E-Learning
Who, What and How?

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Developing high-quality e-learning courses is a complex process. It requires a variety of competencies at every stage of the development process. The literature on the subject so far emphasizes on development of e-learning content. The P3 model of people–process–product continuum explained in this article provides a holistic approach for not only creating good-quality e-learning content, but also deploying the course on the server and maintaining it.

INTRODUCTION

The process of creating quality e-learning content starts with conducting a comprehensive audience/learner analysis and ends with performing a quality check and delivering the finished product to the client. The entire process of development of e-learning content brings together a group of people with different competencies. The process can be considered as The people–process–product continuum or P3 model (Figure 1). For example, people involved in the e-learning development process can be instructional designers, graphics designers, project managers and quality assurance managers. The product can be a well-designed e-learning module and the process can be any standard process like ADDIE or Dick and Carey Model. The P3 model is a holistic approach to course development and helps in not only creating very high-quality e-learning content, but also in delivery and maintenance of the course.

This article is an attempt at envisaging the entire development process in a modular approach. We elaborate various *stages* of the complete e-learning development *process* in terms of *people* responsible for providing various e-learning and blended learning *products*. We also touch upon the kind of people required at each stage. This is an attempt to streamline the process of development of e-learning content.

Figure 1
E-Learning: People–Process–Product Continuum
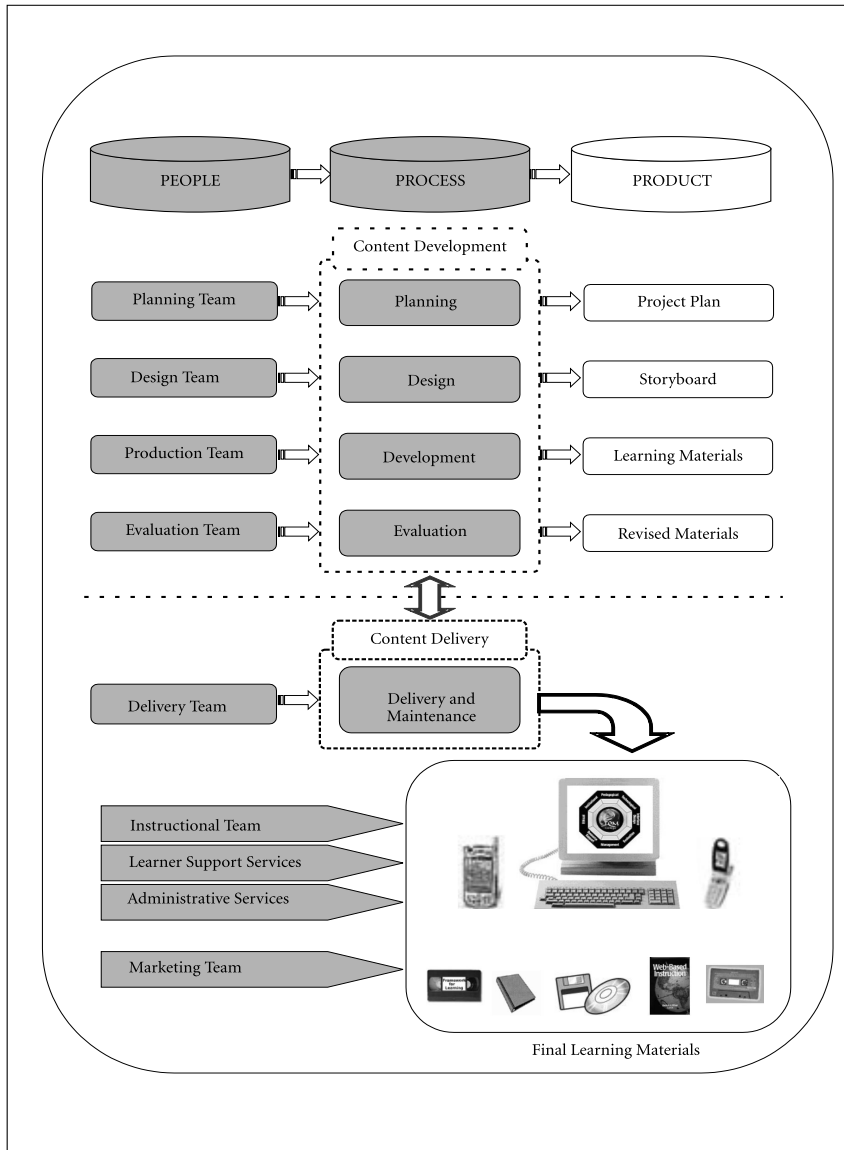
Broadly the e-learning development process can be divided into two major phases: (*a*) Development, and (*b*) delivery and maintenance (Figure 2). Suitable content is developed in the first phase and the same is delivered using an appropriate medium in the second phase.

Development is a one-time activity, whereas maintenance is an ongoing activity. A typical e-learning process has planning, design, development, evaluation, delivery and maintenance stages. The e-learning development process is iterative in nature. Although evaluation is denoted as a single activity in the model, technically it is not so. Evaluation is iterative in nature and there is a need to revise the content at every stage.

Figure 2
The Iterative Process of E-Learning
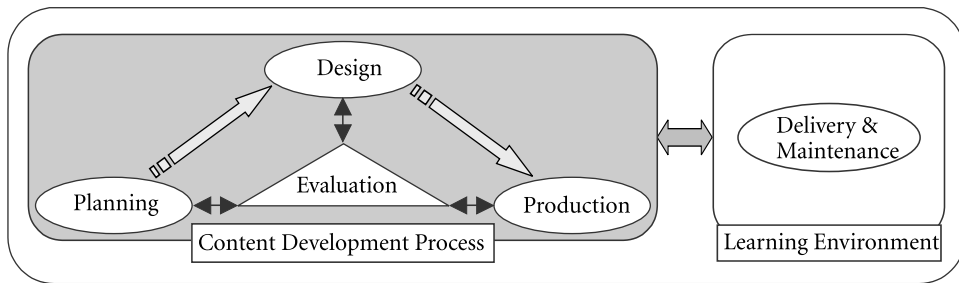
Based on the size and scope of the project, the number of individuals involved in various stages of an e-learning project may vary. *Some roles and responsibilities may overlap*, as many e-learning tasks are interrelated and interdependent. A large-sized e-learning project requires the involvement of various individuals. In a small or medium-sized e-learning project some individuals will be able to perform multiple roles. When an e-learning course is completely designed, developed, taught and managed by a single individual, the same individual has performed the role of content expert, instructional designer, programmer, graphic artist, project manager, etc. This is an example of a small-sized e-learning project. In a small e-learning organization there will be one project manager who acts as instructional designer and also reviewer. S/he is assisted by one content writer and couple of graphic designers.

In this article we have tried to identify various roles and responsibilities involved in the e-learning development process. Some roles and responsibilities may be relevant to specific stages of the process. For example, initially it will be the responsibility of a project manager or marketing person to get specifications from the prospective client. Sometimes there is a need for an instructional designer to explain the learning part of the project. The instructional designer is generally involved during the entire content development process, and once the module is created, it is the responsibility of technical support to ensure delivery of the module and also take care of a few of the quality issues. The roles of individuals and their general responsibilities listed in Table 1 are by no means complete. The titles used for various e-learning roles (in Table 1) are not to suggest that an e-learning institution must create such specific positions; rather, the intention is to describe the roles and responsibilities required for such

projects. Based on what is appropriate for specific projects, one can either hire new people or outsource to external sources. Many organizations work on the model of outsourcing graphics work to vendors, and in some cases the writing task also is outsourced.

Table 1
Roles and Responsibilities in e-Learning

Role of individual	Responsibilities
Director	Directs e-learning initiatives. Develops e-learning plans and strategies. Involved in marketing and selling the concept to the customer.
Project manager	Supervises the overall e-learning process, including design, production, delivery, evaluation, budgeting, staffing and scheduling. Works with coordinators of various e-learning teams. Can also participate in review work.
Business developer	Develops business plan, marketing plan and promotion plan. Coordinates internal and external strategic partnerships.
Consultant/adviser	Provides independent, expert advice and services during various stages of e-learning. Most of the time can be a subject matter expert (SME).
Content development process	
Research and design coordinator	Coordinates e-learning research and design processes. Informs management and design teams about the latest data pertaining to online learning activities and research. Reads up on the latest developments in learning models and theories and uses them in creating content.
Content or subject matter expert	Writes course content and reviews existing course materials (if any) for accuracy and currency. Needs to revise the existing material to make it learner centric.
Instructional designer	Provides consultation on instructional strategies and techniques for e-learning contents and resources. Helps select delivery format and assessment strategies for e-learning.
Interface designer	Responsible for site design, navigation, accessibility and usability testing. Reviews interface design and content material for compliance with national accessibility guidelines.
Copyright coordinator	Provides advice on intellectual property issues relevant to e-learning. Responsible for negotiating permission to use copyrighted material, including articles, books chapters, videos, music, animations, graphics, web pages, etc., from copyright holders.
Evaluation specialist	Responsible for evaluation and assessment design and methodology. Conducts and manages student assessment and evaluation of e-learning environments.

(*Table 1 contd.*)

Role of individual	Responsibilities
Production coordinator	Coordinates e-learning production process.
Course integrator	Responsible for getting all pieces of e-learning (e.g., web pages, chat rooms, Java applets, e-commerce, etc.) working together under a learning management system.
Programmer	Programmes e-learning lessons following the storyboard created at the design stage.
Editor	Reviews e-learning materials for clarity, consistency of style, grammar, spelling, appropriate references and copyright information.
Graphic artist	Uses creativity and style to design graphical images for e-learning lessons.
Multimedia developer	Responsible for creating multimedia learning objects, such as audio, video, 2D/3D animations, simulations, etc.
Photographer/videographer	Responsible for photography and video related to e-learning content.
Learning objects specialist	Guides the design, production, and meaningful storage of learning objects by following internationally recognized standards (e.g., SCORM, AICC, IEEE, etc.).
Quality assurance	Responsible for quality control.
Pilot subjects	Participate in e-learning pilot testing.
Delivery coordinator	Coordinates the implementation of e-learning courses and resources.
Content delivery and maintenance process	
Systems administrator	Administers LMS server, user accounts and network security.
Server/database programmer	Responsible for server and database related programming, especially for tracking and recording learners' activities.
Online course coordinator	Coordinates the instructional and support staff for online courses.
Instructor (or trainer)	Teaches online courses.
Instructor assistant	Assists the instructor or trainer in instruction.
Tutor	Assists learners in learning tasks.
Discussion facilitator or moderator	Moderates and facilitates online discussions.
Customer service	Provides generic help and points to appropriate support services based on specific needs of customers (i.e., learners).
Technical support specialist	Provides both hardware- and software-related technical help.

(*Table 1 contd.*)

Role of individual	Responsibilities
Library services	Provides interactive library services for learners who can ask questions to librarians about their research, both asynchronous and in real time, via the Internet.
Counselling services	Provides guidance on study skills, self-discipline, responsibility for own learning, time management and stress management, etc.
Administrative services	Administrative services include admission, schedules, etc.
Registration services	Responsible for efficient and secure registration process for e-learning.
Marketing	Responsible for marketing e-learning offerings.

STAGES OF THE E-LEARNING PROCESS

A typical e-learning content development cycle contains the following stages: (Khan forthcoming):

- Planning
- Design
- Production
- Evaluation
- Delivery and maintenance
- Instruction
- Marketing

Planning Stage

This is a very critical stage, and success or failure of the entire project depends on how well it is planned. During this stage a team consisting of project manager, instructional designer and the director work together and develop a project plan after a thorough analysis of the audience profile and user requirements. They analyse various aspects of *people*, *process* and *products* involved in the e-learning development initiative. This plan must be pedagogically and financially sound and should guide the entire e-learning team (production, evaluation, delivery, maintenance, instructional and support services) to engage in their respectively assigned activities. The plan must indicate team composition and time schedules for completion of each stage. The team can use any of the planning tools to work out alternate plans and identify the most feasible one. It will also indicate details of time-frame for completion of each stage and of things that can be done simultaneously.

The planning team must consider the various learning models and strategies before working out the entire plan. In several cases the pedagogy is overlooked at this stage, which creates avoidable tension later during the project development. It is just not enough to make the plans pedagogically sound; they must be financially sound too. This is mainly the responsibility of the business developer. The business developer should also develop a marketing plan by including empirical data on the institution's course quality, student satisfaction and retention rates. The research and design coordinator assists the business developer in analysing student data and also provides valuable research information about e-learning on a regular basis. The researchers must also take into account various innovations in the field, both in development and delivery. As this is a very critical phase, it is suggested that the team should do elaborate whiteboard activity before the plan is drawn. Outside consultants can also be part of the planning process.

The team needs to work out the time-frame for every activity of the project, with possible breakdown time and buffer time to take care of exigencies. For instance, one can decide on all the components of a typical module like number of screens, text, audio, graphics, simulations (both standalone and interactive), assessments and additional features that can be provided for one hour of learning content. The time-frame also includes the quality and review activities (this must be around one-third of the entire development time).

The end product of the e-learning planning process is a sound *e-learning project plan* (see Figure 1). The e-learning project plan provides guidance during various stages of the e-learning process. E-learning designers, developers, evaluators, and instructional and support staff should follow the guidelines of the project plan to provide a meaningful environment for learners and delivering the project on time.

Design Stage

People with different backgrounds are involved at this stage. The output from the planning stage, which is a plan document, is available at this stage for reference. People involved in this stage are instructional and graphics designers, interface designers, technology experts, and evaluation, quality and R&D personnel. The R&D person is responsible for reviewing course content for pedagogical soundness and selection of the appropriate delivery medium. He must be aware of limitations and capabilities of every medium and also the latest development in the area.

The design team is involved in understanding the learners' need and capabilities available for the project, and reviewing the course content for instructional and pedagogical soundness. The team may consist of subject matter experts and copyright editors. The review and quality person comes up with the checks that need to be carried out. Care must be taken to ensure the content is created using Aviation Industry Computer-based Training Committee (AICC)

or Sharable Content Object Reference Model (SCORM) compliant if needed. The graphics and interface designers will come up with various interface designs and also designing the complete template including the foreground and background. Graphic designers will create appropriate graphics. They must also create simulations and interface for the learner. Instructional designers play an important role, but their role is usually overlooked. The instructional designer designs the complete environment in which learning can take place. S/he conceptualizes the e-learning strategy and methodologies based on the background of the audience. The design team must also communicate with developers about the action scripts. The output product at this stage is the storyboard.

A very important component of the module is the assignment, and the evaluation expert designs the assignments and the strategy to measure the performance. In few cases, the instructional designer can also play this role. The designers rely on Blooms' taxonomy to design the assessments. The interface expert designs the delivery of the assessments in the module.

Many online universities use outside content experts for their courses. For instance, the first author of this article provided the content for a course entitled 'Developing and Implementing e-Learning Systems' for the masters in education in e-learning at the Jones International University (JIU). As a content author, he worked directly with an instructional designer, who guided him in the preparation of the course content. While writing content for the course, he had to provide a list of all additional readings (for example, journal articles and book chapters). The copyright acquisition coordinator at JIU negotiated with publishers about using their materials in the course.

Production Stage

At the production stage the production team creates the e-learning course from the storyboard put together at the design stage (Khan 2004). The production team creates all the required details independently and integrates them in the course module. It creates all the necessary links and makes the navigation smooth. The production coordinator leads the e-learning production process. Team members include, but are not limited to, the following people: course integrator, programmer, graphic artist, multimedia developer, photographer/videographer, editor, learning objects specialist and quality assurance person.

The production coordinator or the project manager makes sure that the timeline is maintained for all deliverables. S/he constantly monitors the development, and takes corrective steps if required. The e-learning production process is time consuming, and this must be made very clear at the beginning of the development. If sufficient time is not spent, the output will be a glorified power point of no value to the learner or the organization.

In e-learning development process members of the development team can be remotely located. The production coordinator should make sure that members are communicating with

each other and that they comply with deadlines. All members must have patience, as continually emerging issues may demand new changes and modification in the course, which in turn can be added work for all. One suggestion here is that all members must put their modules in a central server so that security issues are also taken care of. All members must follow the same naming convention for each module. Every day team members can work on the module(s) and store it back on the server when they leave. This facilitates checking of the content independent of members. The first author of the article served as a consultant for an e-learning project at the World Bank where the team was located remotely. The second author was involved in executing such an offshore on-site model of development with a client in Singapore and the team in Hyderabad, India. In each case, distributed development was a challenge, and communication between and across teams was found to be an important factor in expediting work and maintaining relationships.

We believe that once the course is created and quality check of the content is performed, it should be pilot tested. The team that tests the content must have a diverse background. It is also important to include the client or customer representatives. Team members can be remotely located and they should be required to check every screen. They must check language, the technical part of the content, navigation and all the simulations. Once the project manager collects all the comments from the pilot test team members, he can discuss them with the instructional designer and necessary changes can be incorporated with the help of the development team. The *product* of the production process, then, is *course material* ready for pilot testing (see Figure 1).

Evaluation Stage

Evaluation is critical to good e-learning. It is done at every stage of the entire life cycle, and feedback is incorporated in the product. Basically, there are two types of evaluations, formative and summative. Formative evaluation is conducted during the development stage and is iterative in nature. Summative evaluation is conducted at the end of the development when all the components are integrated into a full-fledged course. A typical e-learning course can be evaluated from various angles, a few of which are:

- Language (syntax and semantics)
- Technical
- Navigation
- Integration
- Relevancy of graphics
- Simulations (both interactive and stand alone)
- Assessments

- Look and feel (interface design)
- Quality check of standards
- Evaluation of learning by a select audience

The language review verifies the syntax of the text for grammatical errors. There is a need to consider the flow of the language and the ease of reading and understanding. 'Is the language user centric?' is the main question that needs to be answered here. Technical experts review the content and provide information on the technical correctness of the content. An expert reviews if the links are working and whether the navigation is appropriate. It is important to ascertain the smoothness of navigation (no jumps). A course in which navigation is faulty usually puts the learner into difficulty. An integration check considers whether the entire course is well integrated. That is, is the flow smooth from one part or topic to the next topic? Are simulations and graphics placed in the correct place and in the correct context?

In addition, a graphic expert along with the instructional designer checks if graphics used in the course have instructional value. Importantly, the designers need to pay particular attention to such sensitive issues such as regional, religious or gender bias in the choice of graphics. There is a need to check every simulation: whether it works properly and whether it provides a link for leaving the screen, if required. Is interaction smooth when the learner interacts with simulation? Simulations must not get struck in endless loops, which happen in few cases. In some instances simulations are embedded for ornamental reasons to catch the learner's attention. This should be avoided.

Evaluation of assessments is an integral part of the exercise. All the assessments are checked with respect to the learning objects, for their relevance and appropriateness. The overall look and feel of the course is very important and clients are very particular about it. Many large organizations have their preferences and standards (style sheet), and the reviewer must ensure that these are adhered to.

Finally, the learning expert has to satisfy that the learner will learn from the course. The expert has to clearly understand the underlying learning strategy and judge if it is appropriate. Simultaneously, the expert also verifies the graphics and simulations from the learning perspective. The course is also evaluated for conforming to AICC, SCORM or other standards. The final test of the module relates to satisfying the customer's needs. A selected group of individuals together test the module from every aspect before it is delivered to the customer.

Delivery and Maintenance Stage

After the content has been created, the focus shifts to delivery. The driving force behind e-learning is that the course content (or the module) must be available at any time from anywhere to the learner. The content material may include audio, graphics, simulations, assessments, videos, reading material and other features. The delivery and maintenance (D&M)

team plays a pivotal part during this stage. The team has to first load the content either on the server or on the learning management system (LMS) and test every bit of it, including simulation and navigation. The team must also take into account the size of the module and speed of access, etc. In most cases, an LMS may be used for delivery of the module. There is a need to check the SCORM, AICC and other standards once the course is loaded here.

The e-learning module must be available to the learner any time. The learner must have the control to leave the course and come back to it as many times as she wants. Once the course is live every part must work efficiently, be it video, simulation or assessments. If the learner wants to take just a part of the course—only the tests, say—then the system must permit that.

The delivery and maintenance team consists of individuals such as the systems administrator, server/database programmer and webmaster, who are the *people* responsible for maintaining an effective and efficient learning environment, with their assigned roles and responsibilities. Not only do they have to maintain the module, they have to provide all the other information (time of login, feedback from the learners, etc.) to the project manager.

The D&M team maintains the LMS and databases, provides technical support to students, instructors and support staff, and manages LMS user accounts and network security. They provide facilities for the staff to load new courses and allow students to take the course whenever they want. In some cases they maintain the marks and performance. They also provide technical assistance to the design and production teams in the areas of software and hardware. They inform developers about new standards in learning, content and compression techniques so that the course is not very heavy, especially if the delivery medium is the Internet. They are responsible for duplicating and distributing learning materials, and installing and maintaining the course as well. Ongoing updating and monitoring is a major part of the e-learning maintenance process. Individuals involved in maintenance should keep e-learning materials updated on a regular basis. They should also check to see that all links and resources are active. In some institutions e-learning material are developed by outside vendors, who may be responsible for migrating all such material to the institution's server.

Overall, the D&M team is responsible for ongoing updating and monitoring of the e-learning environment, including security measures for access control and information confidentiality. No institutions are immune from hackers. Any network can be a target if security is lacking. The *product* of the delivery and maintenance process is a set of well-maintained *learning material* available for registration (see Figure 1).

Instruction Stage

The instruction team is the core of good e-learning content development cycle. At the course instruction stage (see Figure 3), instructional and support services staff (ISS) are the people involved in delivering the instructional product. The ISS may include (but are not limited to): course coordinator, instructor, tutor, course facilitator, discussion moderator, technical

support, librarian, counsellor, customer service, and registration and administrative staff. In case of a small team some individuals might have to play multiple roles.

Figure 3
E-Learning Environment
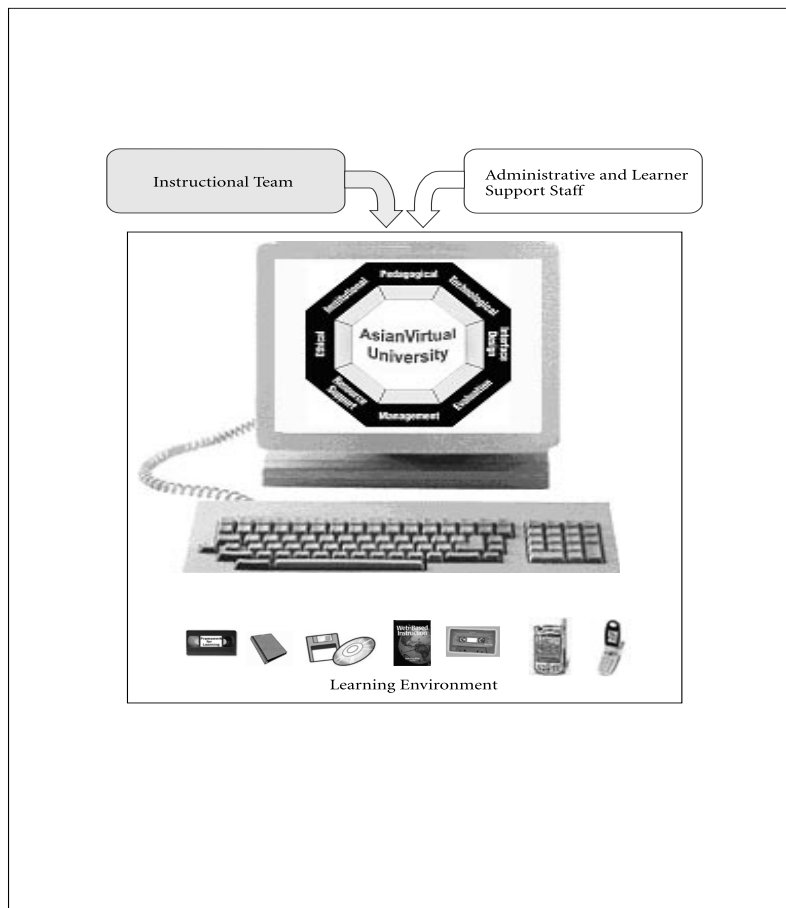
Once the content is ready the course may be offered either through a portal or in stand-alone mode. At this stage the ISS team comes to the forefront. The expectation of the learner is that they must be provided with a good learning environment and uninterrupted learning time. It is necessary to see to it that the correct courses are received by students who register for a particular course. In some cases, it is the responsibility of the ISS team to conduct awareness programmes on how to take the course and how to use all the features provided in the course. In case of any problems with delivery, the ISS team must inform the delivery team so that they are rectified at the earliest.

It is said of the Web that 'the competitor is only one click away'. If students feel unhappy all they have to do is click and leave to take some other course. The delivery and maintenance team must be very careful of not losing learners and should resolve any technical problems that the ISS team may encounter.

Depending on the organizational structure of an institution, the course coordinator may have to work with various departments within the institution, including registration, admissions, legal offices, etc. It is important to note that the instructional staff for online courses may or may not be part of the e-learning management team; academic or training departments may manage them. Table 2 can be used to assign responsibilities for individuals in the ISS team. For example, Ms XXX has been teaching online courses for several years and has experience in providing technical support. With her instructional and technical skills, she can be assigned the responsibilities of an instructor, discussion facilitator/moderator, and technical support for the course EL201.

Table 2
Persons Ideal for Roles and Responsibilities during the Instructional Process

Name of the person ideal for the job	Administrative						Instructional								Learner Support						
	Project manager	Admission	Registration	Payment	Bookstore	Financial aid	Online course coordinator	Instructor (or trainer)	Instructor assistant	Tutor	Discussion facilitator/moderator	Learning objects specialist	Copyright coordinator	Guest speaker (or outside expert)	Delivery coordinator	Systems administrator	Server/database programmer	Customer service	Technical support specialist	Library services	Counselling services
Ms XXX (course number 201)																					

Marketing Stage

The Internet and availability of good bandwidth gives organizations one more medium for delivery of learning content. This is attracting both academic and non-academic institutions to seriously consider e-learning. Several universities and educational institutions worldwide have begun providing e-learning courses. These institutions hope to see great return on investment, but are apprehensive about the future. The learner has more options and can take a

course from any part of the world. This is good for the learner, but makes the e-learning market very competitive. The need to understand the market was never so compelling.

Marketing e-learning courses is a specialized skill that requires fair understanding of learning, instructional design and technical knowledge of networking, bandwidth, Internet, LMS, etc. As the market is dynamic, ongoing market research with e-learners (that is, clients) can provide institutions with comparative advantage over others in their offerings. The marketing person must be aware of the development process and also the likely bottlenecks in the development of courseware. However, the main responsibility of the marketing person is to clearly understand the client's requirements and communicate the same to the course development team.

At the moment the market advantage can be accomplished by registering e-learning sites with search engines, banner advertising, postings in listservs, brand strategy (for example, brand names), endorsement by credible people and institutions, and so on. Effective marketing products will help institutions to attract and recruit students for their courses and programmes.

CONCLUSION

In conclusion, new developments in the-learning sciences and technologies provide opportunities to create well-designed, learner-centred, engaging, interactive, affordable, efficient, easily accessible, flexible and meaningful distributed and facilitated e-learning environments.

The E-learning P3 model provides a comprehensive picture of the e-learning process and helps identify the roles and responsibilities for the design, development, evaluation, implementation and management of all e-learning and blended learning materials and systems.

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