CHAPTER 5

SCEnE INSTRUCTIONAL DESIGN PROCESS MODEL

5.1 Introduction

Strong instructional design and planning becomes the critical piece to a successful learning experience, especially in an e-learning environment. This chapter reviews an instructional design process model that will assist in the development of learning modules based on accepted learning concepts while utilising the e-learning environment. This model is not intended to be a course management tool such as WebCT or Blackboard, but rather a model to help develop learning content that could be placed inside a course management tool based on pedagogy.

One way in which such an approach can be used by the instructor is to develop one or more modules of learning content, each corresponding to information about a particular topic within a chapter. Alternately this approach can be used to develop ‘stand-alone’ lesson plans for e-learning applications. In any case, courses developed for an e-learning environment need to have a flexible design approach and the capacity to accommodate several differing pedagogical approaches in order to cater for different learning styles based on Multiple Intelligences (MI) theory. The rationale for the model has been articulated throughout the previous four chapters. This model consists of a conceptual structure, procedural guidelines, and a list of required elements to include in the e-learning environment.
5.2 Instructional Design for E-learning

An e-learning approach has played a pivotal role in improving flexibility and quality of education and training by using the Internet and collaborative technologies (Schweizer, 1999; Takacs et al., 1999; Gottfredson, 2002). A number of specific applications, such as IBM Lotus LearningSpace, Blackboard, Microsoft Visual Studio, and Netware have been employed to support teaching and learning at universities. Previous studies [(Anderson, 1998), (Beller and Or, 1998), (Schank et al., 1994), (El-Tigi and Branch, 1997), (Horton and Horton, 2002)] show that these applications enable individual tutors to put teaching materials online, create discussion forums, organise assessments, and link with other sources. To a limited extent, these applications can support course design, but it is often up to the individual tutors to decide how the teaching materials should be organised.

Researchers and educators are fully aware that technologies alone will not generate much benefit and are not the drive for courseware design. The most important aspects in e-learning are the employment of appropriate learning theory and paradigms, organisation of contents online, as well as methods and techniques of delivery. So far there is little research for a development of suitable methods for online courseware design with the teaching and learning rooted in a sound educational theory embedded.

A large proportion of e-learning tends to be limited by only making contents available online together with assignments to set a learning environment. The online contents are normally organised according to the functions encoded in the e-learning software. As a result, association between related contents and materials is not based on the ground of effective learning, but more due to the technical constraints or availability of the software. The design of the courseware for e-learning is often driven by the technologies.
The observation below summarises the issues, which require attention in instructional design for e-learning.

- Learning is still pre-determined by instructional sequence and in a *push* manner. Students, therefore, are constrained to apply their prior knowledge to generate their mental models and to conceptualise various parts of information to form a whole within a given context.

- Students often find themselves in various situations and carry out multiple learning activities, which are hardly supported by the current course structure.

- There are computer assisted learning that provides customisation and personalisation mechanism based on user’s navigation and usability of the application, but little methodological guidance is provided for instructors to introduce the functions of the social negotiation on individual learning goals, learning content and learning methods into the courseware.

Contents have been made electronically available but are not organised according to students learning styles for self-analysis and student-centered learning, and are also not presented in a manner that encourage students to seek knowledge independently and achieve their learning goals. There is therefore a need for a conceptual model underpinning the courseware for e-learning which is firmly rooted in a sound theoretical framework for teaching and learning paradigm. In the following sections of this chapter, the researcher proposes a conceptual model for an e-learning environment that caters for Multiple Intelligences and based on sound pedagogy. The model synthesises instructional design pedagogy and e-learning concepts.

The model consists of five basic steps which are needs analysis, design instruction and presentation, develop materials, implement activities and courses, and evaluate
participant progress and instructional material effectiveness. During the analysis stage, the designer develops a clear understanding of the “gaps” between the desired outcomes or behaviours, and the student’s existing knowledge and skills. The design phase documents specific learning objectives, assessment instruments, exercises and content. Actual creation of learning material is completed in the development phase. During implementation, these materials are delivered to the student group. After delivery, the effectiveness of the learning material is evaluated.

Three fundamental concerns are identifying the goals, selecting the strategy and evaluating success. Figure 5.1 emphasises on the needs analysis phase of SCEnE instructional design process model. Needs analysis constitutes to two parts. The first part, assess and analyse needs comprises of assess needs to identify instructional goals (normative needs) and conducting instructional analysis (expressed needs). The second part is on identifying entry points and characteristics (comparative needs).
5.2.1. Assess and Analyse Needs

The first phase, needs analysis, includes the establishment of the instructional goals, requirements, and context. Hence for this study, the need analysis (normative needs) are

\[ \text{Assess needs to identify instructional goal (Normative needs)} \]
- What is the problem?
- How do we solve it?

\[ \text{Conduct instructional analysis (Expressed needs)} \]
- What is the job or context?
- What must be learned?

\[ \text{Identify entry points and characteristics (Comparative needs)} \]
- What are the entry points and characteristics?
- How do we cater for it?
based on the syllabus and course structure of lower secondary (Form 3) of Malaysian schools. The student population changes from course to course and semester to semester. Instructors need to know how experienced their students are with the subject matter and the technology. Identifying the aims and objectives of the material, placing this in the context of the student population and their assumed previous knowledge and describing the detailed syllabus ensure success for the students.

### 5.2.2. Identify Entry Points and Characteristics

In this phase, it is important to identify specific skills students must be able to do in order to begin the instruction. It also includes identification of any specific characteristics of the students that may be important to consider in the design of the instructional activities. To analyse the student, two sets of survey instruments were used:

- Multiple Intelligences Inventory (McKenzie, 2005)
- E-learning Survey

These inventories were used to determine learning characteristics of the particular student population. The information was essential to matching instruction with students’ current life responsibilities. Refer to Chapter Four for detailed analysis and findings. It was not feasible to analyse every trait of every student, but information on general characteristics, entry level competencies, and learning style preferences were collected because they are critical for making good methods and media selection.

Considerations while planning MI lessons:

- How instructors teach more than what they teach
- Including different intelligences in each lesson
• Understanding that all students are smart, just in different ways
• Deepening understanding by presenting the same content via different approaches
• Every lesson does not need all intelligences
• Intelligence is an attraction to (preference for) and skill with (ability) specific stimuli
• Students sometimes like things that they may not be good at
• Students sometimes are good at things that they do not like much

The outline of consideration for planning lessons that accommodate MI is shown in Table 5.1:

Table 5.1
Considerations for planning lessons

<table>
<thead>
<tr>
<th>Multiple Intelligences:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Intelligences Theory, nature or nurture, what “smart” is, Gardner’s definition of “intelligence” is, the Inventory of Multiple Intelligences, the nine intelligences (verbal-linguistic, visual-spatial, interpersonal, intrapersonal, logical-mathematical, musical-rhythmic, bodily kinesthetic, naturalist, existentialist) and characteristics of each, the nine patterns of thinking, simple activities associated with each intelligence, personal feelings of comfort and discomfort with each intelligence, data about frequency of each intelligence, personal applications of each intelligence, real-life examples of persons with a dominance in one of each of the eight intelligences, sub capacities of each intelligence, using a multiple intelligence checklist to identify students’ top three preferences.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Individual Differences:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The interdependence and overlap of the intelligences; caution in examining the intelligences in isolation; micro lessons about each intelligence, including identification of talents (as demonstrated in real-life competencies, occupations, school/university subjects, and extracurricular activities), the brainstorming of possible instructional approaches, and practice activities using each of the intelligences; adapting intelligence-specific strategies by “bridging” to each of the remaining intelligences; using MI to help struggling students.</td>
</tr>
</tbody>
</table>
Table 5.1  
*Considerations for planning lessons (continuation)*

**E-learning Integration:**

MI demonstration lessons, analysis of demonstration lessons, MI lesson planning, adapting a lesson plan to all intelligences for specific content areas, guidelines for teaching to each intelligence, elements of the e-learning environment that can address multiple intelligences.

The following sections are on design and development phase. The design phase includes setting learning objectives for focus and vision, matching outcomes and assessment, and designing instructional strategies. The output from the design phase will be input for the development phase. The development phase consists of developing and selecting instructional materials, and conducting formative evaluation. Figure 5.2 illustrates the design and development phase.
5.2.3. Set Learning Objectives for Focus and Vision

Learning objectives for focus and vision refers to specific statements of what the students will be able to do when they complete the instruction. These objectives should identify the
skills to be learned, the conditions under which the skills must be performed and the criteria for successful performance.

The key here is to list specific objectives that students are expected to meet. These objectives over time will extend into learning and assessment task for students. For instance, if an objective states, “create an interactive written dialogue or journal with two other students”, a list of related topics might be generated as springboard ideas for students’ journal entries. Requirements might include: a) brainstorm new approaches to solving a problem and enlist an expert’s help for researching some aspect of the problem; b) sequence one possible response to an identified problem; c) contrast pros and cons of a controversial issue related to a topic such as ‘photosynthesis’; d) raise three probing questions about a discussion, reading or project proposal on photosynthesis; e) communicate any confusion about some aspect of the material being studied; f) demonstrate the feasibility of an experiment or hypothesis; generate a progression of critical thinking exercises; g) draft an outline for a critical essay for a scientific journal on photosynthesis; h) outline detailed helps sought for locating specific resources on this topic. Through outcomes obtained from journal enquiries like those illustrated here, students are empowered to activate their unique proclivities. They use personal abilities and interests in order to meet real-world challenges which they perceive as meaningful.

Diverse questions help students to break complex problems into manageable pieces that awaken their proclivities to identify its parts without going wildly astray. Throughout the term, students identify and develop their own unique individual questions as tools to identify and solve complex problems. They are better equipped to transfer new facts to solve authentic problems when they use personal strengths to accomplish this task. Following a theme listed by the instructor, and student-created questions, students focus
their investigations, and begin to integrate facts that address real-life problems. Exploration on themes related to photosynthesis might include: musical demonstrations for the question: If photosynthesis were a musical composition, what would it sound like or what song would it be? Bodily-kinesthetic demonstration for the question: How would you create a pantomime or scene to illustrate photosynthesis? Interpersonal demonstrations for the question: How does the transformative role of chloroplasts resemble an aspect of a close friend’s life? Intrapersonal demonstrations for the question: What are your feelings about a personally transforming experience similar to photosynthesis process? Naturalists’ demonstrations for the question: Using words, photographs, art or other appropriate means, how would you compare and contrast photosynthesis process among three distinctive plant families? Logical-mathematical demonstrations for the question: How would you outline the stages of photosynthesis, using scientific principles, laws or theorem? Linguistic demonstrations for the question: How would photosynthesis be described in an essay written to mature students who wish to deeply understand and apply all of its key components to their own scientific works? Spatial demonstrations for the question: How would you represent all the processes of photosynthesis in sketches, images or structures, without using words? These questions are known as questions for curiosity and wonder that reflect learning objectives for focus and vision.

To demonstrate a deep understanding of questions and solve problems posed, students might apply Gardners’s nine domains to demonstrate understanding of photosynthesis. Diverse approaches to express knowledge about a lesson topic allow students to engage their unique abilities and interests such as art, physical activity, musical composition, scientific formulas or teamwork to promote deeper understanding of photosynthesis.
5.2.4. Matching Outcomes and Assessment

Up-front organisation and clear communication about performance expectations and outcome driven assessment are even more important when the student may not be face-to-face with the instructor, or the student is working independently within a traditional classroom. Assessment questions are constructed that parallel and measures the student’s ability to achieve what is described in the learning objectives. Emphasis should be placed on creating assessment items that relate to the kind of behaviour/entry point described in the learning objectives.

Designing assessments that state expectations in advance and reliably measure learner performance can become burdensome. The initial time investment of the instructor can greatly impede completion. Designing assessments come right before the design of the learning activities in Neill’s Instructional Design Flowchart (Neill et al., 1999). Typically, assessments are designed at the course level, rather than the school or national level, and they take on two levels of purpose. The first involves reporting learning results (accountability assessment) at the end of instruction. Examples of these include written/oral tests, performance tests, portfolios, simulations, and projects. These measure larger outcomes, and provide credentials for documenting a student’s competence.

The second purpose of assessment as shown in Figure 5.3 involves evaluating the student’s progress toward achieving the instructional outcomes, or in other words, giving feedback to students (continual improvement assessment) when they have an option to do something about it. This type of assessment also gives instructors feedback on teaching strategies (Neill et al., 1999). Examples include self-checks, peer assessments, guided practice checks, feedback on drafts, and practice activities. In sound instructional design,
performance assessment is closely tied to the performance standards of each major skill or ability needed to perform a task effectively and efficiently. Performance assessment is the process of determining that students can perform these skills according to the specified performance criteria and conditions. According to Neill et al. (1999) assessments should reflect the outcome in the following areas:

- Squarely match the content
- Match the process or product
- Match the domain and level of the competency (outcomes may call for higher level domains, such as application, so a multiple choice test will not match)
- Be clear on whether or not the student meet all the performance conditions (situations in which performance will be assessed). For example, if learners are asked to critique a role play, but instead critique a video, there is a mismatch in assessment and performance condition.
- Engage students in applying knowledge and skills in the ways they are used in the “real world.” Because such skills are transferable, they induce student motivation.

Figure 5.3: The relationship between assessment and effective learning, adapted from (Roads, 2006)
Assessment tasks chosen by students to demonstrate their understanding might include a mix of multiple intelligence tasks such as shown in Table 5.2. These assessment tasks are considered as assignments or project paper for students.

Table 5.2  
List of Assessments

Assessments that include mix of MI tasks (can be considered for assignment or project)

- guided student discovery through hands-on activities
- models that show the process
- interview with scientists, other teachers/lecturers and parents
- advanced organizer to show overview of new work
- ‘Think, Pair & Share’, small group work, including shared inquiry and peer teaching
- conferencing with members of the community
- student presentations, teacher presentation, and mini-lectures
- detailed visuals to describe each stage of a topic (e.g. photosynthesis)
- experience charts to show students’ relationship to the topic
- games and simulations created by students to teach a topic (e.g. photosynthesis)
- computer-assisted demonstrations;
- centers that students created for eight ways of expressing knowledge about the topic
- experimentation and investigation results and records
- performances, role plays, and theatrical techniques
- practical and applicational activities that use MI to illustrate a topic (e.g. photosynthesis)
- field trips and community involvement
- creative problem solving
- independent studies and research projects
- semantic mapping and related discussions
- student designed projects
- portfolios that show one month’s progression
- learning logs
- interest and abilities inventories for each aspect of the topic
- building backgrounds for a story or narrating a play on the topic
- exploratory talk and discussion
- problem solving in groups and individually
- transformation from one form to another
When instructors employ a wide variety of strategies in their teaching, students usually employ more ways of knowing any content. The above list of activities is best generated through student input, so that curiosity is raised for a topic and learners remain active in their unique constructions of knowledge. Not surprisingly, students often succeed in learning new knowledge when their unique mix of abilities and interests is engaged in the process. A sample activity for generating students’ input into the lesson progression might be as simple as asking questions posed before the unit, that open windows into students prior knowledge on the topic to be learned.

5.2.5 Design Instructional Strategies

The design of Web-based instruction requires careful examination of issues important to diverse learners. E-learning instruction is accessible to all users regardless of their location, age, ethnicity, gender, or physical limitation. An e-learning course can be designed to address students’ learning styles by incorporating a variety of multimedia elements, such as graphics and conferencing tools (Khan, 2000). Ross and Schulz (1999) reported that the
way course information is presented and assignments are structured on the web can cater to
different learning styles.

Activities are one of the core structural elements of the ‘learning workflow’ model
for learning design. They form the link between the roles and the learning objects and
services in the learning environment. They describe the activities a role has to undertake
within a specified environment composed of learning objects and services. A learning
activity is directed at attaining a learning objective per individual user. Any user performs a
learning activity usually once (until completion).

A learning activity consists of a single activity-description and several optional
elements. The activity-description is the actual cue given to the user (rendered in the user-
interface) to describe the activity to be performed by the user. In most cases the activity-
description is a text (of type Web content). In other cases, it can be an audio-file (web
content), a video file, image or any other cue to the user. Other activities include examples,
exercises and assessments.

The types of activity in which the users will be involved play significant roles in the
success of pedagogic design (Barker *et al.*, 1991). Thus, studies on what kind of activities
(Edward, 1996), (Campbell, 1997), (Pickering, 1999) cater for most users’ needs are indeed
helpful in promoting better e-learning application design. With regards to this as well as
survey results (Kemalatha *et al.*, 2003), the seemly activities, which should be included in
the design of contents for e-learning environment so as to meet multiple intelligences,
include presenting content in various format, preparing exercises and/or assignment to suit
multiple learning styles and other online activities such as e-mail and chatting programs.

A design of learning content for multiple intelligences requires a holistic approach
to embed the pedagogy in the subject context. In face-to-face delivery, any problems such
as incomplete content and incorrect instruction can be addressed and rectified on the spot, especially if an instructor is experienced. It is very different from the content design for e-learning, because it has to accommodate the searchable, configurable, reusable and interoperable functions.

With reference to the proposed framework for effective e-learning in Chapter three and based on the SCEnE instructional design process model, we have adapted and extended the templates for learning content design to meet the educational requirements for students with Multiple Intelligences.

5.2.5.1 Template for Module Package

Figure 5.4 shows a conceptual model that assists transforming instructional design of learning content for e-learning. There are five major components: Overview, Information Object, Practical Object, Assessment Object and Summary. Practical Objects are optional depending on the requirements of the subject context.

![Figure 5.4: Template for module package](image-url)
5.2.5.2 Template for the Overview Component

The overview offers general information about the module, such as the module code, level, indicative content, learning objectives and pre-requisites (see Figure 5.5). In this template, the attribute of indicative content is associated with information objects representing a set of selected topics at appropriate granularities. The overview is useful to various stakeholders, e.g., content providers, subject tutors, students, and accreditors, to share information consistently. In SCEnE course design, the overview component is built within the ontology for subject disciplines to provide semantics for discovering and comparing relevant content and packaging the courses.

*Figure 5.5: Template for the Overview component*
5.2.5.3 Template for Information Objects and Content Objects

The Information Object component is the place where the core content is contained. The pedagogical and technical considerations will determine the quality of the information object, hence directly affect learning. An information object represents a topic in the module learning object. Figure 5.6 visualises the conceptual template of the information objects. The attributes of the information object have respective content objects, such as title, content layout or presentation, examples and exercises. The practical object refers to practical session (optional) that includes step by step instruction to conduct experiment. Assessment object contains all related information to the examinations which are usually graded.

![Diagram of Information Object]

*Figure 5.6: Template for Information objects and Content objects*
5.2.5.4 Template for Summary Component

The summary component (see Figure 5.7) concludes the module to review the subject which will assist students in self-assessment and self-reflection on understanding of the topics and applying knowledge and skills for problem solving at large. Recommendation on related areas may be provided to guide students to extend their knowledge for deep-learning.

![Figure 5.7: Template for the Summary component]

Based on the information from the four preceding steps, identify the strategies to be used for instruction to achieve the terminal objectives. The strategy will include sessions on pre-instructional activities, presentation of information (TELL), examples (SHOW), exercises (DO), assignments/projects (PRACTICE), testing and feedback, and follow-through activities. The strategy will be based on current theories of learning and results of learning research, the characteristics of the medium that will be used to deliver the instruction, content to be taught, and the characteristics of the students who will receive the instruction. These features are used to develop or select materials or to develop a strategy for effective e-learning instruction.
5.2.6. Develop and Select Instructional Materials

In an e-learning environment based on MI, contents are delivered digitally using text, graphics, animation, sound and/or video with elements of interactivity. This makes learning interesting and experiential. The activities of instructional designers include identifying the most appropriate choice of technology (synchronous or asynchronous mode) to deliver the course material, defining the teaching strategies and learning activities and recommending students’ assessment strategies. The subject expert creates the necessary materials. However, whether to create new materials or use existing materials to support MI is a decision that has to be made by the instructor or SME. Kovacevic (1992) suggests that the development team must consider a number of related features of the presentation of material such as the semantic content of the objects, the channel used for communication, the temporal characteristics of the presentation, the granularity of the objects, the sequencing of display components and the coordination of the overall display. The procedures for generating learning content in various approaches are shown in Figure 5.8 and Figure 5.9.
### Instructional Design Process Model

**Figure 5.8: Guidelines for Generating Learning Content in Various Approaches (VL, VS, IEP, & IRP)**

<table>
<thead>
<tr>
<th>SCENE</th>
<th>OBJECTIVE</th>
<th>TEACHER-CENTERED QUESTIONS</th>
<th>CONTENT PRESENTATION</th>
<th>SAMPLE LESSON (Boyle’s Law)</th>
<th>STUDENT-CENTERED MI STRATEGY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VL</strong></td>
<td>Include reading, writing, speaking and other forms of verbal and written communication</td>
<td>How can I use the spoken or written words?</td>
<td>Detailed text</td>
<td>Imagine a boil on your hand</td>
<td>Narrative</td>
</tr>
<tr>
<td>Verbal-Linguistic (word smart)</td>
<td>Enhance students VL intelligence by having them keep journals, play word games and by encouraging discussion</td>
<td></td>
<td>Recorded lesson</td>
<td>As you squeeze it, pressure builds</td>
<td>Students write a story or report on the topic.</td>
</tr>
<tr>
<td><strong>VS</strong></td>
<td>Utilize charts, graphs, diagrams, graphic organizers, videotapes, colour, art activities, doodling, microscopes and computer graphics software</td>
<td>How can I use visual aids, visualization, colour, art, metaphor, or visual organizers?</td>
<td>Charts, graphs, and maps</td>
<td>The more you squeeze, the higher the pressure</td>
<td>Listening</td>
</tr>
<tr>
<td>Visual-Spatial (art smart)</td>
<td>Enhance students VS intelligence by making them read diagrams or maps and solve mazes/ puzzles</td>
<td>Photographs and pictures</td>
<td>Acronyms, visual chains and mind maps</td>
<td>The boil bursts and pus spurts out</td>
<td>Pre-recorded lessons</td>
</tr>
<tr>
<td><strong>IEP</strong></td>
<td>Design lessons that include group work</td>
<td>How can I engage students in peer or cross-age sharing, cooperative learning or large-group simulation?</td>
<td>Post topic for discussion</td>
<td>Students are molecules in a container</td>
<td>VISUALIZATION</td>
</tr>
<tr>
<td>Interpersonal (people smart)</td>
<td>Plan cooperative learning activities</td>
<td>Group activities</td>
<td>They move at a constant rate</td>
<td>The container shrinks and the pressure increases, as the molecules bump each other</td>
<td>Students form a picture in their minds. This can be guided</td>
</tr>
<tr>
<td><strong>IRP</strong></td>
<td>Assign reflective activities, such as journaling</td>
<td>How can I connect content with personal feelings and memories, give students choices, or give them time to reflect?</td>
<td>Individual research on content</td>
<td>Recall a time you were under pressure</td>
<td>Brainstorm ideas</td>
</tr>
<tr>
<td>Intrapersonal (self smart)</td>
<td>Create self-paced activities</td>
<td></td>
<td>Self-paced projects</td>
<td>Did you feel you had much space?</td>
<td>Role playing and impersonating</td>
</tr>
</tbody>
</table>

**Content Presentation**
- Variety is the Spice of Learning
- Narrative
- Recorded lesson
- Case studies
- Word games
- Detailed text
- Recorded lesson
- Case studies
- Word games
- Detailed text
- Recorded lesson
- Case studies
- Word games

**Sample Lesson (Boyle’s Law)**
- For a fixed mass and temperature of gas, the pressure is inversely proportional to the volume
- Imagine a boil on your hand
  - As you squeeze it, pressure builds
  - The more you squeeze, the higher the pressure
  - The boil bursts and pus spurts out
- Students are molecules in a container
  - They move at a constant rate
  - The container shrinks and the pressure increases, as the molecules bump each other

**Student-Centered MI Strategy**
- Narrative
- Recorded lesson
- Case studies
- Word games
- Charts, graphs, and maps
- Photographs and pictures
- Acronyms, visual chains and mind maps
- Flow diagram

**Content Presentation**
- Narrative
- Recorded lesson
- Case studies
- Word games
- Detailed text
- Recorded lesson
- Case studies
- Word games

**Sample Lesson (Boyle’s Law)**
- For a fixed mass and temperature of gas, the pressure is inversely proportional to the volume
Figure 5.9: Guidelines for Generating Learning Content in Various Approaches (MR, LM, BK, & NA)
Once a set of solutions are decided upon, small working prototypes are built and tested with students to determine learnability, the effectiveness of the solution in enabling learning.

5.2.7. Conduct Formative Evaluation

Once a prototype of the instructional materials is created, they should be piloted with a group of learners to collect data in order to identify how the instruction can be improved to suit varied learners. Data from a formative evaluation are not simply used to revise the instruction itself, but are used to reexamine the validity of the instructional analysis and assumptions about the entry points and characteristics of students. It is necessary to reexamine statements of performance objectives and test items in light of collected data. The instructional strategy is reviewed and finally all this is incorporated into revisions of the instruction to make the e-learning environment more effective.

The following sections describe the implementation (refer to Chapter Seven) and evaluation phase (refer to Chapter Eight). In the implementation phase, the instruction is implemented in the actual learning setting with real learners. During this phase, typically instructors, technical support, facilitators, and other stakeholders of the instruction need to be briefed, if not trained themselves. For example, trainers would need to be familiarized with how to present a new course, how to use the instructor guides, and how to run the activities for example. The effectiveness of the course is assessed through summative evaluation procedures.
5.2.8. Implementation – Instruction Delivery

Implementation is the presentation of the learning experience to the participants utilizing the appropriate media. Table 5.3 shows the implementation techniques that support learning pedagogy. Table 5.3 gives a summary of the pedagogy needs that have been repetitively
surfaced in the research by the instructional design and web-based design fields for more effective e-learning. These needs are matched with known implementation techniques that take advantage of the unique properties of web-based courseware to support e-learning accommodating multiple intelligences.

Table 5.3
*Pedagogy Needs and Implementation Techniques*

<table>
<thead>
<tr>
<th>Pedagogy Needs</th>
<th>Instructional Techniques/ Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usage Help</td>
<td>On-line help for navigation and system use</td>
</tr>
<tr>
<td>Orientation and</td>
<td>Navigation Tools to help go back/forward, skip and access a table/contents</td>
</tr>
<tr>
<td>Progress through the lesson</td>
<td>Consistent Interface</td>
</tr>
<tr>
<td>Content questions</td>
<td>Glossary</td>
</tr>
<tr>
<td></td>
<td>E-mail/ chat to instructor or peers</td>
</tr>
<tr>
<td></td>
<td>FAQ’s</td>
</tr>
<tr>
<td></td>
<td>Search Engines</td>
</tr>
<tr>
<td></td>
<td>Hyperlinks to definitions</td>
</tr>
<tr>
<td>Additional references</td>
<td>Internal or external hyperlinks</td>
</tr>
<tr>
<td></td>
<td>Search Engines</td>
</tr>
<tr>
<td>Principles of Instruction</td>
<td>Table of content, orientation help</td>
</tr>
<tr>
<td>Overall structure</td>
<td>What are the module objectives</td>
</tr>
<tr>
<td>Provide an Introduction</td>
<td>Are pre-requisites defined</td>
</tr>
<tr>
<td>Pre-requisites</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3  
*Pedagogy Needs and Implementation Techniques (continuation)*

| Support for multiple learning styles | Text, Image, Sound, Video, Real life examples, Simulation, Games |
| Collaboration                        | ‘ThinkPairShare’, Group Work |
| Practice                             | Problem sets, Projects, Assignments |
| Testing                              | Multiple Choice, T/F, Short Answer, Essay, Matching |
| Feedback                             | Variation of style of feedback, Yes correct or No not correct, Using complete sentences to incorrect answers with correction, Placing feedback on the same location on every screen, Points back to where they can re-learn the material, Instant feedback vs delayed feedback, Adaptive feedback |

**Administrative Needs**

- **Attendance**: Logged participation
- **Grades**: Database of grades
- **Communicate**: Email/bulletin boards, listserv etc
- **Changes**
- **Analysis**: Scores average, tests analysis by questions

**Special Needs for Web Courses**

- **Authentication**: Passwords, ID Swipe Cards, Thumbprints
- **E-learning system**: Ease of use, Improve learning curve of instructor
- **Updating**: Hyperlinks that become obsolete
5.2.9. Conduct Summative Evaluation

The criteria for summative evaluation include the assessment of a) course content b) learning effectiveness c) layout, usefulness of exercise, activities, etc and d) instructional materials used for development. These evaluations provide valuable information for improving the course in the future. Summative evaluation is usually conducted at the end of the duration of the course conducted.

5.3 SCEEnE Instructional Design Process Model

The proposed model consists of nine phases, namely assess and analyze needs, identify entry points and characteristics, set learning objectives for focus and vision, develop criterion-referenced assessment items, design instructional strategies, develop instructional materials, conduct formative evaluation, implementation, and summative evaluation. The nine basic steps represent the procedures that one employs when the systems approach is used to design instruction. When instructional materials are being developed, data are collected and the materials are revised in light of these data to make them as effective and efficient as possible. Figure 5.11 illustrates the overall process flow of SCEEnE.
Figure 5.11: SCEnE Instructional Design Process Model
In this millennium, instructors of schools and higher learning institutions struggle to keep pace with all of the demands placed upon them. The educational pendulum continues to swing back and forth, with educators patiently waiting to see what courses they are expected to take. One of the appealing elements of incorporating Multiple Intelligences theory is that it allows teachers to teach in a manner that does not ask them to sacrifice verbal and analytical skills for, what some might term, more affective or nontraditional forms of intelligence (Latham, 1997). Instead, it provides an opportunity for educators to provide students with a deeper understanding, which Gardner defines as “sufficient grasps of concepts, principles, or skills so that you can bring them to bear on new problems and situations” (Gardner, 1993).

All too often, success in schools involves merely covering the book and sailing through the curriculum. However, to promote lifelong learning, students must be taught to think in ways that are natural and meaningful to them. Gardner (1993) describes intelligence as the ability to collect and analyze information and fashion products valued in at least one culture. The goal of education is not to look for what students can replicate, but instead what they can generate, demonstrate, and exhibit (Brooks and Brooks, 1993).

The model presented in Figure 5.11 provides educators with an instructor-friendly tool that can be used easily to ensure that students explore content, honor diversity, and support multiple intelligences. Instructors can differentiate instruction in their classrooms/online learning to enable students to learn as deeply and quickly as possible. The instructional design model is created based on the sound learning theories – behaviourist, cognitivist, constructivist and best technical practices in the research community and industry. The algorithms as the outcomes of this work are integrated with
the instructional design model to devise some underpinning design principles for learning content in e-learning environment.

Students learn in a variety of ways. Technology and mediated courses can meet these needs better, however, there is currently no authentic assessment tools that work in an online environment. There is currently no model or an e-learning application that meets the needs of diverse intelligences of students. The creation of a theory, model and an e-learning application will have a profound effect on the adoption of mediated courses because of its interactive, diagnostic, and multiple use components.

The SCEnE instructional design process model can be used by any electronic learning educator seeking to develop online courses prescriptive to the needs of different types of electronic learners. The basis of the model is that technology provides a deeper learning experience for students if content materials are presented in their most preferred style first, then in his/her second and third styles. Mediated learning materials assist students in learning more quickly and are more engaging for them than traditional delivery methods. The importance of the model is that it will provide individualized learning, although several dozens or hundred learners might be enrolled in the same online course. The template for course unit creation, generated by the model, will enable educators to plan effectively and modify curriculum and assignments to contend with each student’s individual learning style differences while adhering to e-learning pedagogy.

The instructional process shown in Figure 5.11 can be viewed as a system. The components of the system are the students, the instructor, the instructional materials, and the e-learning environment. These components interact in order to achieve the goal. In the following sub sections, we describe a series of steps, all of which will receive input from the preceding steps and will provide outputs for the next steps. All of the components work
together in order for the users to produce effective instruction. The model includes an evaluation component that will help determine what, if anything, went wrong and how it can be improved.

The nine basic steps in the SCEnE instructional design process model represent the procedures that one employs when the systems approach is used to design instruction. This set of procedures is referred to as a systems approach because it is made up of interacting components, each having its own input and output, which together produce pre-determined products. Data are also collected about the system’s effectiveness so that the final product can be modified until it reaches the desired quality level. When instructional materials are being developed, data are collected and the materials are revised in light of these data to make them as effective and efficient as possible.

The new role of the e-learning instructor is to:

- Design experiences and activities to facilitate student learning
- Encourage students to become active learners and constructors of knowledge
- Guide the process of learning while encouraging student initiative
- Teach, as well as learn from students

### 5.4 Strategies for the Application of MI in the Model

Following are the five strategies for the application of multiple intelligences:

*Focusing on the uniqueness of the individual*

An underlying assumption behind the practical application of the MI theory is the realization that every student is different. Effective e-learning cannot be enhanced through limited methodological approaches.
Teaching to the intelligences

In order to vary instructional approaches, instructors who use MI in the e-learning environment plan activities in order to incorporate each of the nine intelligences. Most schools emphasize the linguistic and logical mathematical intelligences. Educators (e.g., Armstrong, 2000; Chapman, 1993; Lazear, 2003), who advocate the application of MI in classrooms, suggest all the other intelligences (musical, spatial, bodily kinesthetic) be incorporated into lessons to help students learn linguistic and mathematical concepts. In addition, these educators suggest there should be a balance of interpersonal and intrapersonal activities in the learning environment.

Planning MI lessons

It would not be practical to teach every concept through each of the intelligences. Application of this theory does suggest, however, that instructors analyse their lesson plans to ascertain which intelligences are being utilised with each activity. Instructors should keep a log of their activities in an attempt to determine if any of the intelligences are over or under emphasised in their lesson plan. The significant point is that instructors should be aiming for balance in their plans by checking for overkill in some areas and omissions in other areas. Once instructors haven taken stock regarding the level of use of the intelligences in their planning, then instructors have enough information to revamp and adjust their plans in order to achieve the balance they desire.

Assessing the effectiveness of MI lessons

Students’ performance on assessments should be the criteria used to indicate the effectiveness of the course. Ultimately, the goal is to determine what the students have learned. The application of MI theory does not discourage testing as a primary source of e-learning assessment. In fact, previously it was stated that a primary focus should be to
incorporate other intelligences (i.e., musical, visual-spatial, interpersonal and intrapersonal) into instructional practices in order to assist students to master difficult verbal-linguistic and logical-mathematical concepts. Therefore the testing of those concepts is most appropriate.

In addition to tests, the application of MI does lend itself to other forms of assessment. An e-learning application featuring MI instruction can focus on alternative assessment methods which can accommodate students’ multiple intelligences, different ability levels, and special needs. Some of the assessment tools that can be utilised include student portfolios, performance assessments, artifacts, journals, logs, group projects, and rubrics.

Learning about successful application

In order to successfully implement MI theory, instructors should attempt to learn as much about the application of it as possible. There are a number of sources for this information. In addition to reading current literature about MI, instructors might seek out workshops and in-services focusing on the application of MI. Another great source of information is other instructors. Instructors should be in dialogue with each other regarding the success they have had in teaching the intelligences. Particular emphasis in the discussion should be aimed at discovering successful e-learning activities.

5.5 Features and Benefits of the Model

It appears that there are a number of reasons that systematic approaches to instructional design are effective. The first is the focus, at the outset, on what students are to know or be able to do when the instruction is concluded. Without this precise statement, subsequent planning and implementation steps can become unclear and ineffective. The second reason
for the effectiveness of the SCEnE system approach model is the careful linkage between each component, especially the relationship between the instructional strategy and the desired learning outcomes. Instruction is specifically targeted on the skills and knowledge to be taught and supplies the appropriate conditions for the learning of these outcomes. Another reason is that, instruction is designed not for one delivery, but for use on as many occasions as possible with as many students as possible. As it is reusable, it is worth the time and effort to evaluate and revise it.

5.5.1 SCEnE Course Model Format

To improve study effectiveness, the following course model format has been adopted: (Explained in detail in Chapter Seven)

- The definition of learning objectives
- The listing of necessary pre-requisite knowledge
- Different styles of presenting learning content
- Allowing the learner to control the pace and direction of the lesson
- Offering interactive progress to master the course contents. This includes self test, exercises and quizzes
- The creation of Web-based study support system where the student can find all information needed such as delivering study material and communication tools necessary for exchanging electronic messages such as e-mail, chatting and discussion groups
SCEnE’s goal is to create modules that provide a complete instructional program for the student, including online access to digitally recorded lecture presentations; reading materials developed by the instructors or in the assigned text book; examples and exercises in the student’s field of interest; link to other online materials of interest; individual and group assignments; and self assessment material to provide feedback on the skills being learned. The new organization of the course and the variety of materials and activities will allow for greater flexibility in catering to diverse learning styles based on the theory of MI: students can rely on the textbook, lectures, group work, or individual coaching mastering a module. In addition, students will be able to seek help from a variety of different people – the school/faculty member, teaching assistants, and peer mentors – again allowing flexibility in interacting with the person who can provide the best help for each particular problem.

The SCEnE system has seven learning concepts embedded in the e-learning application, for the developer of an e-learning module. They are the identification of learning objectives, the listing of pre-requisite knowledge necessary, various styles of presenting learning content, allowing the student to control the pace and direction of the course, and stipulations for testing and feedback. In addition, the system manages the screen design and navigational as well as other e-learning tools for the students and the developers/instructors. Each of these principles is discussed in more detail in the following sections.

**Characterisation of learning objectives**

Schank, (1998) reports that students need a road map of the course plan. Similar to a traditional setting where lecturers define the learning objectives of a course, developers of
e-learning courses should define the learning objectives clearly for a student to attain his/her goal. In support of this viewpoint, the first screen for input is the development of learning objectives for the course.

**Characterisation of pre-requisite knowledge**

One viewpoint from the cognitive learning theorist is that knowledge is learned by the merging of previous knowledge with new information (Hannafin and Peck, 1988). In a similar view, Brandt (1997) agrees that students construct knowledge by making sense of experience in terms of what is already known. The SCEEnE system prompts the developer for a list of the previous knowledge the student should have acquired prior to this topic.

**Present content in variety of learning styles**

Once the developer has created the learning objectives and the pre-requisite knowledge, the system automatically takes the developer to the construction of the learning content task area. The first task in the lesson content screen is the development of topics based on each chapter of the module. A topic is similar to the headings in a handout of the lecture. Once a new topic is entered, the system requests the instructor to develop the learning content in various styles to support multiple intelligences theory (Gardner, 1993). The importance to learning by providing the lesson content in a variety of styles also supports the views of (Murray, 1996; Merrill, 1997; Schank, 1998; Hannafin and Peck, 1988; Gagne *et al.*, 1992). Students have different preferences in the manner they learn best. Some students (verbal/linguistic intelligence) like to learn by reading a narrative of new information, as in reading a textbook or article. Some like to learn via visual representation, audio or video. The second view of learning styles is the inclusion of examples as suggested by Collins and Brown (1987). Some students prefer to view examples to have better understanding of a
topic. The third view of learning is the doing of quizzes or exercises. Assignments and projects can include a mix of multiple intelligence tasks. For example, small group work, including shared inquiry and peer teaching, experience charts to show students’ relationship to the topic or building backgrounds for a story/narrating a play on the topic. When instructors employ a wide variety of strategies in their teaching, students usually employ more ways of knowing any content.

Testing and Feedback

SCEnE incorporates various testing formats (true/false, multiple choice, short answer and matching). The developer has several options when adding the feedback capabilities to a course. Cyboran (1995) reports that feedback should be more than “correct answer” or “wrong answer” and states that feedback should let students know why their answer is wrong, use complete sentences and present feedback in the same location on every screen. Based on these recommendations, SCEnE supports complete sentences and other forms of enhanced feedbacks (links to the source material) that can be added to quiz questions. To allow the use of special terminology within content and to further support non linear reading patterns, an automated Glossary feature is included in the system. An instructor may insert a term into a glossary database for any course that is created. A key feature is that any term in the glossary will automatically become a hyperlink in the learning content documents.

Summarising the lesson

The summary component concludes the lesson, allowing students to recap what they have studied and to review the subject. This will assist students in self-assessment and self-
reflection on understanding of the topics and applying knowledge and skills for problem solving at large.

**Student controls the pace and direction of instruction**

Unlike traditional course structures that engage students in the same series of activities regardless of students’ disparate abilities and interests, SCEnE learning environment permits students to move quickly through content they already know and spend more time on areas they find more challenging. Students engage in study at their preferred time rather than at prescheduled times. Students do not all have to do the same thing rather allow them to learn at their own pace. However, instructors caution that some control of the flow of the course must occur by the developer. SCEnE does have both of these features incorporated into the design. First the learner must review the learning objectives, pre-requisites, and topics. From the point of the course onwards, the student can control the path through the hyperlinked topics. Some students may choose only examples, while others may choose the entire complement of content presentation, examples and exercises.

**The information management, communication tools and online resources**

Information Management includes services like registration, syllabus, bulletin board, grade book, calendar, online diary and assessment. Communication tools in SCEnE are e-mail, forum, chat, whiteboard, and file-sharing archives (submission and posting assignments). Online resources have annotated links to external websites as well as library access.

**5.6 Structural Components of SCEnE**
By adopting mathematical sets, it can be suggested that the structural components of SCEnE are:

\[
\text{SCEnE} = \{\text{Overview Section, Main Section, Summary Section}\}
\]

Overview Section = \{module code, learning objectives, pre-requisites, indicative content, assessment strategy, credit hours\}

Main Section = \{Module \(i\) for \(\forall i \in N\), where \(N = \text{Num of modules} = [1, 2, 3 \ldots]\)

Module \(i\) = \{Chapter \(i\) for \(\forall i \in N\), where \(N = \text{Num of chapters} = [1, 2, 3 \ldots]\)

Chapter \(i\) = \{Topic \(i\) for \(\forall i \in N\), where \(N = \text{Num of topics} = [1, 2, 3 \ldots]\)

Topic \(i\) = \{Title, \{Information Objects \(j\}\}\} for \(j \leq 3\) and \(\forall i \in N\), where \(N = [1, 2, 3 \ldots]\)

Summary Section = \{review, next steps, additional resources\}

In the above definitions, the main section can have as many modules as required, and in each module, there are no limits to the number of chapters. There are on average three to ten topics for each chapter. Each topic which has a title or heading, consist of three or less than three information objects. The information object comprises of TELL, SHOW, DO and PRACTICE methods. An idle topic includes content presentation in various formats (TELL), examples (SHOW) and exercises (DO). However, for some topics, there might be content presentation without examples or exercises \((j \leq 3)\).

Information Object = \{Content Object, Practical Object, Assessment Object\}

Content Objects = \{TELL, SHOW, DO\}

TELL = \{Tell Page, \{Method \(T_{ij}\)\} for \(\forall i = [1,2,3\ldots]\) and \(i \in TP\)
where TP = \{lesson content presented in various format; narrative, images, flash format, audio, video, facts presented in spreadsheet, database and document file\}

SHOW = \{Show Page, \{Method S_i\}\} for \(\forall i = [1,2,3..]\) and \(i \in SP\)

where SP = \{show questions and sample answers related to the topic\}

DO = \{Do Page, \{Method O_i\}\} for \(\forall i = [1,2,3..]\) and \(i \in DP\)

where DP = \{provide various types of exercises: multiple choice, true/false, short answers questions and give feedback to assist students in doing the exercise\}

Practical Objects = \{Practice\}

PRACTICE = \{Practice Page, \{Method P_i\}\} for \(\forall i = [1,2,3..]\) and \(i \in PP\)

where PP = \{assignments, project papers or experiments (if any) created in different ways to accommodate multiple intelligences\}

Assessment Objects = \{Evaluate\}

EVALUATE = \{Evaluate Page, \{Method E_i\}\} for \(\forall i = [1,2,3..]\) and \(i \in EP\)

where EP = \{evaluation through assessment or testing\}

Other Toolbar = \{Common e-learning tools, collaborative tools, self-paced tools\}

\textit{Note:}

Method refers to various approaches used to enhance learning activity

\(T = \text{Tell}, S = \text{Show}, D = \text{Do}, P = \text{Practice, E = Evaluate}\)

The above definition describes each topic as containing contents presented in various styles plus a combination of examples, exercises, practical and assessments. The higher the
number of i, in the definition Method T_i/S_i/D_i/P_i/E_i the more activities are provided in the e-learning environment.

Rather than serving a “fixed meal” of instructional resources, these new designs allow students to take advantage of resources according to their own needs. Redesign involves moving from an expensive and inefficient push strategy, which presents all material to all students in the same way, and at the same time, regardless of their particular needs, to a pull strategy.

Students access the material when they need it, an approach that takes into account differences in learning preferences and abilities. The latter strategy is not only more effective in dealing with learning issues but also more economical in dealing with resource issues because students use only as much resource as they need. Organized around computer-based assignments, with on-demand tutorial assistance provided as required; these new designs dramatically reduce both student failure rates and instructional costs.

A structured buffet of learning experiences tied to each content module was developed to meet the varying needs of students with different learning styles as measured by the Multiple Intelligences Inventory.

5.7 Summary

An effective and quality e-learning requires an employment of appropriate learning theory and paradigms, organization of contents, as well as methods and techniques of delivery. This chapter explains the research work in designing an e-learning environment with emphases on instructional design of courseware for e-learning. The focuses are on new innovation modules of production, presentation and delivery that take advantage of the
Internet’s power emphasising the capability of the students to participate. The instructional design model supports the development of a prototype system that should be easy for the developers to use, easy to learn and prompt the author for lesson content based on learning principles, and at the same time, emphasise on individual differences based on theory of multiple intelligences. In addition, the system should be highly interactive and take advantage of the web’s capabilities. In the following chapter, algorithms as the outcomes of this work are integrated with the instructional design model to devise some underpinning design principles for learning content in an e-learning environment.