

Innovation in learning and innovations in technology: seventeen cases

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Abstract

Innovations in adult learning are a complex mix of pedagogy, technology, organisation, strategy, and vision. In this chapter seventeen chapters in the book "Innovating Adult Learning with Innovative Technologies" are summarised as cases representing state-of-the-art design and practice in nine countries and with a wide range of technologies and innovations in instructional practice.

Keywords: Innovation, advanced learning technologies, communication technology, collaborative learning, cases

1. SEVENTEEN CASES AND THEIR KEY CHARACTERISTICS

An explosion of innovation is taking place in adult learning, motivated partly by the social recognition that learning is a lifelong need and by the motivation that increasing equity in learning opportunity for adults is a strategic and economic goal for a society. But there are many other motivations, including the continued need to enrich and improve instruction in traditional learning institutions; the philosophical belief that learning for adults is often improved if it is a social and constructivist activity; the increasing recognition of the value of various forms of communication in adult learning; the need of adults for flexibility in time, place, and other dimensions of learning activities; and not least the problem of combining all these motivations with economic realities and decreased budgets. Paralleling and intertwined with these motivations for innovation in adult learning are the rapidly growing innovations in technology and instrumentation occurring throughout the world. Communications technologies allow not only internal benefits within an institution through shared access to central servers of resources and through increased internal communication, but also facilitate wide-area networking with access to resources as far ranging as those available through the Internet to multi-media desktop conferencing via ISDN and other transmission technologies. New forms of instrumentation bring new tools for information access and handling, for different communication possibilities, for collaborative work and learning, and for the management of access to overall learning settings. The permutations of new technological possibilities with new forms of user instrumentation are increasing faster than can be inventoried.

But this book does intend to provide an overview, not of all possibilities but of 17 cases representing state-of-the-art innovations in adult learning and the learning technologies involved. Each case is presented by authors centrally involved in the situation being described; each case reflects real practice as well as innovative ideas. The cases deliberately represent a wide variety of countries, types of learning innovation, and types of innovative technology. All authors were invited, as specialists in their fields, to

contribute to the collection. All are researchers working in practice-oriented settings and with learner-centred motivations.

Table 1 Overview of Cases

Parts and Chapters	I	II	III	Technologies
Part I Innovative instrumentation				
Information Overload	X		x	Information retrieval systems
Cognitive Tool for Learning Mathematics	X		x	Cognitive mapping tool
Learning from Other People's Dialogues	X	X	x	World Wide Web, Network
Using an Intelligent Tutor	X	X	x	Common database and intelligent coach
Networked Mediated Professional Specialization	X	X	x	Client package includes application programs related to the course; tools for accessing group workspaces, discussions; server supports public and private communications, representations of the knowledge base being built by the group
Modelling the Virtual Campus	X	X	x	Hypertext front end, teleconferencing, tools for content analysis, distributed multimedia database
Part II Innovations in learner collaboration				
Social Learning Systems	X	X	x	Software packages, networks
Collaborative Learning in Distributed Groups	X	X	x	Document-sharing software, parallel use of audio (non-integrated audiographic conferencing)
Virtual Mobility & Distributed Laboratories	X	X		Caucus conferencing system, email, Lotus Notes
Cooperative Learning in the Distance Learning of Adults	X	X	x	ISDN-connected desktop conferencing environments for audio and shared workspace and documents (integrated audiographic conferencing)
Cooperative Learning Between Schools and a University	X	X	x	ISDN-connected desktop conferencing environments for projects between teacher-education faculty and schools, including tele-mentoring
Cooperative Work Within Rehabilitation	X	X	X	Videophones, videophones and PCs connected via ISDN
Part III Innovations in practice				
Upgrading Adults Through Open and Flexible Learning	X		x	Caucus computer conferencing, network tools, 4-Windows interface to Lotus Notes
Increasing Access to Higher Education using ISDN Conferencing	X		X	Video conferencing and desktop-document conferencing with ISDN
Project Pedagogy and Computer-Supported Collaborative Learning	X		X	Computer conferencing
Distance Education at the College of Gjøvik	X	x	X	ISDN-connected workstations with videophones and desktop multimedia conferencing
Evaluating Technology Based Learning	x		X	Perspectives on evaluating innovations involving telecommunications in distance education

Notes:

I = Innovative Instrumentation

II = Innovations in Learner Collaboration

III = Innovations in Practice

X = Emphasized, x = Of some importance

The range of countries represented by the cases is a strong feature of this book: Norway, Spain, the UK, Netherlands, France, USA, Denmark, Canada, and Taiwan

The international selection of chapters and authors was done deliberately, in order to suggest trends and issues that transcend particular national policies or experience. The range of technologies and instrumentations is also broad, from chapters focusing on innovations in software design to chapters examining broadscale educational systems, where different technologies play an important role.

In trying to organise the chapters, many different possibilities of groupings were possible. The grouping chosen for this book, finally, was one based on degree of emphasis within the chapters rather of clear distinction among the chapters. This grouping reflects the focus in some of the chapters on innovations in computer-based instrumentation itself, the design and features of new software environments. Although all the chapters to a certain extent include discussion of new forms of computer-based instrumentation, six chapters in particular are grouped under this heading as Part I of the book. Many of the chapters emphasize innovations in facilitating learner collaboration as a key component of innovative adult learning. Twelve chapters involve this emphasis, but six chapters were judged to be particularly rooted in this interest and are grouped in Part II of the book. Because applications in practice was a core criterion for selection of chapters for the book, all of the chapters also share this characteristic, but five chapters in particular, where a broadscale integration of practice was a major aspect of the case, are grouped in Part III. Table 1 gives an overview of the book, with its chapter titles expressed in summary form, the overlap in orientation among the chapters suggested, and the technologies playing a major role in the cases noted.

2. PART I: INNOVATIVE INSTRUMENTATION

While all of the chapters in this book deal with innovative instrumentation (innovative software, innovative combinations of software and communication technologies), the six chapters in Section 1 each offer a detailed look at software packages designed for some aspect of the innovation of adult learning. Taken as a set, they provide not only a rich collection of software descriptions but also an increased awareness of how much the potential of innovative instrumentation, no matter the level of its technical sophistication, is shaped and constrained in its use by many human and organisational issues. The six chapters and some of their interrelationships are discussed below.

2.1 Reducing information overload:

Buenaga, Fernandez-Manjon, and Fernandez-Valmayor base their work on the problem of information overload, particularly with respect to textual information available in electronic platforms. Working over a number of years, they and their team have focused on the design of software tools to help learners reduce some of the information-related problems that occur in specific domains. In their chapter, "Information Overload at the Information Age", they identify two main approaches for such tools: the text-processing approach relying on the statistical analysis of text, boolean searches, document identifiers and keywords, and weighting factors; and the information-processing approach, attempting to build knowledge structures and user models in such a way that an increasingly "intelligent" interpretation can be made as to the information most appropriate to the user. As an application domain, Buenaga and his colleagues have focused on the particular area of reducing some of the information-related problems that confront users of the UNIX operating system. In their chapter they discuss three systems they have built for this context. The first used frequency-based techniques oriented at helping users manage the information existing in the text manual shipped with the UNIX system. This first system used a hypertext structure and some aspects of user and information modelling. Based on user reactions to this system, a second system was developed integrating a lexical database and a domain-specific unification

grammar. Finally, Buenaga and his colleagues describe a third system, under development, which is focused on explicit representations of the domain, represented as an ontological structure, and to which the various pages of the UNIX manual are being mapped. With this approach, the user will have overview maps of the domain in which the relationship of concepts and specific items from pages of the text-based manual are contextualized.

This chapter is a strong representative of a long line of research work, work not only within educational fields but also in the various disciplines concerned with human understanding of written language and language-understanding systems. In some ways, this work has limited direct application to the innovation of the learning process as seen from the perspective of current learners and their instructors. The systems developed require long and complex research work; the generalisation to domains outside that of the UNIX manual will be another long process. However, fundamental issues are involved: if learners are to be increasingly expected to learn in a more self-directed way, with more and more recourse to source materials and less instructor-managed confrontation with a knowledge domain, then the problem of how those learners can effectively handle the knowledge in that domain will become more and more central.

Can these complex selection and information-matching processes be automated enough, so that the adult learner in the future, working more and more independently in complex domains and without an instructor serving as a filter between the learner and information associated with the domain, can effectively find information useful to his learning needs? What will be the consequence if we do not offer such tools to a learner expected to be increasingly self-directed in the information age?

2.2 Cognitive tools for knowledge representation

Zwaneveld's chapter, "A Cognitive Tool for Learning Mathematics", directly relates to many of the same questions and issues as those in the chapter by Buenaga and his colleagues. In both cases, it is taken as crucial that the learner structure the knowledge domain in order to contextualize experiences and items within it. Buenaga and his colleagues are attempting this in their third information-processing system, involving ontological structures; Zwaneveld in contrast describes a software tool to support both instructor and student articulation of such structures themselves. Zwaneveld further sets the tool in a specific learning-activity context: students use the semantic mapping tool to represent their own structure of the knowledge domain in the form of a semantic network, as a learning activity within a course structure. The tool developed is called "KenniGraaf" (Dutch for "knowledge graph") and has been developed in Smalltalk/V. It is a concept-mapping tool allowing the user (instructor or student) to represent key concepts in a domain via various forms of boxes and to show linkages and the directionality of those linkages among the concepts.

While concept mapping tools are not new, their application has still been little absorbed into instructional practice and their implementation as a software type has not yet reached any mainstream usage. One of the instructional strategies considered by Zwaneveld in the application of KenniGraaf was to compare the semantic networks constructed by a first group of learner-users among each other and also to that of an expert (the instructor). Interestingly, such comparisons are proving difficult, in that each representation being produced differs in many ways from the others. From a constructivist perspective, this is not surprising, as one's view of a domain will be personal and unavoidably contextualized in one's own prior experiences and existing semantic networks. From the perspective of creating an "intelligent help system" such as described by Buenaga and his colleagues, the observation is significant: if concept mappings of a domain are so individualised, then what is the possibility of developing "a" conceptual ontology of a domain as the reference for an automated information system?

Particularly interesting in Zwaneveld's chapter is his attention to the user interface of the KennisGraaf system, including important questions about the functionality of such a system and how to balance adequate power of expression with a user interface that is as simple as possible to use. The skills required to use the tools must be minimised, while at the same time the expressive power available to the learner should be as great as possible; this is continually a challenge for software tools, especially if the learner is to use those tools in an increasingly self-directed manner.

2.3 Learning from the questions of others

While Zwaneveld's work is focused on tools to support the learner's development of the conceptual overview of a domain, Mayes and Neilson are focused on tools to support effective learning through the question-and-answer experience of class members. In their chapter, "Learning from Other People's Dialogues: Questions about Computer-Based Answers", they discuss the innovative use of networked hypermedia environments for the redistribution of one-to-one dialogues between learner and tutor to multi-user environments where appropriate dialogues can be matched to the learner's immediate need. One way in which this is being implemented is through the "Answer Web", a way of using the functionality of a World Wide Web distributed hypermedia environment. Within the Answer Web, questions being presented by learners contribute to the growth of an interlinked system of questions and responses which are accessed by other learners. If a new question is not well handled by existing resources in the Answer Web, a new question can be sent to the instructor, who can then decide if the question can be a new node in the Answer Web or could have been answered through closer attention to a previous dialogue already present in the web. A particularly innovative aspect of the Answer Web environment described by Mayes and Neilson is that it allows the value of critical variables in the current state of simulation programs to be linked to the learner's question and then further to the Answer Web system itself, thus adding interactive simulations to the other forms of expression (text, audio, graphics, video) available in hypermedia Web environments. Mayes and Neilson see the potential of Web environments as perhaps most strong through the idea of the growth of the Answer Web organically via the continued input of new questions and resources by the participants themselves, but through the tree structure linking the already contributed dialogues and the tree structure linking the already contributed dialogues and resources. In this way, Mayes and Neilson see the participants and the system itself building a structured overview of the domain, thus both similar and different to what was described by Buenaga and his colleagues and Zwaneveld. All three are similar in that they yield an integrated overall structured organisation relative to a learning domain; Buenaga and Mayes and Nielsen share a strong focus on natural dialogues and language, but differ in how the structure for interpreting natural dialogue is built up and in the instrumentation to do it. Zwaneveld and Mayes and Neilson are similar in their focus on the value of the learner being involved in the development of the structural overview that evolves while studying a domain, but differ in that Zwaneveld's is primary a individual's view of the domain while Mayes and Neilson grows organically through the input of and sharing of dialogue among many.

Mayes and Neilson use an environment, HTML and the World Wide Web, that has a great advantage compared to the other instrumentations discussed in this book--it is an environment easily available to designers and developers throughout the world, not a prototype system situated in a local environment whose access is typically limited to those involved in its development.

2.4 Intelligent tutoring for collaboration

In the chapters by Buenaga and his colleagues and by Zwaneveld, the scenarios being supported involved the individual learner, either participating in a course or needing to access and structure information for his own learning need. Even in Mayes and Neilson's Answer Web system, the learner probably approaches the system in response

to his own individual needs, even though its content is in fact the product of the interactions of the learning community. In many cases, however, learning in the context of social interaction is of particular importance. Such collaborative learning is not an automatic consequence of asking learners to work together; educational literature contains many examples of the difficulties confronting effective group learning. Some of these difficulties relate to group organisation and management while others to the communication skills of the group members. Difficulties relating to the task to be solved collaboratively offer another layer of challenge. Effective collaborative learning is complex to manage in the face-to-face setting, but because even more challenging when the participants are networked, and carrying out at least some of their collaboration via software tools. In the chapter by McManus and Aiken, "Using an Intelligent Tutor to Facilitate Collaborative Learning", the design and use of an "intelligent collaborative learning system" to assist in collaborative learning among networked group participants is described. (In Part II of this book, collaborative learning in general is focused on in more detail).

McManus' and Aiken's system involved tools to handle different sorts of needs associated with collaborative learning. There are tools to facilitate group meetings and project management, tools to monitor participants' discussion, tools for the instructor to enter task-related information, tools to help the participants develop a "common-knowledge database", and most innovative, tools to tutor or coach the participants on effective communication skills for group work. The latter, called the "Group Leader Intelligent Tutor", is the innovative heart of the system. This tool has a number of aspects: it helps participants to structure their discussions by use of menued sentence openers, it contains a parser to react to the participants' input following their choice of the various menued sentence openers, it compares the input to a database of examples of good collaborative practice, it maintains a learner model of each participant and updates this model following its assessment of the person's collaborative-skill practice, and it provides feedback in the form of coaching to the users as to how well their input reflects various cooperative skills related to communication, trust, leadership, and conflict handling.

McManus and Aiken describe the specifics of their system and also give the results of first uses of the system by students in an informatics course at the university level where the students work collaboratively on the development of a computer program in the C language to perform various statistical tasks. The assignment was organised so that students had to work as a group in order to complete the overall task, dividing the responsibility for various components of the task to different subgroups of students. The students were positive about the support system, both in its functionality and its user interface.

The particular value of this chapter is in its identification of the value of tutoring and coaching with respect to effective collaborative learning and of a tool to manage the provision of this tutoring and coaching in a computer-based way to distributed group members. Just as the work of Buenaga and his colleagues shows that providing learners with access to information is not enough without appropriate tools to filter and contextualize the information, the work of McManus and Aiken shows that setting the expectation for collaborative working is not enough without anticipating the need to help participants learn how to work together collaboratively. Again, the use of innovative instrumentation provides an important key to integrating the innovative use of collaborative learning into instructional planning.

2.5 Integrated support of collaborative learning at a distance

Similar to McManus and Aiken's work, Verdejo in her chapter "An Experimental Project for Networked-Mediated Professional Specialization: Distance Learning Scenario, Design and Support System" also describes the design of integrated software

tools to support the learner involved in collaborative activities. In Verdejo's chapter the system described has a broader range of intended functionalities than was the case with McManus and Aiken's, in that Verdejo's system supports an overall course being offered at a distance, not only the collaborative learning activities occurring within that course. In Verdejo's system, software support is supplied for a course in linguistic engineering in which there are three types of users: students, tutors, and a network manager. The four tutors involved are based at three different universities; the students represent a variety of profiles. The learners work both individually and collaboratively, all at a distance. The system that Verdejo describes in her chapter includes tools for all these learning modalities. For the learner, tools include single-user software for the creation and modification of clause-grammar formalisms, and also tools to support task-oriented collaborative work and task-oriented discussion. The tools are integrated with a common workspace for each group, and with successive releases of the group's "knowledge base". Tools are also available to link aspects of group discussions to aspects of the group's problem-solving activity. Tools are also provided for the tutors and the system manager. The tutors have mechanisms for group participation, group intervention, and for various forms of communication, private and public.

Verdejo's work, like McManus and Aiken's, Mayes and Neilson's, and Zwaneveld's is embedded in a particular course context, where adults are able to work in innovative ways within the course through the combination of insightful instructional and instrumentation design and innovative technologies. Like the other chapters in Part 1, Verdejo provides valuable detail into the design of the instrumentation supporting this innovation. Like most of the authors of the chapters in this overall book, Verdejo also notes the need for a "deep change in the organisational model" being used for instructional delivery if innovative learning via innovative technologies is to be realised. As the difficulties involved in stimulating instructors, particularly of adults, to alter and expand their familiar methods of instructional delivery are well known, the realisation of the potential of the innovative instrumentation being described throughout this book, but particularly in Part 1, beyond the prototype level will require time, strategy, and continued improvements in the functionality of the instrumentation and technologies involved.

2.6 Tools for the virtual campus

While each of the previous chapters has referred to instrumentation for a particular course or problem domain, Paquette's chapter, "Modelling the Virtual Campus" moves a step higher in its focus, to the level of metaphors as well as instrumentation to support an overall architecture for distributed innovative learning among adults at the Télé-université in Quebec. With over two decades of experience and more than 200,000 students following its courses, the Télé-université is evolving new "tele-training models" and the tools needed to realise those models. In Paquette's chapter the complex and interrelated aspects of these models are described, from the learner's perspective, the course developer's perspective, and also the perspectives of instructors, content experts and technical managers involved with the design and use of materials, instructional examples, and tools for the emerging "Télé-université".

Key to the integration of the actors and their roles in the Télé-université is the "HyperGuide" user interface, which offers the learner-user access to three main areas of activity: access to communication with advisors, access to tools and environments for collaborative activity, and access to the repository of multi-media documents and the tools to handle and retrieve what is useful from those documents. All of these areas of activity are accessed via an "interactive road map". Clearly the evolution of this virtual campus for the Télé-université of Quebec is a long and emergent process; Paquette's chapter describes various component projects under development as well as the conceptual model for a virtual campus that underlies both the process and intended

product. The functional specifications for tools needed in the eventual "teletraining workbench" is a major task, as the example shown in Paquette's chapter indicates.

2.7 Innovative instrumentation: a conclusion

The software environments described in Part 1 of this book are indeed complex and innovative. As they are particular examples, they have grown from local needs and typically are designed to fit a local situation. All can be generalised, at least in concept, to critical needs facing innovative adult learning in general--needs relating to support for information handling, for communication, for collaboration as the learner moves farther and farther from the traditional model of education. All show what a complex and difficult job it will be to eventually have generic tools for a wide range of potential learner needs. Yet each is now functionally, at least at a partially realised level; each is now making an important contribution to the viability of innovative learning in its home setting. Without the instrumentation, the innovative learning would be less innovative and less rich than it now is in those settings. In some cases, the innovative learning would not be possible without the instrumentation.

But instrumentation is never enough in itself, as all the above chapters make clear. Much focus must also be given, in parallel, to the human dynamics of learning and interaction, in order for instrumentation to have meaning in practice. In the second part of the book, six chapters are grouped that each give a particular focus to the process of collaboration itself among adult learners, and through this focus, on the instrumentation and technologies that can support and stimulate the process.

3. PART II: INNOVATIONS IN LEARNER COLLABORATION

There are many ways to consider learner collaboration as an innovative aspect of adult learning. Different learning scenarios involving collaboration can be identified, the process of collaboration itself can be studied, the examination of some of its aspects in more detail can occur, the application of the process can be described in terms of its educational and social value, and the technology and instrumentation that support collaboration and potential stimulate or frustrate it can be described and evaluated. The six chapters in Part II relate to these various perspectives; all of them share the last. In addition, four of the six chapters in Part I also related to tools for learner collaboration with the chapter by McManus and Aiken centred on this topic. Thus supporting learner collaboration via innovations in technology is a strong theme of this overall book.

3.1 Social learning and its support

Chan's contribution, "Social Learning Systems", identifies a range of metaphors for social learning, learning where interaction between partners is a key focus. While not all of these metaphors involve collaboration between the partners, Chan's analysis helps to place collaboration within the spectrum of social-interaction possibilities. But the metaphors in Chan's analysis are not presented in the abstract; each is accompanied by a discussion of various computer software packages which realise the metaphor. Particularly interesting is Chan's distinction between centralised and distributed social learning systems. Centralised social learning systems are defined as simulated learning companion(s), with no connection to other computers, while distributed learning systems support groups of human students in different locations learning together through networked computers. The extension of social learning to also include "learning companions" as programmed within software enriches our overall sense of what social interaction can involve and also places the ensuing description of various distributed social learning systems in a broader perspective. Following the overview of various metaphors for social learning and their technological realisation, Chan also includes a framework of design issues for social learning systems which are relevant for innovation in collaborative learning. The scope of Chan's work, and its

creativity, provide an effective entry to the more-specialised studies of innovations in learner collaboration in Part II.

3.2 Researching collaborative learning: small groups and higher-order thinking tasks

What is effective collaborative learning? This question underlies all the innovative activity in this area; not surprisingly, the question is not easy to answer and the measurement problems associated with giving an answer to it are considerable. Heeren's chapter, "Investigating Collaborative Distance Learning in Small Groups Which Use Audio Conferencing and a Shared Workspace", illustrates the selection of a theoretical framework for the study of collaborative distance learning and the application of that framework to specific technological settings. In particular, Heeren describes the design chosen to study three-person groups of university students where the groups are seen as information-processing systems whose members do not see each other as they work together, involved in a problem-solving task whose goal is the strengthening of higher-order thinking skills in the context of ethical issues. The physical distance among the group members was compensated for by either audio conferencing or the combination of audio conferencing and the use of shared workspace software, allowing the participants to share the same screens and software environments, and with their respective cursors to work collaboratively on the shared document which they evolved in the course of their collaboration.

Heeren's article shows the complexity involved in looking more closely at collaborative learning. As with that of McManus and Aiken in Part I and those of Chan's, Heeren's analysis shows that collaborative learning is not a single-variable phenomenon but instead a descriptor for a domain that is complicated not only in metaphor, but also in instrumentation and in task and setting.

3.3 Researching collaborative learning: distributed researchers and on-going learning

While Heeren chose as a focus collaborative learning among small groups carrying out a well-defined task, Lewis and Collis describe another research focus--groups of distributed researchers, sometimes loosely defined in terms of both group membership and task, but learning from each other as members of a professional community. In their chapter, "Virtual Mobility and Distributed Laboratories", Lewis and Collis describe a research project based on the general question of how to support effective collaborative learning among distributed professionals learning from each other in their informal interaction. Unlike Heeren, who chose an experimental approach to identify critical variables in tele-cooperation, the VMDL Project (Virtual Mobility and Distributed Laboratories) in which Lewis and Collis are project leaders has chosen the naturalistic study of distributed researchers, their needs and existing technological strategies for on-going professional interaction through knowledge exchange and various learning-related cooperative activities. Through this study, involving researchers in various European countries, a systematic inventorisation is occurring of collaborative behaviours, needs, and learning opportunities among international professional communities and of the instrumentation and technologies that can support these interactions.

3.4 Balancing collaboration and autonomy

In contrast to the on-going learning that accompanies the professional collaboration of distributed researchers that is being studied in the VMDL Project, many forms of collaborative learning for adults occur within the framework of participation as learners in a specific course. Particularly in the course-specific situation, one important complication of collaborative learning for adults is its balance with autonomy and individualisation. In particular for adults for whom on-the-job and just-in-time learning

bring important new flexibility to the learning process, the integration of collaborative learning experiences with others can become increasingly difficult to realise the more that flexibility is being made available in other aspects of the learning setting. In their chapter, "Cooperative Learning in the Distance Education of Adults: Why, How and First Results from the Co-Learn Project", Derycke and D'Halluin focus on this balance, and describe their principle of "cooperative autonomy" for adult continuing education. Essential to it is being able to participate in a network of co-learners and educational agents, and to use computer networks and various tools for both synchronous and asynchronous interaction. Also essential is the delineation of appropriate collaborative learning activities for adults, so that the tools have a motivated reason for their use.

Against this framework, Derycke and D'Halluin describe some results that have accumulated from their trials of a prototype system, Co-Learn, that offers a range of such tools to the adult learner distributed from his learning partners but interacting with them through a desktop conferencing environment. This portion of the chapter could well be placed within Part I of this book, in that the instrumentation described is indeed innovative. However, the chapter overall makes its strongest contribution in its overall analysis of collaborative learning activities for adults and how instrumentation can relate to those; the main message that emerges is the importance of selection of appropriate activities for collaborative learning, the tension between stimulating these activities and accommodating the adult learner's needs for individualisation and flexibility in learning settings, and within this, the contribution that a single desktop system with well-designed instrumentation can bring to this tension.

3.5 Collaborative educational projects using desktop conferencing

Like Heeren, Lewis and Collis, and Derycke and D'Halluin, Davis also begins from a standpoint of understanding the nature and characteristics of group collaboration and through this the design of adequate computer-based technologies to support particular types of this collaboration. In her article, "Co-Operative Group Work Between Schools and a University Using ISDN2 and Desktop Conferencing", Davis radiates out from the standpoint in a different manner from Heeren, who set up an experiment after careful consideration of a theoretical framework and design parameters; from Lewis and Collis, who describe the investigation of existing practice; and from Derycke and D'Halluin, who worked to embed their theoretical understandings in a software environment. Davis' direction is to look for, and try out, a variety of types of collaborative activities among teachers, students, teachers-in-training, and university specialists when these different persons had the opportunity to use specialised desktop conferencing environments for collaborative learning. As with Derycke and D'Halluin's system, the technology involved in Davis' field experiments used ISDN connectivity to allow the sharing of voice and computer systems through single desktop computers. In particular, participants at the two ends of a connection can talk with one another while running the same software together, altering it together, and passing files and information back and forth. Davis and her colleagues have carried out a range of explorations, many involving children, in which collaborative learning experiences were made possible through joint use of the desktop environments.

After looking deeply at the complications that ensue when attempting to measure the effectiveness of collaborative learning scenarios (in Heeren's chapter and also that of Lewis and Collis') or when translating a large range of desired functionalities into new instrumentation (Derycke and D'Halluin's chapter), Davis' work is encouraging and refreshing; Yes!, despite the complexities, there are many good things that can happen in new and innovative combinations of collaborative learning. Innovative technologies, such as current versions of desktop conferencing, although they may not be ideal instrumentations, can be used, now, for innovative learning. But of course the technologies in themselves are not the ends but only the means; their use in the hands of

creative and well-informed educators like Davis and her colleagues is what brings a critical synergy which transcends the theoretical analysis of possibilities.

3.6 Collaborative learning and the handicapped

Like Davis' chapter, Flydal also focuses on the field and what can be facilitated when particular groups, with particular needs, can increase and enrich their possibilities for working together collaboratively because of innovative technologies. Flydal, in his chapter "Co-Operative Work Within Rehabilitation Through Videophones and Computers", describes how various combinations of videophones, computers, and software are bringing new possibilities for communication and collaboration for people with impaired speech, hearing, sight, and/or movement. In a two-year project, 46 field offices supporting the rehabilitation needs of handicapped adults in Norway were equipped with standard ISDN videophones, allowing the simultaneous transmission of voice and video image, and the personnel in these settings were given training in how to use this equipment. In addition, other tools were gradually added to the standard videophone base, in particular computers and software integrated with the videophones.

As with Davis', Flydal's work shows how knowledge of the needs and characteristics of the potential users, coupled with effective technologies and sparked by creativity, can tap a wide range of ideas and applications. The needs and characteristics of the handicapped and often socially isolated adult learners in Flydal's setting required some technical adaptations, for example, for those who cannot operate a keyboard or keypad. Examples of how innovations in input technologies were used to allow collaboration to occur are an important part of Flydal's chapter, not only for their technical aspects, but more meaningfully because for many of these users, there had been no way before these technologies to collaborate with others at all.

But Flydal describes more than only the unleashing of collaborative possibilities for handicapped learners. The project he describes also stimulated new forms of collaborative learning among the professionals involved, including remote cooperative diagnosis. Not only were the professionals able to work more efficiently, an important consideration given the distances in Norway and difficulties in making face-to-face contacts, but they were able to learn from each other in new and creative ways through the networked videophone-based systems connecting all their field offices.

This chapter could well be placed in Part III of this book, the part focusing on innovating learning with innovative technologies in broadscale practice. However, its primary focus on making collaboration possible and stimulating its purposeful application through sensible and professional use of existing technologies have placed it in Part II of this book. Like a number of the other chapters, Flydal's spans all three of the divisions in the book.

4. PART III: INNOVATIONS IN PRACTICE

As with Flydal's chapter and also with Paquette's in Part I, the chapters in this section of the book describe innovative learning situations integrated into broadscale field settings. Each focuses on a particular situation in which innovative technologies play a facilitative part. While the first four describe settings related to professional development and to different manifestations of deep-seated changes at the university level, the final chapter reflects a different perspective: that of the evaluation of innovative learning for adults with innovative technologies.

4.1 Professional development at a distance

Lifelong learning: beyond being an idea and a attention-capturing phrase, how can it be realised in practice? Ask, in her chapter "Upgrading Adults Through Open and Flexible Learning", describes various examples in Norway involving medical practitioners,

corporate staff, and other professionals that are leading to change in the organisation of studies at academic institutions more generally. Using computer conferencing, other networking tools, and a specially developed interface over Lotus Notes, a variety of trials have taken place investigating the distribution of electronic materials and the support of group work and cooperative learning among professionals at their workplaces. While there is a general appreciation of the flexibility in the environment and the increased access to relevant resources, Ask notes that it is a more difficult task to bring professionals to an orientation toward sharing and exchange of knowledge. There remains a general expectation that some sort of tutor will structure and lead a learning experience and the self-discipline and strategies necessary to contribute to a common knowledge base and to cooperative learning processes are still new to most professionals.

To better facilitate the culture change that will be necessary for lifelong learning to be realised, Ask describes various developments among academic institutions in Norway involving new ways to combine courses, new ways of offering access to distributed students, and new kinds of cooperation among faculty and staff. Ask's chapter highlights a central question: How can the gap between idea, potential, and project be bridged in practice? What sorts of organisational and cultural changes must occur before innovative learning for adults yields broadscale alternatives?

4.2 A university without boundaries

Milner's chapter, "Increasing Access to Higher Education Using ISDN Conferencing to Create a Virtual Classroom: A Model From the University of Sunderland", shows how one institution is responding to lowering the gap between vision and practice with regard to adult learning. Through its "University without Boundaries" initiative, the University of Sunderland is using ISDN conferencing technologies to support a diverse range of adult students in its region to study microcomputing skills in interactive but flexible ways. The focus of the initiative is not on reducing geographical barriers to higher education but rather cultural barriers. Flexibility pertains to both organisational and instructional aspects, and with special attention to facilitating the transition from stimulating flexible variation in learning to moving the learner into more traditional learning paths when appropriate.

The use of ISDN-based desktop and video conferencing, established at points throughout the region, is the major link between the university and the community for the initiative. Learners especially appreciate the document conferencing aspects made possible through such technology--that an individual can come to a regional ISDN-point, connect to a tutor and show the tutor what he or she has done with a certain software package, discuss the work together while it was displayed on their screens, and changed by either party via their own keyboards. Tutor training for effective work in such an environment is important, but not yet consolidated (nor is it consolidated anywhere, because of the newness of these environments as pedagogical domains.)

Milner emphasises that the university-without-boundaries principle is no longer only an idea at the University of Sutherland, but a reality, one which does not detract from the provision offered at the host campus, but rather extends it. However, she also notes the reality of funding-dependency as a challenge to the growth of such extensions.

4.3 A project pedagogy for distance learning

While innovation at the University of Sutherland has as one of its core motivations increasing the openness of the university to members of the community, a core motivation for learning innovation at the University of Aalborg in Denmark is to extend its project-oriented pedagogy to students studying at a distance. The project pedagogy at the University of Aalborg is based on a problem-oriented and interdisciplinary organisation of learning experiences, where learners working collaboratively and in

control of their own problem solutions are the core instructional characteristics. Making this kind of experience open to students wishing to study at a distance, from their homes or workplaces, has required not only technological innovation but also instructional and organisational change.

Computer conferencing is used as the means of interaction for the distributed groups participating in the project-approach, and Dirckinck-Holmfeld summarises the experiences since 1987 at Aalborg with the use of this technology in this context. She notes computer-mediated communication's central value in creating a "collective room" of experiences and reflections for the distributed learners, and of stimulating new, communal development of course materials and organisation, a process which she notes can break down the dominant paradigm in traditional distance education, of prepared study materials and guides, and replacing it a knowledge-construction activity among the participants. Dirckinck-Holmfeld sees computer conferencing has having its major contribution to exchange on information, to brainstorming, for exchange of comments on written work, and for updating on organisational issues. Its use for substantive dialogues and discussions she finds to be more limited.

4.4 Distance learning about technology through technology

Similar to the evolution of experience with computer conferencing at the University of Aalborg, the College of Gjøvik in Norway in another example of how such experience can evolve in order to expand and enrich the learning experience for adults at a distance from a home-campus site. In his article, "Distance Education at the College of Gjøvik, Norway", Sponberg describes the evolving use of videophone technology for innovative distance learning in technical subjects such as engineering, nursing, and forestry at his college. Videophone technology makes it possible, at low cost, to give lectures with live pictures and sound at any distance, and since 1992 the College of Gjøvik has been continuously involved in investigation of the potential of this technology for its educational needs.

One of these needs quickly emerged: to provide for more than the transmission of lectures with opportunity for real-time verbal and visual communication by also making available the opportunity to integrate computer software and interaction with that software into the interconnectivity. As with Davis' chapter in Part II and Milner's chapter earlier in Part III, ISDN networks are used to combine this kind of application sharing with the benefits of live person-to-person communication, all within the costs of ordinary telephone calls. At the College of Gjøvik training is now taking place at a distance through these desktop technologies in computer-aided design for architects and engineers and in geriatrics for nurses, specialist courses which earlier required professionals to find time and funding for periods of study away from their homes.

Sponberg, from his experience within the evolution of innovative learning at the College of Gjøvik, completes his chapter by noting that the possibilities for such innovation are many, bounded only by the lack of imagination. Yet his chapter, like the others so far in this Part, show that imagination must be combined with many other components in order for broadscale learning innovation to take place in practice.

4.5 Evaluating technology-based learning

This complexity not only challenges the development of innovative learning situations but also their evaluation. In her chapter, "Evaluating Technology-Based Learning", Mason, herself a practitioner and innovator in the use of computer conferencing in distance education, draws on her parallel experience as an evaluator of innovative-learning projects involving new technologies to comment on the difficulties of answering the predictable and reasonable question: "Was the learning more effective with the particular technology than it would have been without it?" The question of measuring the effectiveness of innovative learning is not only a research-design

problem (see, for example, Heeren's chapter in Part II) but also a practical problem, directly related to the continuation of funding support and of institutional support for any initiative (see for example Milner's chapter earlier in this Part). Learners and those who support them must be convinced that the complexities involved in using innovative technologies are to be repaid by the benefits to come from that use. While benefits are often quick to see in projection, i.e., to realise a university without boundaries, or in immediate added value, i.e., to bring collaborative learning possibilities to handicapped adults who would never have them otherwise (see Flydal's chapter in Part II), benefits in practice with respect to learning outcomes are harder to measure. Mason illustrates these measuring difficulties in her chapter and discusses an holistic approach to the evaluation of innovative learning with innovative technologies. Her discussion makes it clear that such evaluation must be both skill and craft, both disciplined and transcendent, in order to fit its target.

5. CONCLUSION

In this book, a fascinating collection of first-hand experiences in innovating adult learning with innovative technologies has been realised. The range of settings and technologies is considerable; the experiences while differing in various aspects, share certain central similarities.

All begin with a real learning need for adult learners -All show all integration of context and technology in response to that need -All show the importance of supporting communication and collaboration as part of innovative learning -All show that the task is often hard, time-consuming, and evolutionary

And while all show that innovative learning technologies can expand or make possible learning innovation appropriate and attractive to adults, they also clearly support the observation made by Mason as the close of her chapter:

"More important than these specific conclusions...is the overriding conclusion about learning technologies generally - that their contribution to learning comes primarily from the ability of teachers and course designers to use them in context and adapt their instructional methods to the medium as well as to the social, cultural and cognitive demands of the learners". (Mason, this volume)

And even though new learning paradigms for adults may be expanding the traditional definition of who is the teacher and who is the learner, Mason's conclusion remains valid. Especially as more and more adults have the opportunity to make their own decisions about learning, the expectation that the individual learner will have the insight and ability to make these adaptations and learning decisions for himself will arise as a major constraint on realising the possibilities of innovative learning technologies. As Ask's chapter in Part III shows, such an expectation is far from realised. Its realisation will lag considerably behind developments in learning technologies themselves.