling Case Studies Project*

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Abstract

As noted in the study overview, this project was intended to produce three sets of case study reports: one for the U.S. educational community, one for an OECD Quality of Schooling study, and one for the IEA SITES study. The OECD study did not have a formal conceptual framework but it emphasized reform in the school as an organization. The IEA SITES study emphasized innovation at a classroom level and its conceptual framework is described in this report. The frameworks effectively guiding the design of the study and the analysis of the cases are discussed. Reflections are given regarding the implications of these frameworks for the research conducted and for future studies of this type.

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## Conceptual Frameworks of the Exemplary Technology-Supported Schooling Case Studies Project*

The theoretical underpinnings, which are described here as conceptual frameworks, of the project emerged from several sources. The original motivations for the project were tied to presumptions related to the information (and knowledge) society. As the planning for the project got underway, the most appealing conceptual foundation appeared to be an input-output model. As we designed the methodology for the project, the contextual circles model was the most compelling and implied the need for case studies. Theories of innovation and educational reform were also of great interest. The conceptual framework adopted for the project evolved out of these theoretical orientations or conceptual starting points.

### The Information Society (and Knowledge Society1) Paradigms

Theories of the information (and knowledge) society diverge in the nature and magnitude of societal discontinuities arising from shifts toward a greater role for information and knowledge (cf. Webster, 2002). However they all accept the basic premise that information technology contributes toward these shifts. With the rapid penetration of education by Internet-related technologies, research to understand the nature of these impacts has become more inherently compelling. Likewise research that seeks to understand how best to design curricula and support structures to maximize the potential benefit of these technologies also has increased in importance.

In fact, information technology appears to be pushing the boundaries of education conceptually and methodologically. Technology pushes education by expanding where and when learning can take place, by forcing changes in priorities for the curriculum, by giving new ways for students and teachers to communicate, and by repeatedly making teachers' "best practices" obsolete. These challenges for education are given more substance in Table 1, which shows the particular aspects of technology that yield these consequences for society and for education in particular.

The societal implications of these new aspects of information technology are listed in the table because in some instances it is the interaction between the technology and society that produces the greatest impact on education. For example, the need for more emphasis upon collaborative projects results from a combination of trends toward knowledge as a collective process and networking technologies that facilitate this trend. Likewise, the need for policies that address inequities in access to technology at home and school arise from both cultural factors and the high cost of newer technologies and information infrastructures.

In addition to reducing dependence on geographically-based schools, information technology, by offering new capacities for teaching and learning, implicitly raises questions about appropriate teaching roles. Another anomaly that generates issues is the incongruence that many students have more technology knowledge and skill than their teachers and parents. Given the growing importance of knowledge acquisition, its application, and information handling in the global economy, decision-makers are reconsidering educational goals and pedagogical priorities. Also disconcerting is the discriminatory implications of the high cost of contemporary technology, making it nearly impossible for lower income parents and schools to benefit as much as those with higher income advantages.

Table 1

How Information Technology Yields or Implies Changes for Society and the Education Sector

| Technology & Technology Attributes | Societal Implications | Educational Implications |
|---|---|---|
| Distance learning | Potentially improved access to learning by all social groups | • Virtual schooling, "schools without walls"<br>• Anytime, anywhere learning required<br>• Home schooling more feasible |
| Database technology | Information explosion | • Students need to learn knowledge management<br>• Just in time learning required |
| Network-based communication technologies | Knowledge becoming more collective | • Both teachers and students can more easily collaborate across geographical boundaries<br>• Project learning more important |
| Productivity, creativity tools | Knowledge as critical commodity | • Rise in value of knowledge construction<br>• Inquiry skills essential |
| Rapid obsolescence | Renewal, social change | • Greater need for innovative teaching practices<br>• Professional development of teachers more critical<br>• Greater need for lifelong learning and relearning |
| Complexity | New job requirements, labor force changes | • Need to integrate IT subjects, skills into curriculum |
| High cost of newer technologies | Digital divides | • Need for equity solutions for both school and home |

The “Exemplary Technology-Supported-Schooling Case Studies" project exemplified the need to rethink the conceptual models as well as methods for future research on the role of technology in education. Through this project we sought to employ methods that would allow us to learn more about the types of student outcomes resulting from technology-supported learning activities, the changing roles of various actors---students, parents, teachers, administrators, and others---in helping to make successful reforms happen, and how districts and schools are addressing new challenges such as bridging the digital divide.

## The Input-Output Framework

Planning for this project began in 1998 and one of the first tasks of project was to develop and refine conceptual models and an overall framework. Our initial conceptual framework (Figure 1) was a model developed by Means (1994 and 1998) for analyzing and evaluating the decisions in implementing technology-supported reforms. This framework emphasizes the key inputs and outputs in evaluating the likely success of a technology-related intervention or reform. The model emphasizes that any educational technology initiative has a variety of explicit or implicit non-technology inputs and that the implementation depends upon a complex of school, classroom, teacher, and student factors. Means (1998) applied this model to diverse types of educational technology implementations. She evaluated diverse types of projects and concluded that implementers need to help clarify the goals of any given initiative, and that they needed to evaluate outcomes in order to assess whether the implementation was adequate. She also concluded that an implementation often fails because of inadequate time as it may take several years for the development of teacher skills for a particular instructional innovation.

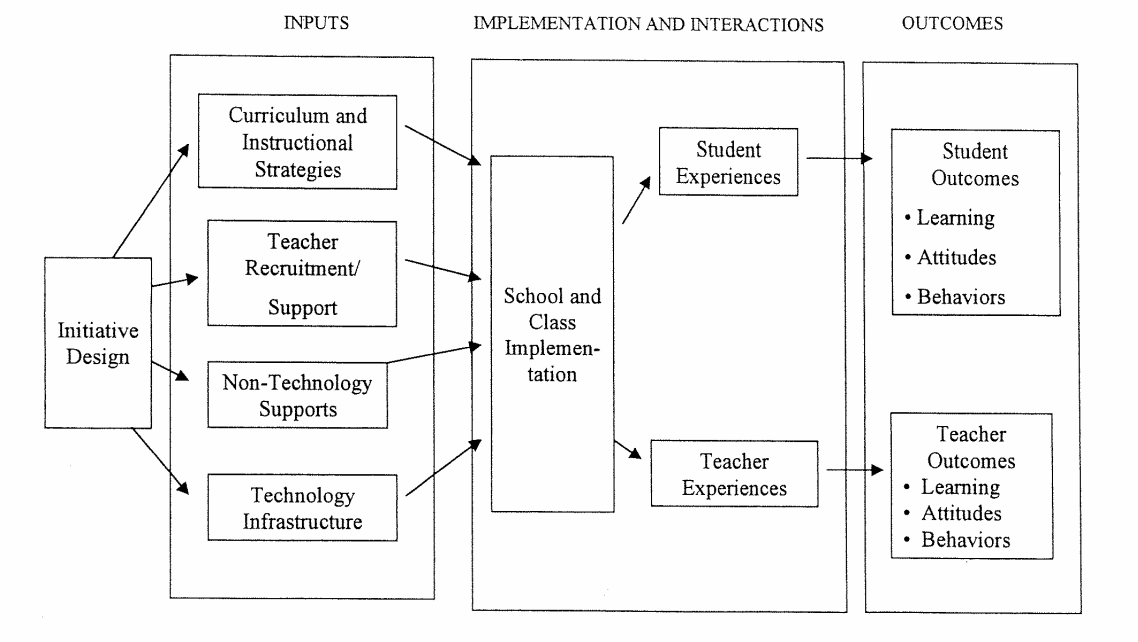


Figure 1. An input-output model for evaluating decisions regarding technology. (Source: Means, 1988)

While we may have wide consensus on the nature and scope of exemplary educational practices using technology, there is less agreement on the key underlying factors relevant to the initiation and success of such innovative practices. Thus there is a need for a research portfolio containing designs that simplify the construction of future research plans. It is expected that the portfolio of research designs will encompass a diverse variety of components including but not limited to options implied by the following design choices. These design choices are grouped by the evaluation model.

Each of these components may to some degree contribute to the implementation and continuity of an educational, technology-supported innovation. Thus each could be the basis of a solicitation for the selection of exemplary sites. And each could be serve as criteria for the collection of relevant data. The proposed research planning will attempt to incorporate these components into alternative designs that contain considerable detail including estimates of costs and projected outcomes.

## The Cultural Contexts Framework

Another model that had a large influence upon our conceptual development was that of the cultural psychology of Cole (1996), especially his notions of cultural context as a dynamic weaving of threads of activity, practice, and artifact. Cole (1996; p 144) suggests a "culture as garden" metaphor to emphasize that when investigating a "system of interactions within a particular setting," there is always a critical "next higher level of context." This paradigm is particularly apropos because Cole has shown it to be useful for analyzing the sustainability of an ongoing technology-based, group educational activity called the Fifth Dimension.

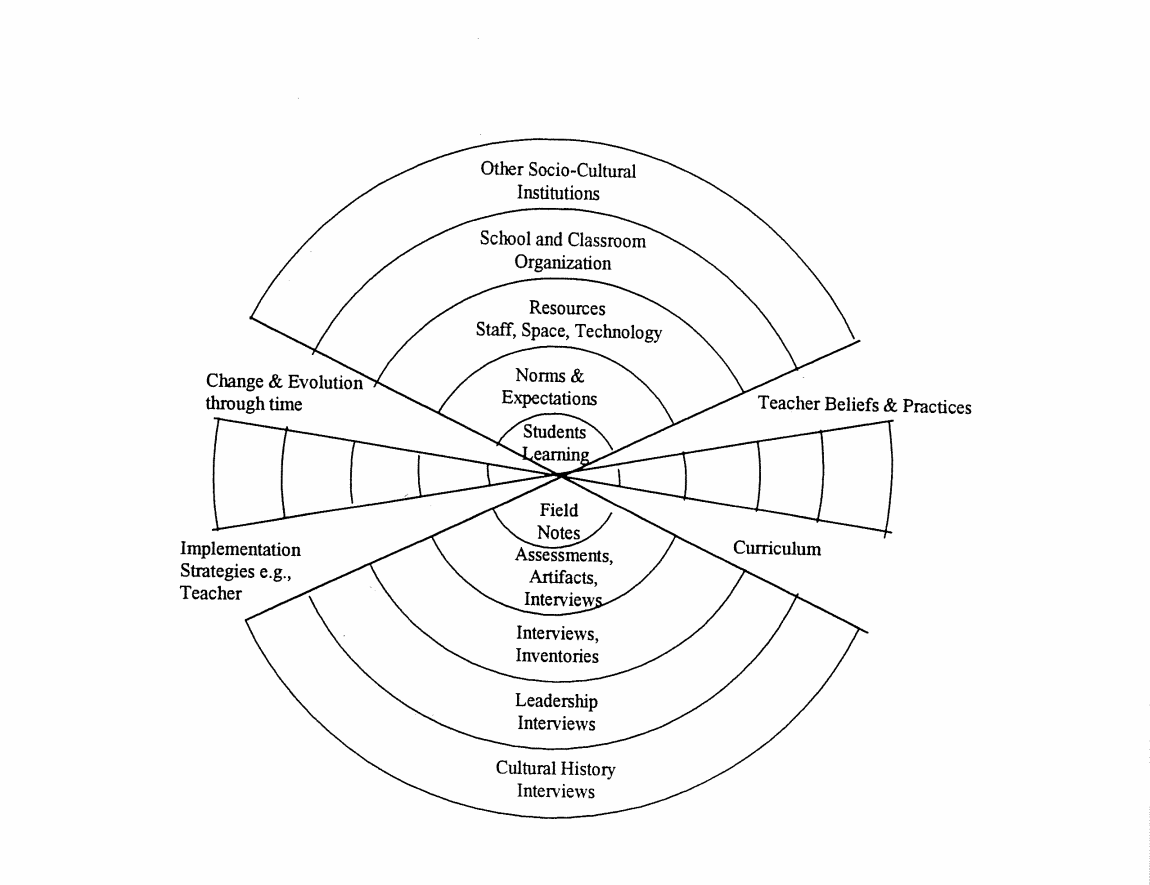


Figure 2. Cultural context circles model. (Adapted from Cole, 1996.)

A set of concentric circles (Figure 2) shows how these concepts can help us plan research on technology-based exemplary practices. In the innermost circle are the activities in which learners are engaged including the computer-mediated events and the associated social interactions. These are the foci of the main in-person observations and accompanying field notes. At the next higher level are the norms and expectations for working, playing, teaching, and learning that result from a particular implementation of intended pedagogy. Indicators such as rituals, participation rates, and assessments can be derived to capture the components that emerge as essential. At the next higher level are the resources, including staff, space, and all the remaining aspects of the technological context. Surrounding that is the context of organization, including both the classroom and school structure and leadership. It is at this level that policies that sustain innovation may be set. The outermost circle encompasses all the remaining institutions including the larger educational system, parent groups, and other support networks. This system is indeed complex as each circle contains elements that are woven together with elements in other circles.

Static circles do not lend themselves to depicting dynamic change. To highlight our intent to capture this dimension, time is depicted as a wedge on the left side. This is particularly important to targeting aspects of sustainability, which will be sought through both observation and retrospective interviews. Additional considerations that cross cut the layers of the paradigm can be mapped as additional dimensions as necessary. For instance, teacher beliefs and practices, the curriculum, and other implementation factors are depicted with smaller wedges in order to

emphasize that these elements impinge upon and will be evaluated at each level.

While the student is the primary learner of the system, the model can be applied to some extent to the teacher as learner and to the school organization as learner. In so far as professional teacher development and change in pedagogical practice are relevant, any study of exemplary practice must examine the process of teacher learning as well. While the organization is not always viewed as a learning agent, Fullan (1993) portrays the school as a learning unit and suggest mechanisms for institutionalizing this role. It may be possible to refine some useful indicators of these dimensions.

The concentric circle diagram emphasizes the complexity of the social, organizational, and cultural contexts for exemplary teaching and learning practices. This complexity, which borders upon the chaotic, has been emphasized by Fullan (1993). In recognizing this context it is obvious why qualitative, case study methods are most appropriate for the study of exemplary technology-supported educational practices.

The collective case study method (Stake, 1995) seems to offer a useful approach for the research at hand. This method utilizes multiple cases to represent both prototypical cases and contrasts or differences across cases. Thus the sites can be analyzed in terms of both specific and generic properties. This type of research design follows replication logic rather than sampling logic (Creswell, 1998; Yin, 1984). Perhaps the most unique aspect of case study research over other approaches is that the boundaries of the case figure into the reporting of the data (Miles and Huberman, 1994). Various documentation, archival records, physical artifacts interviews, and direct observations, all allow for description of the sites and provide the basis for analysis of themes and issues.

## Adaptation of the IEA SITES M2 Conceptual Framework

The main conceptual framework for this study emerged primarily from the framework of the IEA study but to some extent the OECD study as well. The central focus of the OECD study was organizational innovation while the central point of the IEA study was pedagogical innovation. From the standpoint of our study, which was the U. S. component of each of these two international studies, this difference was addressed partly by limiting our selection of school sites to those where organizational changes had included or produced innovations in classroom practices. We addressed it also by writing three separate case reports: one for the OECD study, one for the IEA study, and one for the audience of researchers and educators in the United States. Conceptually the divergences were addressed by attempting to give equal priority to both the organizational aspects and the classroom level processes. A single conceptual model, taken from the IEA project, integrated these different attributes, and this model is depicted in Figure 3.

At the core of our conceptual model is the innovative pedagogical practice, which is embedded in a concentric set of contextual levels that affect and mediate change (Cole, 1996). These levels for present purposes are (1) the classroom (micro), (2) the school organization and the local community (meso), and (3) the state, national, and international (macro) level. The accompanying diagram (Figure 3) depicts these three levels and gives some specific examples of relevant factors at each of these contextual levels.

The diagram also shows an inner constellation of four interacting components critical to the learning process. These four elements: the teacher, the student, the curriculum content and goals, and the instructional materials and infrastructure, together have the most immediate impact on outcomes (Plomp, Brummelhuis, and Rapmund, 1996). These four contextual elements are given special attention in this study because of the central role they play in

facilitating or hindering learning, especially during a process of pedagogical innovation or change.

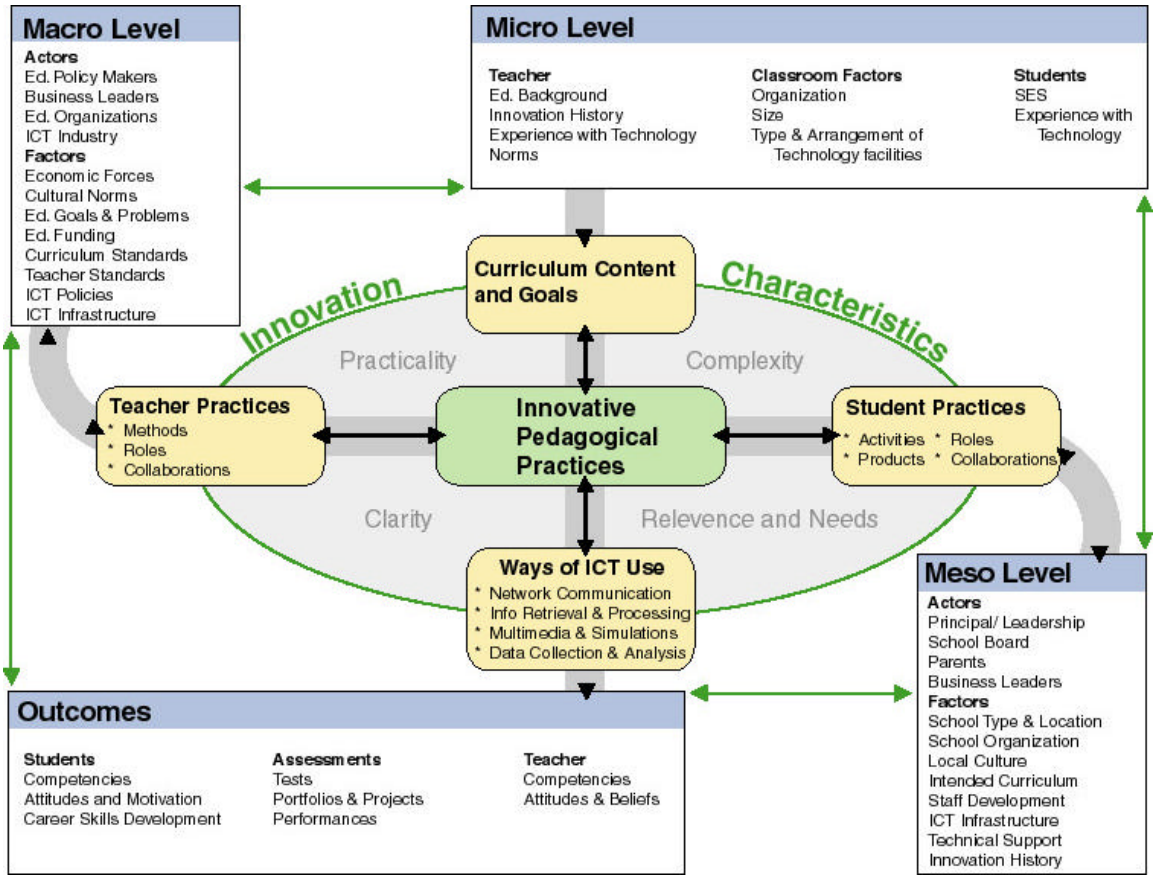


Figure 3. The IEA SITES Innovative Pedagogical Practices Model.

The micro level includes teacher and student characteristics and experiences, especially with innovation and technology. It also encompasses interaction patterns, classroom norms, patterns of technology utilization, assessments, and the curriculum as it is practiced. The research literature (Means & Olson, 1997) documents a strong association between new technology-based practices and changes in curriculum and pedagogy. For example in many countries, the use of educational technology is part of an instructional shift toward project-based learning within a context of school improvement or reform. Instead of focusing solely on increasing the acquisition of facts related to specific subject areas, teams of students are engaged in solving complex, authentic problems that cross disciplinary boundaries. This moves education beyond the notion of a place where knowledge is imparted, to one of classrooms, organizations, and societies as knowledge building communities (Bereiter, 1999; Scardamalia & Bereiter, 1994; Brown & Campione, 1994.

The meso contextual level includes school administrators, support staff, and school policies and practices. In our framework it also includes parents, community characteristics, and local partnerships. Particularly critical at this level are the programs for organizational learning and those for professional development. It is well known (Fullan, 1991, 1993; Van Den Akker,

Keursten, & Plomp, 1992) that innovation benefits from a supportive school environment. Innovative practices are likely to be sustained when the school management supports the practice by adjusting the curriculum as necessary, provides professional development and offers other incentives, resources, and services for the teachers (Louis & Miles, 1991). School improvement studies emphasize the central role of school culture in mediating change (Fullan, 1991, 1993; Dalin, 1973, 1978, 1994; Huberman, 1992; McLaughlin, 1993; Fuller & Clarke, 1994; Stoll & Fink, 1996).

The macro level encompasses a variety of cultural and policy characteristics at regional, national, or even international levels. Curriculum standards and assessment requirements are examples of such factors, as are professional development trends and telecommunication infrastructures. Current theories of comparative education (Arnove & Torres, 1999) identify a fundamental tension that affects contemporary educational change. This is a dialectical tension between massive global forces that affect social relations and institutions across national boundaries and the accommodation of these forces based on local cultural, political, and historical factors.

Each level suggests a set of research questions that were explored in our study. For example, questions at the micro level included: What new teacher and student roles were emerging and how was the educational innovation changing what teachers and students did in the classroom? Questions at the meso level included: Who directed the change? What leadership role did the teachers play? How important was the role of staff development?

In addition to these contextual questions, there were some additional research questions on the nature of outcomes from the educational innovation, such as: What evidence was available, pro and con, regarding the effectiveness of the innovation for all participants? What sets of standards were being used in conjunction with the program? How equitably distributed were the benefits of the program? Finally, there were research questions that cross-cut the levels because they apply to multiple levels, especially the meso and micro levels. These cross-level questions include: What special resources, if any, were required to sustain the innovation? What might be required to scale up the innovation to a much larger population of teachers and/or schools? All of these research questions have been used to guide the development of data collection instruments and protocols. Key factors implicit in each question have been used to develop one or more items in interview protocols.

## Conclusions

Because of the pioneering character of the study, we worked from several different models or frameworks during the life course of the project. While the information society paradigm was the starting point of the project, an input-output framework, a contextual circles model, and an innovative practices model with embedded contexts were the most helpful in setting priorities and guiding the project conceptually. While this latter framework was effectively the working theoretical model for the project, during the course of analyzing the data and writing up the findings, it was sometimes necessary to elaborate specific pieces of this framework. For instance, it was necessary to map out the relationships among various contexts and issues when analyzing the role of leadership. Thus in the end we will have a stronger conceptual framework than when we started the analysis.

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[1] There are important distinctions between the information society and the knowledge society concepts, but here they are treated as one because the emphasis is upon how evolving information technology has influenced society and education in particular. These changes have made the concepts of information society and knowledge society more compelling.