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Designing Instruction for e-Learning Environments

Som Naidu
The University of Melbourne, Australia
s.naidu@unimelb.edu.au

INSTRUCTIONAL DESIGN IN CONTEMPORARY OPEN AND DISTANCE LEARNING (ODL)

Contemporary open and distance learning (ODL) is widely known for spearheading and refocusing our attention on several aspects of teaching and learning. The most pervasive of them all, perhaps, is the recognition of the important role and function of instructional design. Others include the role and function of electronic publishing and distribution of study materials, use of alternative and noncontiguous delivery technologies in teaching and learning (i.e., alternative to face-to-face instruction), asynchronous communication among participants in learning and teaching, and ownership of intellectual property and copyright.

In much of traditional face-to-face education, what passes for instructional design was and still is, rightly or wrongly, the sole responsibility of the teacher in charge. This situation changed with the advent of nontraditional distance teaching and learning practices. Teachers in charge, largely as subject matter experts, could no longer be seen to be responsible for the entire teaching and learning transaction. The development of printed and other types of study materials for independent study by distance learners required a team effort with significant input in the educational process from instructional designers and media producers. This brought into the educational process specialized skills in various types of media production, subject matter representation, and in supporting student learning in technology mediated educational environments.

Despite this growing recognition of the important role and function of instructional design in ODL, educators have, on the whole, failed to make the best use of the opportunities that alternative delivery technologies can provide. Evidence of this is all around us in the form of innumerable university course Web sites that contain little more than the schedule, a brief outline of the course content, PowerPoint slides of the lecturer's notes, and sometimes, sample examination papers. Instead of exploiting the unique attributes of information and communications technologies, such practices replicate the "education is equal to the transmission of

information" model of teaching that is so common in conventional classroom practice. Regardless of the capabilities of the delivery medium, the nature of the subject matter content, and learner needs, much of educational practice continues to be teacher directed and delivery centered. Rarely have we paused to think about why we are teaching the way we do teach and support learning and whether our instructional approaches are based on sound educational principles of cognition and learning.

This kind of instructional practice has led to a great deal of frustration for learners and teachers, many of whom have grown increasingly skeptical about the educational benefits of the newer delivery technologies (see Kirkwood, 2000; Rumble, 2000; Schellens & Valcke, 2000). The source of much of this frustration has to do with the failure of instructional designers and subject matter experts to come up with instructional and learning designs that best match the type of the subject matter and the needs of learners within the parameters of their learning environments.

CONTEMPORARY DEVELOPMENTS IN OPEN AND DISTANCE LEARNING

Surveys by the U.S. Department of Education's National Center for Education Statistics (2000, March) show that the number of "distance education-like" programs in the United States has been increasing exponentially, and many more institutions plan to establish distance education programs in the next few years. The U.S. National Survey of Information Technology in Higher Education (1999), as part of its Campus Computing Project, carries out surveys annually on the use of information and communications technology in higher education. One of its recent surveys (1999, February) reveals that:

- An increasing number of college courses are incorporating information and communications technology, including use of e-mail as part of their teaching and learning transactions, Internet resources as part of the syllabus, and the World Wide Web for presenting course materials.
- Students and faculty alike are spending an increasing amount of their study time on the Internet and both student and faculty percentages in this regard are highest in research universities.
- Across all sectors of higher education, a growing number of institutions are using the World Wide Web to provide students access to admission forms, financial aid applications, course catalogs, and other related material.

The proliferation of information and communications technology (ICT) in conventional, campus-based educational settings is clearly blurring the traditional boundaries between distance education and campus-based, face-to-face educational practices. However, it is not an objective of this chapter to trace in great detail contemporary developments in distance education, nor is its goal to define the various forms of educational activity that incorporate open and distance learning practices.

The focus of attention in this chapter is on designing learning and instruction for educational settings that incorporate use of information and communications technologies. The preferred terminology for such educational settings is e-learning. One of the most comprehensive descriptions of e-learning describes it "as the systematic use of networked multimedia computer technologies to empower learners, improve learning, connect learners to people and resources supportive of their needs, and to integrate learning with performance and individual with organisational goals" (Goodyear, 2000). This definition has two main parts—a reference

to information and communications technology (and in particular to the systematic use of this technology) and a reference to purposes or goals. While e-learning embraces distance education practices, distance education's broader scope also incorporates print-based correspondence education. Hence it is meaningful to equate e-learning with distance education, but distance education is not necessarily e-learning (Rosenberg, 2001).

The use of the term *e-learning* is growing rapidly all around the world and frequently being used interchangeably with terms such as *online learning, virtual learning, distributed learning, networked learning,* and *web-based learning*. Despite their unique attributes, each of these terms fundamentally refers to educational processes that utilize information and communications technology to mediate asynchronous as well as synchronous learning and teaching activities. Indeed, with the exception of conventional open and distance learning, it can be argued that the emergence of *e-learning, online learning, virtual learning, distributed learning, networked learning, and web-based learning*, is directly linked to the development of and access to a reliable and robust information and communications technology infrastructure. Without access to this kind of infrastructure support, the viability of such educational activities is undermined and those without access to such support are increasingly disadvantaged from accessing the educational opportunities they afford.

E-learning appears to be growing out of three distinct directions:

1. From within educational providers, which have historically offered open and distance learning opportunities either in a single, dual, or mixed mode.
2. From conventional campus-based educational institutions that have never been involved in open and/or distance learning. Such institutions are applying information and communications technology to support and enrich their campus-based, face-to-face learning and teaching experience. Their goal, in most cases, is to increase flexibility and efficiency in the belief that doing so will enable them to tap into niche markets and student populations, which were previously out of their reach.
3. From the corporate sector, where many organizations are favoring e-learning to conventional residential workshop-based approaches to staff training. The corporate world is increasingly finding e-learning to be an attractive model as it offers flexible and "just-in-time" learning opportunities.

Forces driving the growth and development of e-learning include:

1. The increasing accessibility of information and communications technologies and also their decreasing cost.
2. The capacity of information and communications technology to support and enrich conventional educational practices through resource-based learning and synchronous and asynchronous communication.
3. The need for flexible access to learning opportunities from distributed venues such as the home, workplace, the community learning center, as well as the conventional educational institution.
4. The demand from isolated and independent learners for more equitable access to educational opportunities and services.
5. The belief among many educational institutions that the application of information and communications technology will enable them to increase their share in an increasingly competitive educational market.
6. The need, among educational institutions, to be seen to be "keeping up with the times" in order to attract the attention of parents, students, and other donors.

7. The belief and the expectation that e-learning will reduce costs and increase productivity and institutional efficiency.

There are also forces working against the growth of e-learning and these include:

1. The lack of access to reliable communications networks with sufficient bandwidth capacity in most parts of the world. Even in relatively developed and affluent societies such as North America, Western Europe, and Australia, major disparities along geographical and socioeconomic lines exist in access to this infrastructure. This kind of disparity is arguably the most critical issue that is impeding the proliferation of e-learning.
2. The lack of basic necessary ICT appliances such as computers and modems, including know-how, which is increasing the "digital divide" and widening the gap between the "have" and the "have-nots."
3. Intellectual property and copyright laws that restrict the sharing of information and collaborative arrangements.
4. The up-front costs of establishing an e-learning program, even if savings can be achieved over time and economies of scale. The costs of hardware, software, and ongoing electronic communication for both the institution and the learners are a major deterrent.
5. Absence of suitable and effective models of learner support that are designed for supporting learners in e-learning environments.
6. Reticence and a lack of enthusiasm on the part of faculty to embrace information and communications technology in their teaching and in supporting learning. A large number of faculty still lack the necessary skills to effectively use these technologies and are unsure about the merits of incorporating them in their teaching. Some of this fear is driven by student demands and expectations for lecturers to be lecturing and also by the incentives and rewards for promotion and tenure that are currently in place in many educational institutions. The latter tend not to reward excellence in teaching as much as they do reward excellence in research. The educational philosophy that faculty hold, and what is likely to work in their own discipline areas, is also a major contributing factor in the adoption of these technologies.

ATTRIBUTES AND CAPABILITIES OF e-LEARNING EDUCATIONAL TECHNOLOGIES

E-learning educational technologies are information and communications technologies that enable the delivery and use of information in electronic formats. This chapter does not attempt to describe the form and functions of these technologies as there is an abundance of literature in print as well as in electronic form on these technologies (see Rapaport, 1991; Collis, 1996). Instead, by way of an introduction, it briefly recounts the critical and unique attributes of these technologies. These attributes are a) the flexibility that e-learning educational technologies afford; b) electronic access to a variety of multimedia-based material that these technologies enable; and c) opportunities for learning and teaching that they afford.

The Flexibility That E-Learning Educational Technology Affords

Flexible access to information is the most identifiable attribute of e-learning educational technologies. Learner choice is at the heart of the concept of flexible access, which incorporates the facility to access subject matter content and support at a time, place, and pace that is suitable and convenient for the individual learner, rather than the teacher and/or the educational

organization. Flexible access to subject matter content and learning activities orchestrated via e-learning technologies across classrooms, workplaces, homes, and community settings is the defining characteristic of what has come to be known as flexible and distributed learning (see Dede, 2000; 1996). E-learning educational technologies such as various forms of "groupware" and computer conferencing technologies can support collaborative inquiry among students who are in different locations and often not online at the same time (e.g., Edelson, Gordin, & Pea, 1999; Edelson & O'Neill, 1994). Through a mixture of emerging e-learning technologies, learners and teachers can engage in synchronous and asynchronous interaction across space, time, and multiple interactive media (see Gomez, Gordin, & Carlson, 1995). With the help of these technologies and telementors, students from different locations can create, share, and master knowledge about authentic real-world problems (see Edelson, Pea, & Gomez, 1996; Gordin, Polman, & Pea, 1994).

Electronic Access to Hyper-Media and Multimedia-Based Resources

E-learning educational technologies also enable the delivery of subject matter content in a variety of media formats that is not possible within the spatial and temporal constraints of conventional educational settings such as the classroom or the printed study materials commonly used in open and distance education (Dede, 2000). This means that learners in distributed settings can have access to a wide variety of educational resources all via their desktops, in a form that is adaptable and amenable to individual approaches to learning (Spiro, Feltovich, Jacobson, & Coulson, 1991). These educational resources are, moreover, accessible to learners at a time, place, and pace that is convenient to them (Pea, 1994; Pea & Gomez, 1992). Typically they may include any combination of components like:

- Hyperlinked textual material, incorporating pictures, graphics, and animation.
- Videotaped elaboration of subject matter, including interviews, and panel discussions.
- Hyperlinked multimedia elements such as QTVs, simulations, graphics, and animations.
- Just-in-time access to a range of electronic databases, search engines, and online libraries.
- Just-in-time access to coaching and assistance via telementors, e-communities, and peers.

The one limitation to this for many at the moment is the capability of their networks and bandwidth to deliver this information (Dede, 1991). But this situation is sure to change and for some, very rapidly indeed.

OPPORTUNITIES FOR LEARNING AND TEACHING THAT E-LEARNING AFFORDS

Research in learning and instruction suggests that people learn most effectively by pursuing realistic goals that are also intrinsically motivating (Schank, Fano, Jona, & Bell, 1994). Learning is also greatly enhanced when it is anchored or situated in meaningful and authentic problem-solving contexts (Barron et al., 1998; Brown, Collins, & Duguid, 1989; The Cognition and Technology Group at Vanderbilt, 1990). While "goal-based learning" is not constrained by any particular media type, certain delivery technologies can impede anchored instruction or situated learning. Conventional classroom-based instruction, for instance, while it may be cost-effective, is constrained to a large extent by its fixed time and space in being able to situate learning in realistic contexts. Printed text as well, while it affords transportability, is limited by its inability to incorporate anything other than text, pictures, and illustrations.

Contemporary e-learning educational technologies, with their temporal and spatial flexibility and ability to support resource-rich multimedia content, afford us the opportunity to develop educational opportunities that are known as "generative learning environments" (The Cognition and Technology Group at Vanderbilt, 1991). These are learning environments that are based on a theoretical framework that emphasizes the importance of anchoring or situating instruction in meaningful, problem-solving contexts. A major goal of this approach is to create shared learning environments that permit sustained exploration by students and teachers to enable them to understand the kinds of problems and opportunities that experts in various areas encounter and the knowledge that these experts use as tools. Experts are known to be very familiar with the endemic nature of their disciplines or domains of practice. In order for novices to approximate this level of familiarity with the discipline, they need to become immersed in the culture of that discipline. This necessitates access to a range of resources and experiences, including multimedia-based simulation of components that are not readily accessible in real time, such as certain aspects of biological and medical science, engineering, and educational practice.

Quality of E-Learning Practices

In the midst of all this interest in and proliferation of e-learning, there is a great deal of variability in the quality of e-learning and teaching. However, this shouldn't be any surprise as there are just as many instances of poor and reckless face-to-face teaching as there are instances of excellence in that regard as well. In 1997, a group of adult educators from the University of British Columbia in Canada carried out an investigation of Web-based courses (Boshier, Mohapi, Moulton, Qayyaum, Sadownik and Wilson, 1997). This is a somewhat dated study, and this snapshot of Web-based courses will be undoubtedly replaced by the fast pace of change in this area, but it does shed some interesting light on e-learning and teaching practices, which are probably, on the whole, not very different at the moment. The focus of this investigation is on the attractiveness and face validity of "stand-alone" Web-based courses. These researchers defined a stand-alone course as one that "might include supplemental material but can be completed entirely without face-to-face interaction with an instructor" (Boshier et al., 1997, p. 327).

Of the 127 subjects they reviewed, the investigators classed 19 of them as "not enjoyable" to walk through, 42 were considered as "mildly enjoyable," 43 as "moderately enjoyable," 19 as "very enjoyable," and 4 as a "complete blast." They also found that very few of the courses surveyed offered much interactive capability for the learner or opportunity for collaborative learning. They found that many of the courses seemed to have been overly driven by an obsession with statement of objectives, assessment outcomes, and a hierarchical ordering of subject matter content, as opposed to a focus on building rich resource-based learning environments around enduring themes. The researchers concluded from this study that the biggest challenge for Web-based course developers seemed to be conceptual, not technological. They suggest that course developers ought to be focussing more on how to make their courses "attractive, accessible and interactive" (p. 348).

RECOGNIZING THE NEED TO RECONSIDER CONTEMPORARY APPROACHES TO E-LEARNING

It should be no longer necessary to reiterate that media in itself can have little impact on the quality of teaching and learning (see Clark, 1983; Kozma, 1991). There is no doubt that information and communications technologies offer tremendous opportunities for building rich and resource-based learning environments. However, these technologies are mere vehicles of the

educational transaction and on their own cannot substantially enhance learning and teaching. Despite this, in the rush to embrace e-learning, many educators are able to do little more than post the course syllabus and Powerpoint slides of their lectures on a course Web site. This is little different from making photocopies of such material and distributing them in class. However, while posting the course syllabus and one's lecture notes on the Web is a very worthwhile use of this technology, there is a whole lot more that information and communications technology can enable by way of supporting learning and teaching. To make the most of the opportunities that these technologies offer, careful attention needs to be paid foremost to the *pedagogy* of the learning and teaching transaction. This refers to the "design architecture" of the learning and teaching environment and it incorporates, *inter alia*, consideration of how subject matter content will be presented, what the learners would do, how learning will be supported, what would comprise formative and summative assessment, and how feedback will be provided.

There is no shortage of advice on how to design rich and resourceful e-learning environments and reconsider our approaches to teaching and learning to ensure that we are making the most of the delivery technologies we are employing (see Burgess & Robertson, 1999; French, Hale, Johnson, & Farr, 1999). In fact, we do not have a choice in this regard. The changing needs of education and training in both business and higher education are forcing a reconsideration of our conventional approaches to teaching and learning. This incorporates, among other things, the changing role of the classroom teacher from one of being a "sage on the stage" to a "guide on the side." It also includes the changing nature of student learning from one of being "teacher-directed" to being "student-directed" or "student-centered." Information and communications technology has a significant role to play in supporting these foreshadowed changes in the nature of teaching and learning.

French et al. (1999) suggest three ways in which information and communications technology can be used to effectively support a self-directed and student-centered learning environment. These are (1) augmenting teaching; (2) virtual learning; and (3) progressive application. *Augmenting teaching* is based on the premise that educators can enrich their current teaching practices by supporting their classes with one or more aspects of ICT-based activities. Augmented classes may use anything from making use of the Web for distributing information about the course to e-mail communication for discussion between students and teachers and among students, and collaborative computer conferencing among students for group work. *Virtual learning* refers to the process of learning and teaching on the Internet without any face-to-face contact between or among the participants. In this mode, the Internet replaces conventional lecture formats, creating new opportunities for self-directed and flexible learning. Finally, *progressive application* refers to the process of applying ICT-based technologies to teaching and learning progressively as one develops his/her confidence in the use of the technology and its imperatives. The concept of progressive application of the technology is based on the notion of just-in-time learning, which is the process of having educational access at the time when one needs to learn something.

PEDAGOGICAL APPROACHES FOR OPTIMIZING E-LEARNING

This section of the chapter discusses a selection of pedagogical approaches that reflect the foregoing approaches to student-centered learning and that also attempt to make the most of the opportunities afforded by information and communications technology. The focus in this chapter is on the design architecture of these approaches and not on the outcomes of their implementation for learning and teaching. Evidence of these can be found in their specific applications (see associated references cited in text).

Distributed Problem-Based Learning

Problem-based learning (PBL) is a widely used approach to learning and teaching that uses an instructional problem as the principal vehicle for learning and teaching. The analysis and study of this problem comprises several phases that are spread over periods of group work and individual study (Barrows & Tamblyn, 1980; Evensen & Hmelo, 2000; Schmidt, 1983). *Distributed problem-based learning* refers to the use of this strategy in a networked computer-supported collaborative learning environment (CSCLE) where face-to-face communication among participants is not essential (see Fig. 24.1). The process starts with the presentation of a problem via a case or vignette that could be presented to learners via the network (cf. Fig. 24.1: Presenting the problem). Next, learners work individually to engage in problem analysis. During this phase they generate explanations for the occurrence of the problem in this case (cf. Fig. 24.1: Expressing first perceptions of the problem). Based on this exercise they identify what they know and do not know about the problem at hand and make decisions about individual research (cf. Fig. 24.1: Exploring the problem and first perceptions). As the next step, this individual study is carried out and its results are reported to the group via the collaborative learning network. Following this, a reevaluation of the problem takes place and the first perceptions are probably revised (cf. Fig. 24.1: Revising first perceptions of the problem). All of this is followed up with the preparation and presentation of a critical reflection, which is a personal synthesis of the discussion that has ensued via the network (cf. Fig. 24.1: Preparing and posting a critical reflection record).

The bulk of the learning task in this model takes place in an electronic environment that is supported by computer-mediated communications technology (see Naidu & Oliver, 1996). For each one of the topics addressed in the course, the learning experience in this electronic environment may unfold in stages over a defined period such as four weeks. In the first week students are required to articulate their first perceptions of the problem as presented to them. They develop some hypotheses, which are their conjectures regarding the problem including its causes, effects, and possible solutions; outline how they were going to go about searching for evidence to support their hypotheses; and then collect that evidence. They "post" these comments on the electronic environment so that everyone can read others' approach to the understanding and resolution of the same problem. In the second week, after reading the initial reactions and comments of others on their own thoughts, students reexamine their first perceptions of the problem. They expand and refocus their conjectures regarding the problem and, if necessary, revise their hypotheses and data-gathering strategies and post these on the electronic environment. In the third week, as a result of the online discussions students would be able to identify new or related issues, revise their conjectures regarding the problem, and perhaps make modifications to their problem-resolution strategies. In the fourth week they prepare and present their own "critical reflection record" on the electronic environment. This comprises their final comment on the problem situation and how they sought to resolve it.

Critical Incident-Based Computer-Supported Collaborative Learning

There is growing interest in building learning environments that focus on supporting groups of learners engaged in reflection on critical incidents from their workplace (Wilson, 1996). A model of learning and instruction that embodies the essence of this focus is the "Critical incident-based computer supported collaborative learning" (see Fig. 24.2). It is so called because the model integrates reflection on and in action, collaborative learning, and computer-mediated communication into a holistic model of learning and instruction. This model of learning and instruction is inspired, *inter alia*, by knowledge of the fact that practitioners regularly encounter in the workplace critical incidences that present them with learning opportunities

Distributed Problem-Based Learning

Presenting the problem on the CSCLE

- Outline the problem situation and its attributes.
- Describe the learning process, and define the learning task.

Participants post their first perceptions of the problem on the CSCLE

Issues	Hypotheses	Method	Data
Learners articulate their first perceptions of the problem	Learners state their conjectures about the problem	Learners identify and choose data collection strategy	Learners gather data and share this with their peers

Participants explore the problem and their first perceptions on the CSCLE

Issues	Hypotheses	Method	Data
Learners explain and justify their first perceptions	Learners expand and focus their conjectures	Learners agree to revise their action plan if necessary	Learners gather additional data and share with peers

Participants may revise their first perceptions of the problem on the CSCLE

Issues	Hypotheses	Method	Data
Learners identify any new or related issues to problem	Learners revise their conjectures re: the problems	Learners make adjustments to their action plan	Learners gather additional data and share with peers

Participants prepare and post a critical reflection record on the CSCLE

In this last phase learners present a "critical reflection record" that synthesizes the discussion that has taken place on the computer-supported collaborative learning environment. This is more than a record of what transpired and reflects each person's understandings of the problem.

FIG. 24.1. Distributed Problem-Based Learning.

(see Naidu & Oliver, 1999). It serves to teach learners to recognize these critical incidences as learning opportunities, reflect on them critically while in action, and then finally share these reflections in a computer-supported-collaborative learning environment.

A critical incident (from the workplace) presents a learner with a learning opportunity to reflect *in* and *on* action. A learner can do this by keeping a *learning log*, which is a record of learning opportunities presented. The log records how one approaches the incident, successes and failures with it, and any issues that need to be resolved (e.g., things not fully understood or concepts that "didn't make sense"). The critical attribute of the learning log is that it concentrates on the process of learning. It is not a diary of events nor is it a record of work undertaken, rather it is a personal record of the occasions when learning occurred or could have occurred. The learning log also relates prior learning to current practice and is retrospective and reactive in action.

Learners engage in this process of critical incident-based learning in a phased manner. Phase one in the process comprises identifying a critical incident. Learners do this by identifying an incident from their workplace, which they consider as being significant to their roles. They describe the *what, when, where*, and *how* of this critical incident including its special attributes and more importantly the learning gain they derived from this incident. Phase two comprises

Critical Incident-Based Computer-Supported Collaborative Learning

Phase I: Identifying Critical Incident on CSCLE

Identify	Describe	Attributes	Learning
Learners identify an incident from their workplace, which they consider as being significant.	Learners describe this incident in terms of what happened, when, where, and how without revealing names and identities.	Learners identify the special attributes or aspects of this incident that sets it apart from all others in their experience.	Learners reflect on what happened to them in terms of the learning gain for them.

Phase II: Presenting Your Learning Log on CSCLE

Learners post their reflections (i.e., "learning logs") on the computer-supported learning environment. It should:

- help them remember what happened as part of that critical incident;
- explain to themselves and others reading it why they did what they did;
- evaluate their action and that of others who were involved in the incident;
- outline what they should or shouldn't have done, in retrospect;
- how they would behave given a similar incident in the future;
- describe what they believe they learned from that critical incident.

Phase III: Discussing the Learning Logs on CSCLE

Presenting their learning log, in the manner described, is the first task as part of this exercise. After learners have done that, they study carefully all the learning logs presented on the system by the other students.

Learners attempt to make insightful comments and observations on other's learning logs directly and by offering empathy, encouragement and helpful suggestions, both from their own knowledge base and their personal experiences.

Phase IV: Theory and Practice

This last phase has to do with learners making the connection between theory and practice.

This process should lead to a summary **Critical Reflection,** which should focus on the:

- extent to which learners feel that the theory helped them cope with the critical incident they encountered at work.
- adequacies and inadequacies of their theoretical knowledge with regard to their performance during that critical incident.
- enlightenment they may have gained from reflecting on the learning logs of their peers and the reflections of peers on their own learning logs.

FIG. 24.2. Critical Incident-Based Computer-Supported Collaborative learning.

the presentation of the learning log via the computer-mediated communication system. This log outlines to the group the critical nature of the incident and the reasons for the actions taken by the practitioner during the encounter with the incident. It includes reference to what should or shouldn't have been done and the learning gain derived from the incident. Phase three comprises the discussion of the learning logs posted on the systems by all students. Learners attempt to make insightful comments and observations about other's learning logs with the explicit intention of learning from the pool of experience that lies there in front of them in this shared electronic space.

Finally, phase four is about the coalescence of theory and practice, that is, bringing theory to bear upon practice and practice to inform theory. This last phase in the process has to do with learners making the connection between what they are being presented as part of their formal education and what they are being confronted with as a part of their daily work. This process leads to a summary reflection, which seeks to identify the extent to which learners feel that the theory enabled them to cope with the critical incident they encountered at their

workplace. It also reflects the adequacies and inadequacies of their theoretical knowledge and any enlightenment learners may have gained from reflecting on the learning logs of their peers and from the reflections of others on their own learning logs.

Goal-Based Learning

A goal-based scenario (GBS) is essentially a simulation in which learners assume a main role in the pursuit of a mission or task associated with their main role in the scenario (Schank, 1990, 1997). In order to achieve this goal, the learner needs to acquire particular skills and knowledge. This is where the learning is taking place. Goals in this context refer to the successful completion of the task at hand, not the achievement of grades. A GBS serves both to motivate learners and also to give them the opportunity to "learn by doing." As long as a goal is of inherent interest to learners, and the skills needed to accomplish those goals are the targeted learning outcomes, we have a match and a workable GBS. The important idea here is that a GBS is organized around "performance" skills, and the result is a student who can perform the specified task (Schank & Cleary, 1995).

The intent of goal-based scenarios, such as the one presented in Fig. 24.3, is to present students with a contrived but an authentic scenario, which offers them an opportunity to learn by making mistakes in a safe environment (see Naidu, Oliver, & Koronios, 1999). Mistakes offer real opportunities for learning when these are accompanied by timely and potent feedback.

Clinical Decision Making in Nursing: A Goal-Based Scenario

- **Goal**: The "goal" for the learner in this simulation is to deal with a crisis situation and develop an action plan for managing the patient's situation.

Phase I: Case Encounter

- Learners encounter the case at *handover* where they are explained its history and pathology.

Phase II: Understanding Problem

Precipitating event	Identifying its causes	Managing the crisis
Learner encounters the precipitating event.	Learner seeks to locate the causes of the precipitating event.	Learner attempts to deal with the crisis and contain it.

Phase III: Seeking Solutions

Making decisions	Listening to stories	Case-based reasoning
Learners are required to make decisions about patient care.	They listen to experts and ask questions about their experiences.	Learners attempt to reason on the basis of the experts' stories.

Phase IV: At the Case Conference

Raising issues	Listening to stories	Developing care plan
Learners explore new and related issues to the problem by reviewing sources of information.	They ask experts additional questions about their experiences.	Learners develop their final care plan based on experts' stories.

Phase V: Developing a Care Plan

- Learners submit their care plan to the supervisor and receive feedback on their decision making.

FIG. 24.3. Clinical Decision Making in Nursing Practice: A Goal-Based Scenario.

As learners enter the particular learning environment illustrated in Fig. 24.3, the learning context is explained, as is their "goal" within it, which is not the same as a learning outcome but a means to achieving one or more learning outcomes. Following this, users proceed to the *handover* (cf. Phase I: Case Encounter). This is a routine event in nursing practice, where nurses coming on for duty are brought up to date by their outgoing colleagues on the condition of patients who are in their care. After handover nurses move on to attend to routine nursing care activities and meeting patients' needs by administering medications and ensuring patients' comfort. Following the administration of antibiotics to one of their patients, users are met with a precipitating event. A precipitating event in this instance is an emergency situation that causes a chain of events. It requires nurses to make complex decisions under the pressure of time. In the first instance, the nurse must do everything that is necessary to manage the crisis situation before recommending a care plan. In order to do this, it is necessary to first understand the crisis situation, including its causes (cf. Phase II: Understanding the Problem). In order to arrive at a correct diagnosis, the nurse can access a whole range of information including documentation on hospital procedures/protocols and stories by expert practitioners (experienced nurses), which also comprise advice on appropriate procedures to follow or not to follow under such circumstances (cf. Phase III: Seeking Solutions).

Following this diagnosis nurses must take appropriate action to manage the crisis situation. A number of resources are available to users at this point for them to be able to make informed decisions about what are the appropriate actions to take in situations like this. These comprise electronic resources on anaphylaxis including intervention strategies and case studies of anaphylaxis. However, the most important resource that users have access to in this learning environment is the stories of experienced nurse practitioners. Users are able to make informed decisions after having listened to the experiences of expert practitioners. This kind of knowledge comes only with experience over many years and is not normally available in textbooks. Most e-learning environments fail to bring good stories to the learning context. Finally, when a draft care plan has been developed, users proceed to a case conference (cf. Phase IV-V: Case Conference–Developing Care Plan). This is a place where users have the opportunity to reflect upon their own care plans and those of others. There is the opportunity here to engage in questioning, critiquing, negotiating meanings, and commenting on alternative approaches of care that are deemed appropriate to the case.

Learning by Designing

Designing as a means for acquiring content knowledge is commonly used in practice-based disciplines such as engineering and architecture (Hmelo, Holton, & Kolodner, 2000; Newstetter, 2000). The obvious benefit of a design task is its inherent situatedness or authenticity. In design-based learning activities, students' understanding is "enacted" through the physical process of conceptualizing and producing something. The structures created, functions sought, and behaviors exhibited by the design solution also offer a means to assess knowledge of the subject matter. As such a student's conceptual understanding or misunderstanding of domain knowledge can be ascertained from that artifact. The failure of that artifact, for example, may suggest an incomplete understanding of the subject matter.

A big advantage of setting a design task as the basis for the study of the subject matter (such as *Designing the "Virtual Print Exhibition,"* see the next section) is the variety of cognitive tasks required to move from a conceptual idea to a product. These include *information gathering, problem identification, constraint setting, idea generation, modeling and prototyping,* and *evaluating.* These tasks represent complex learning activities in their own right, and when they become the environment in which knowledge of the subject matter is constructed, students

have the opportunities to explore that content in the different phases and through different representations (see Naidu, Anderson, & Riddle, 2000).

Designing a "Virtual Print Exhibition" Activity. The *National Gallery* is planning a major exhibition to celebrate the re-opening of its print room in 2003, for which they have received a grant of $100, 000. You and your colleagues have been asked to put together a *virtual exhibition* from the newly developed electronic database of old master print collection in the library. To accomplish this task, you will need to prepare a proposal in which you design, install, and curate an exhibition online, focusing on an appropriate theme of your choice. The director of the Gallery would like to see you put together a detailed plan with time lines and a budget with a detailed rationale before he or she can release the funds for you to begin work. The group with which you will work will have access to an asynchronous computer conference facility, to which you and your colleagues will be automatically subscribed. You must conduct all your planning activity using this medium. You should complete the concept of the proposal in five weeks and submit it for discussion and feedback from other curators in the gallery as well as the exhibition committee. You will also be required to present your team's proposal in a seminar to the director of the museum.

The complexity of design activities such as these makes them excellent vehicles for knowledge acquisition. Moreover, design complexity requires iterative activity toward better solutions that can support refinement of concepts. Design complexity also dictates the need for collaboration. A workable team possessing different kinds of knowledge and skills can tackle complexity more successfully than an individual. On student teams, one student might have good research skills, another domain knowledge, another drawing and representation skills, and another construction skills.

Web-Based Role-Play Simulation

Role-play simulations are situations in which learners take on the role profiles of specific characters in a contrived educational game. As a result of playing out these roles, learners are expected to acquire the intended learning outcomes as well as make learning enjoyable. While role-play is a commonly used strategy in conventional educational settings, it is less widely used in distributed Web-based learning environments. The technology is available now to support the conduct of role-play simulations on the Web (see Naidu, Ip, & Linser, 2000). The essential ingredients of a Web-based role-play simulation are a) goal-based learning; b) role-play simulation; and c) online Web-based communication and collaboration. Let us consider each one of these in turn.

First, goal-based learning is acknowledged as a strong motivator of learning. Typically, goal-based learning comprises a scenario or context that includes a trigger or a precipitating event. This event may be presented as a critical event and usually requires an immediate response from students. The second critical ingredient of this learning architecture is role-play, both in the sense of playing a role, playing with possibilities and alternative worlds, and playing to "have fun." Students are organized into teams to play out particular roles within the context of the given crises or situation. In order to play out their roles effectively they need to do research. The third critical ingredient of this learning architecture is the Web. The Web houses the virtual space for the role-play; it enables communication and collaboration among students and between the students and the facilitators. A role-play simulation generator enables the creator of the simulation to specify the roles that are central to the operation and the success of the role-play simulation (see Naidu, Ip, & Linser, 2000). This generator also enables the simulation creator to define tasks, create conferences, assign rights to participants in these conferences, as well as provide specific information and scaffolds to support the simulation.

CHALLENGES POSED BY E-LEARNING AND DIRECTIONS FOR FURTHER RESEARCH

A great deal of work has been done in supporting students' learning with various types of technologies in open and flexible educational settings (see for example, Bates, 1990; Collis, 1996; and Khan, 1997). These authors survey several technologies including: print; radio; audio-cassettes; telephone; computer-based applications such as electronic databases and CD-ROMs; and computer-mediated communication technologies including e-mail, computer conferencing, bulletin boards, electronic document exchange and transfer, audio and video conferencing, broadcast television, and the Internet. Many of these technologies are ideal vehicles for content delivery and supporting communication, but in themselves, they are lacking in the capability to support or "scaffold" student learning activity in e-learning environments.

A *learning scaffold* is best described as a "transitional support strategy or mechanism" that is put in place to guide student learning in desirable directions or to enable the development of desirable cognitive skills in students. The expectation is that when the scaffold is removed from the learning context, the targeted skills become part of a learner's repertoire of learning skills. Parents or human teachers are excellent examples of learning scaffolds. Among other things, of course, they are there to provide advisement and support when these are most needed. At some point in the development of the child these types of supports are progressively removed and as such are no longer accessible or accessible to them only in limited ways. Children go on to live and function in society independently of the supports and advisement previously provided by their parents and teachers.

Similarly, learners in e-learning and open, distance, and flexible learning environments who often work independently with self-instructional study materials need help with the organization and management of resources as well as the skills to critically reflect on information they may have gathered. A considerable amount of work has gone on in supporting student learning with various types of cognitive tools and strategies in conventional technology-enhanced learning environments (see, for example, Gordin, Edelson, & Gomez, 1996; Scardamalia & Bereiter, 1994). Very little exists in the area of "cognitive support tools" for supporting student learning in e-learning and open, distance, and flexible technology-enhanced learning environments. Existing software-based cognitive tools provide support to students for learning in *face-to-face educational settings* where other forms of advisement and support are also available (see Scardamalia & Bereiter, 1991; Schauble, Raghaven, & Glaser, 1993). These support tools help learners organize their arguments for presentation and also guide them in their cognitive processes. They are, however, less effective in *e-learning* and *open, distance, and flexible educational settings* where learners do not have access to additional advisement and support.

Work on developing scaffolds for student learning activity in e-learning and open and flexible learning environments is sorely lacking. Existing work on supporting student learning with various types of learning and study strategies (see for instance the works of Weinstein & Mayer, 1986; Schon, 1987, Candy, 1991; Schmeck, 1988) suggest that the development of learning strategies (for example *learning how to learn*) can influence learner characteristics. These authors argue that employing these strategies and methods can help with the cognitive process, which in turn affects learning outcomes. They have identified several categories of learning strategies, namely *rehearsal, elaboration, organizational, self-monitoring*, and *motivational.* These strategies provide a pedagogically sound framework for supporting learning how to learn, and it is suggested here that they can also be used to guide work on scaffolding student learning in the contexts of e-learning, open, distance, and flexible learning environments.

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