CHAPTER II

REVIEW OF RELATED LITERATURE

The development and evaluation of training materials for teachers on information technology (IT) in general, and the Internet in particular, demands a combination of knowledge and skills. To build up a strong theoretical basis for this study, the researcher reviewed related literature on the use of Internet in education and in-service training for teachers on IT. The main objectives of the review of literature are to

- obtain background knowledge about the Internet and its use in education;
- understand the needs of the teachers as adult learners; and
- gather information on Instructional Development (ID) principles and practices that would be subsequently applied in this study.

Journals related to IT in education, telecommunications, adult education, teacher education, staff development, and instructional technology were the main references. Local studies, conference papers and dissertations were also scrutinized. The major constraint in the review of literature was the limited collection of related journals and publications – particularly on the use of Internet in education – available in the institutions of higher learning in Malaysia. This reflects a need for the institutions to acquire more publications in this field to support related research in future.

In the review of related literature, the researcher looked into three major areas. First of all, literature and research reports on how the Internet is being used, or can be used in education, were studied. This is done to develop further idea on how the Internet can help the teachers in their daily tasks.

This was followed by the study of the teachers' training needs as adult learners in general. Special attention was given to their training needs on IT. For this purpose, the researcher reviewed articles that offer suggestions to the effective planning and implementation of in-service training programs and computer/IT training courses for teachers.

The third area that was covered in the review of related literature was related to ID principles, theories, and techniques. The researcher studied major ID models, supported by literature on the ID process – needs assessment, task analysis, instructional objectives, selection of media and instructional activities, and formative evaluation. Helpful suggestions were gathered in order to systematically develop the Basic Internet for Teachers (BasIT) training package.

The review of the related literature presented in this chapter is organized under the following headings:

- Using the Internet in Education
- The Internet for Teachers
- The Teachers as Adult Learners
- In-Service Training on IT for Teachers
- Overview of ID Models
- ID in In-Service Training for Teachers
- Needs Assessment
- Task Analysis

- Definition of Instructional Objectives
- Selection of Media
- Selection of Instructional Activities
- Formative Evaluation of Instructional Program/Materials

Using the Internet in Education

With the many facilities it provides, the Internet has great potential as an instructional tool. It offers facilities that will expand the classroom walls infinitely and provide more meaningful interaction with learning materials. Shepardson (1995) acknowledged the potential of the Internet in education:

> Connecting our nation's schools to the Information Superhighway would allow the students to find and access information that otherwise would be unavailable to them. . . . Teachers and students could leave the boundaries of the classroom to interact with scientists and mathematicians, other teachers and students, and people globally. . . . Through traveling the Internet, students can access information and data about scientific phenomena in real-time, real-life situations, making learning exciting, relevant, and meaningful. (p. 14-15)

There are many ways the Internet can be used in education. It can be used to provide activities for students through existing projects on the Internet. For instance, Payne-Blackwell (1995) used the National Geographic Kids Network (NGKN) in her science lessons for elementary school children and Kang (1996) conducted Internet activities for a group of Malaysian secondary school students using KIDLINK and MathMagic. Such activities provide opportunities for students to interact with their correspondents from other states or countries. This will increase the students' awareness about others, improve their communication skills, and urge them to be more altruistic and cooperative.

The Internet can also be used as a channel for interactive-learning. Teachers can develop problem situations and send them electronically to the students, who will solve the problems cooperatively and send their answer back to the teachers for assessment and feedback. A telecommunications project like this had been carried out by some student-teachers in the Illinois State University (Day, 1995). This way, the students can be exposed to a new tool of information exchange as they learn.

The Internet provides opportunities for real-time learning. Kang (1996) suggested that, together with a video camera, the Internet Relay Chat (IRC) facility of the Internet can be used to conduct video-conferencing sessions. Communications between students separated geographically face less obstacle and delay in time. This will encourage more information-sharing among students (Robinson, 1994).

Teaching and learning become lively and full of fun with the World Wide Web (WWW). Using user-friendly software generally referred to as browser, teachers and students can search the Internet for all kinds of educational materials. There are numerous Web sites directly or indirectly dedicated to education for all levels. Many have contributed their efforts to review these sites for interested readers – educators in particular (Chan, 1998; Ellsworth, 1994; Gan, 1998)

The Internet for Teachers

Teachers need to be aware of the potential of the Internet in the classroom. They should realize that the facilities on the Internet can be used to provide meaningful and exciting learning activities like those reported by Day (1995), Kang (1996), and Payne-Blackwell (1995). They should also be creative and innovative, constantly seeking new ways to incorporate the Internet in their teaching tasks.

Effective teacher education and in-service training programs should be designed to increase their awareness of the potential and capability of this new technology.

Many institutions of higher learning and teacher education had recognized the potential of the Internet in education. In the United States (US) and United Kingdom (UK), universities had started to introduce training on the use of the Internet in their teacher education curriculum (Coyle and Harrison, 1993; Kyle, Abell, Shepardson, Seals, and Ruth, 1995; Russett, 1995; Waugh and Rath, 1995). From the findings of some of the studies conducted, the exposure to the Internet was reported to have provided the student-teachers with more ideas of the advantages and the application of the Internet in the classroom (Coyle and Harrison, 1993; Kyle, Abell, Shepardson, Seals, and Ruth, 1995; Russett, 1995). Other findings included that e-mail is most frequently used by student-teachers among other Internet facilities, followed by the Usenet (newsgroup) facility (Waugh and Rath, 1995).

For the in-service teachers, the Internet can be used as a tool for professional collaboration, consultation, as well as an instant resource center (Bos, Krajcik, and Patrick, 1995). Gallo and Horton (1994) find that teachers who use the Internet

1. developed a more positive attitude toward education and computers;
2. sustained higher self-esteem; and
3. tend to restructure their classes and daily work schedule to accommodate Internet use.

Based on their findings, Gallo and Horton (1994) suggested that educators who are considering establishing Internet connections at their schools should, among others,

1. provide teachers with ongoing training on using their computers;
2. give teachers user manuals and any other appropriate documentation related to their computers;

3. insure that the teachers' Internet work stations are configured with sufficient memory, disk space, and processor speed; and
4. design workshops or in-service activities that would assist teachers in making a transition from a lecturer to a facilitator.

For Malaysia, where the Internet is being seriously considered as an instructional tool, the suggestion that teachers should be provided with workshops and in-service activities in order to further equip them as Internet-using educators should be given due consideration.

The Teachers as Adult Learners

Training should be among the top agenda in the implementation of any innovation into an existing system. The plan of the Ministry of Education (MOE) to incorporate the Internet into the Malaysian education system should be supported by well-planned training programs for the pre-service and in-service teachers. The purpose of this study is to develop a training package for the teachers on the use of the Internet -- the BasIT training package. To produce an effective training package, it is important to first understand the characteristics of the teachers as adult learners.

Wood and Thompson (1980) stressed that awareness about adult learning is important in order to plan and conduct effective in-service training programs. A number of facts about the adult learners are (Cline, Billingsley, and Farley, 1993; Wood and Thompson, 1980):

1. Adults commit to learning when the goals and objectives of the training program are considered realistic and important to them, that is, the skills taught is job-related and immediately useful.

2. Adults will learn, retain, and use what they perceive as relevant to their personal and professional needs.
3. Adult learners need to see the results of their efforts and have accurate feedback about progress towards their goals.
4. Adult learning is ego-involved. Adults are always anxious in new learning situations such as in in-service training programs. They have fear of external judgment on their adequacy.
5. Adults come to any learning experience such as in in-service training programs with a wide range of previous experiences, knowledge, skills, self-direction, interests, and competence. Thus, individualization is appropriate for adults as well as for children.
6. Adults want to be involved in the planning of their own learning, i.e. in the selection of objectives, content, activities, and assessment.
7. Adults will resist learning situations which they believe are attacks on their competence.
8. Adults reject prescriptions by others for their learning, especially when what is prescribed is viewed as an attack on what they are presently doing.
9. Adults' learning is motivated by incentives like good salary, fringe benefits, and fair treatment. Sometimes, the motivation may come from recognition, achievement, and increased responsibility.
10. The adult learners are self-motivated, one can only encourage and create conditions which will nurture what already exists in them.
11. Adult learning is enhanced by planner and trainer behaviors that demonstrate respect, trust, and concern for the learner.

12. Adults learn best through concrete experiences in which they apply what is being learned and in informal situation where social interactions take place.

Therefore, Wood and Thompson (1980) suggested that in-service training programs should

1. include more participant control over the "what" and "how" of learning;
2. focus on job-related tasks that the participants consider real and important;
3. provide choices and alternatives that accommodate the differences among participants;
4. include opportunities for participants in in-service training to practice what they are to learn in simulated and real work settings as part of their training;
5. encourage the learners to work in small groups and to learn from each other; and
6. reduce the use and threat of external judgments from one's superior by allowing peer-participants to give each other feedback concerning performance and areas of needed improvement.

In-Service Training on IT for Teachers

Based on the knowledge of the characteristics of the teachers as adult learners, effective in-service training programs can be developed. However, to produce a training program on IT demands some knowledge of the teachers' needs for IT training. Some important elements to be considered are the instructor, content, instructional activities and support, course schedule, and assessment.

The Instructor

The credibility and competency of the instructor in a training program will assure the participants of the quality of training they will receive. In her study on the

practice of teachers' in-service training in Malaysia, Robiah (1992) found that teachers prefer credible trainers such as college and university lecturers in in-service training. Others, such as Noordin (1991) and Bennett (1994) stressed the importance of the instructor to be a teaching-professional as well.

> There is higher probability of success if the instructors themselves have been "front line troops" because they can more readily identify with the "real world" of classroom teaching and the complexity of integrating technology into classroom practice. (Bennett, 1994, p. 158)

Thus, in the matter of IT training for teachers, the instructor should be a trained teacher who is also competent in the matter of IT.

Content

In-service training programs on IT for teachers should concentrate on job-related tasks corresponding to the needs of the teachers, and have clearly defined goals and objectives (Bennett, 1994; Oh, 1992). Its training content should be application-oriented, rather than programming-oriented. It is better for them to start with something less technical (Gan, 1991; Noordin, 1991; Oh, 1992).

> In any teacher training course, be it pre-service or in-service, we should highlight computer uses which do not require massive and sophisticated expertise, do not involve understanding of complex computer language, and do not necessitate elaborate programming techniques. . . . the major kind of expertise the teacher need is still his expertise as an educator, not technological expert. (Gan, 1991, p. 217-218)

The content of any in-service training program on IT for teachers, then, should have clear goals and objectives, relevant to their needs. In addition to that, the planners of such programs should adopt a practical and less technical approach. The teachers, as adult learners, need to see the result of their learning and are motivated by early success. Therefore, less technical activities will encourage them to learn.

Instructional Activities and Support

The teachers, as adult learners, learn better in training programs that encourage interaction and collaboration (Bennett, 1994; Wood and Thompson, 1980). The participants should be encouraged to work in small groups, providing each other with feedback on their performance.

> Professional growth of teachers in areas of technology best takes place in an interpersonal setting that is supporting and non-threatening. Teachers prefer staff development activities that allow them to share idea with other teachers within a learning context which is interactive and congenial. (Bennett, 1994, p. 155)

Wood and Thompson (1980) had also suggested that in-service programs should include practice and simulation activities. It is important for participants to practice what they have learned in a simulated setting. This is especially appropriate where IT is concerned as hands-on practice is a vital element in computer training (Martin, 1990). It is also discovered that it is better to provide the training on the same type of computers found in the teachers' respective schools (Martin, 1990).

Joyce and Showers (1980) contended that the combination of several training components will be more effective than using only one. They suggested that in-service training activities should include several and perhaps all the training components they have listed after analyzing more than 200 studies on in-service training. The five major components of training that they listed down are:

1. Presentation of theory or description of skill or strategy;
2. Modeling or demonstration of skills or models of teaching;
3. Practice in simulated and classroom settings;
4. Structured and open-ended feedback (provision of information about performance);
5. Coaching for application (hands-on, in-classroom assistance with the transfer of skills and strategies to the classroom).

Other elements which will support the instructional activities in in-service training programs on IT for teachers are sufficient hardware and software, properly designed instructional manuals, and ergonomically designed computer training room (Oh, 1992). The use of educational technology like the computer will also be beneficial for adult learners (Office of Vocational and Adult Education, 1992). These should remind course planners of the importance of physical setting, instructional materials, and technical support in an in-service training program on IT for teachers.

Course Schedule

Desired changes in teaching behaviors are more likely to occur if teachers were given a period to adapt, modify, and integrate new techniques into classroom practice. Thus, in-service training activities should be spaced out to allow gradual change and adaptation in the participants (Bennett, 1994). Course planners and administrators should be concerned with the needs of teachers, as adult learners, for respect and trust (Cline, Billingsley, and Farley, 1993; Wood and Thompson, 1980). They should realize that teachers need time to practice their acquired new skills before the skills become operational in their classroom practice.

Besides the need for in-service courses to focus on their specific needs and abilities, teachers prefer the in-service courses to be scheduled conveniently (Ee, 1992; Minnesota Department of Education, 1989):

> In-service opportunities need to be conveniently scheduled. The times most frequently mentioned by teachers are during teacher workshop days and during the summer. (Minnesota Department of Education, 1989, p. 17)

In Malaysia, teachers' preferred time for computer in-service courses are likely to be during working days – that is during their free time in the afternoon – or weekends and semester breaks as discovered by Ee (1992).

Assessment

As adult learners, teachers need to see the results of their efforts and have accurate feedback on their progress. On the other hand, they are anxious about new learning experiences and are fearful of any indication of their inadequacy. They tend to resist any learning situations which they perceive as attacks on their competence (Cline, Billingsley, and Farley, 1993; Wood and Thompson, 1980). Planners of in-service training programs on IT should be aware of these while planning to assess the performance of participants.

Bennett (1994) suggested that assessment in in-service training programs for technology diffusion in education should be continuous, measuring teacher and student over time. The trainer should aim to assess the progress of the participants throughout the program, rather than only their final performance after the program.

In an introductory computing course, Noordin (1991) suggested that the assessment method should be able to encourage the participants to be confident with the practical aspects of the subject, rather than merely the theoretical foundation. He recommended the joint application of four assessment modes:

- Oral presentation (the participants verbally relate their knowledge)
- "On-the-terminal" assessment (practical demonstration of skills)
- Prompt quiz (test of theoretical foundation)
- Assignment/Homework (application of skills and group interaction)

The combined application of these assessment methods will cover both the theoretical and practical aspects of the subject.

Overview of ID Models

In-service training programs are instructional in nature. They should be planned and developed systematically based on sound theories and principles of Instructional Development (ID). Seels and Glasgow (1990) defined ID as

> . . . both a process and a discipline. As a process, it is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. As an area of study, it is that branch of knowledge concerned with research and theory about specifications for instruction and the process for developing those specifications. (p. 4)

Many ID models had been introduced. These include the Instructional System Development (ISD) Model (Leshin, Pollock, and Reigeluth, 1992); the models introduced by Gagne and Briggs (1979), Jerrold Kemp (1985), Dick and Carey (1985), Seels and Glasgow (1990); and the Layers-of-Necessity Model (Tessmer and Wedman, 1990). ID models are representations of the process one agrees to follow when doing ID. They serve several purposes (Seels and Glasgow, 1990):

1. They visualize a systematic process, thus allowing those involved to reach consensus on that process.
2. They provide a tool for managing the process and project.
3. They allow the designer to test theories by integrating them within a practical model that can be applied.
4. They set tasks for the designer that can be used as criteria for good design.

Most ID models – including the ISD Model (Leshin, Pollock, and Reigeluth, 1992), Gagne and Briggs Model (Gagne and Briggs, 1979), Dick and Carey Model

(Dick and Carey, 1985), and Seels and Glasgow Model (Seels and Glasgow, 1990) – follow the sequential pattern in ID. In these models, the ID process is described as a series of stages and steps of action, one following another. The output of one phase serves as the input to the next.

Other ID models moved away from the step-by-step sequential pattern. For instance, Kemp Model (Kemp, 1985) listed down several ID components – such as learning evaluation, pre-testing, learner characteristics, subject content, task analysis, formative evaluation, revision, etc. – and considers their relationship with one another.

The Layers-of-Necessity Model (Tessmer and Wedman, 1990) offers yet another approach where ID activities were considered as layers with increasing degree of sophistication. In this model, the course developer can control the complexity of each ID step, according to the time and resources available. For example, the formative evaluation can be carried out through the expert review under severe time and resource constraints, which actually can be supported by more sophisticated ID activities – such as the multiple one-to-one, small group, and field trials – under less constrained situations.

There are more similarities than differences among the ID models. Systematic ID processes as described in these models involve five major phases (Thiagarajan, 1990, 1991):

1. **Analysis** – inquiry of what the problem is, the conditions and characteristics of the learners, etc.;
2. **Design** – creation of a blueprint for the instructional methods and materials;
3. **Production/Development** – preparing the training package;
4. **Evaluation** – improvement of the package by trying it out; and

5. **Implementation** – installation and diffusion of the package on site.

Thiagarajan (1990) commented that one may not skip any of these phases without potential hazards. However, he stressed on flexibility and exercise of discretion when going through the phases:

> Don't turn into an obsessive-compulsive. You do not have to complete the entire analysis before you proceed to design. Real instructional designers work on the design of one unit while constructing the analysis of another. They even begin the analysis activity in the middle of evaluation. Use the five phases with freedom and flexibility. (p.17)

ID in In-Service Training for Teachers

ID principles should be applied in designing training programs for teachers. The systematic approach of planning is necessary to provide personalized training assistance for teachers. Dealing with teachers of special students, Cline, Billingsley, and Farley (1993) recommended that the planning of staff development programs should begin with the identification of the needs of the target learners, followed by the definition of goals and objectives, and so on. The characteristic of the step-by-step sequential ID models can be seen in their proposal. Similarly, this characteristic is also demonstrated in the technical assistance approach proposed by Trohanis and Jackson (1980), which involves five steps in planning and implementing in-service training:

1. Client has mission and in-service plan.
2. Agent and Client assess needs.
3. Agent prepares agreement with Client.
4. Agent coordinates and/or delivers assistance to Client.
5. Agent and Client evaluate assistance.

In-service training for teachers should be planned with the needs of the teachers in mind. Applying ID principles in the planning of in-service training for teachers will help to fulfill the training needs of the teachers.

Needs Assessment

Instructional programs should be designed with the learners in mind – their experiences, interests, levels of ability, etc. Therefore, in the planning of in-service training programs, the characteristics of the adult learners should be taken into consideration. Ineffective staff development programs are often caused by the failure to identify relevant needs and priorities (Cline, Billingsley, and Farley, 1993).

Teachers, as adult learners, will commit to learn only when they find the learning tasks are relevant to their daily work (Cline, Billingsley, and Farley, 1993; Robiah, 1992; Wood and Thompson, 1980). Therefore, the development of training programs for teachers will certainly have to be based upon the understanding of the teachers' training needs. Proper needs assessment helps the course developer to identify the problem in an organization; know more about the target learners and their needs; recognize the resources and constraints of the organization; and design an appropriate instructional solution (if relevant) for the problem.

One should first determine what he need to know, how he will collect the information, and whom or what he will use as a source of information before proceeding to collect data for needs assessment. Information needed can be obtained from various sources including the learners themselves, educators, school administrators, parents, and community members (Cline, Billingsley, and Farley, 1993; Dick and Carey, 1985). Methods of inquiry such as interview, survey by questionnaire, observation, and consultation can be used where applicable. For

instance, Ganske and Hamamoto (1984) – who developed a Computer Literacy training program for pre-service teachers – conducted needs assessment through survey, review of literature, and interview. Zoraini (1985) obtained data to formulate a theoretical model of a computer literacy curriculum through review of literature, correspondence, and survey.

In another study, Pina (1992) visited the school where he is supposed to develop and implement a computer literacy curriculum. The result of his visits and discussions with the school administrators prompted him to shift the focus of the curriculum from programming to computer application and usage. From his visits, he had also discovered that the school has problem with computer facilities. As a solution, he helped the school to establish a partnership with the Department of Instructional Science nearby so that the students can use the Department's Computer Laboratory on every week-day before its normal operating hours. Thus, needs assessment helps the course developer to assess the resources available and constraints in an organization so that support can be obtained accordingly.

Task Analysis

In order to achieve the instructional goals of a training program, the learning tasks involved should be identified and analyzed. This can be done by performing task analysis. Task analysis is the process of breaking a task down into a manageable number of steps.

Leshin, Pollock, and Reigeluth (1992) explain that a task can either be a procedural task or a transfer task (Table 2). The selection of content in ID will depend on whether the learning task involved is procedural or transfer. Tasks that are procedural can easily be broken down into sequential steps. On the other hand,

transfer tasks have activities that vary considerably each time they are performed. Thus, it is more useful to analyze a transfer task as to the underlying principles which the learner can use to generate the appropriate procedure for a given situation.

TABLE 2

Examples of Procedural Tasks and Transfer Tasks

Procedural Tasks	Transfer Tasks
• Performing cardiopulmonary resuscitation	• Evaluating mid-level managers
• Adding fraction	• Counseling patients
• Loading a roll of film into a camera	• Motivating employees
• Installing a hard disk on a computer	• Implementing an unpopular change in a workplace

From *Instructional Design Strategies and Tactics* (p. 84) by C.B. Leshin, J. Pollock, and C.M. Reigeluth, 1992, Englewood Cliffs, New Jersey: Educational Technology Publications.

To analyze the learning tasks involved for a computer literacy training program, Ganske and Hamamoto (1984) began by giving an operational definition for computer literacy. They then arranged the skills/knowledge involved in a hierarchy and constructed a flow-chart to show the sequential relationship of the skills/knowledge with one another.

In the development of a computer application curriculum, Pina (1992) proposed a list of tasks for the students. These tasks were then further analyzed to produce the list of content for the curriculum.

Definition of Instructional Objectives

The purpose of having instructional objectives are (Leshin, Pollock, and Reigeluth, 1992):

- To provide a focus for selecting instructional content

- To provide a focus for selecting media, instructional strategies, and tactics
- To provide a focus for assessing the learner's knowledge, skills, or performance in relationship to the task
- To provide a focus for continuing evaluation of a training program and materials
- To direct the learner's attention to the expected learning and desired performance.

Adult learners need to have clear goals and objectives in their learning (Bennett, 1994; Cline, Billingsley, and Farley, 1993; Wood and Thompson, 1980). Therefore, instructional objectives should clearly state the intended learning outcome in terms of a measurable learner performance. Researchers recommended that the statements of objective should identify the skills to be learned (performance), the conditions under which the skills must be performed (conditions), and the criteria for successful performance (standard) (Dick and Carey, 1985; Leshin, Pollock, and Reigeluth, 1992).

Gagne and Briggs (1979) suggested that there are five components of operational descriptions of instructional objectives. The objectives must describe

- the **action** that the learner is to take
- the **situation** in which the action takes place
- the **object** (product) of the performance
- the kind of human **capability** to be learned from the performance
- the **tools and other constraints** expected to occur in the performance.

Seels and Glasgow (1990) compared three formats of objective statements -- Mager format by Robert Mager, ABCD format by the Instructional Development Institutes (IDI), and the Gagne and Briggs format (Table 3).

TABLE 3

Comparison of Formats of Performance Objectives

Component	Mager	Gagne and Briggs	ABCD
Behavior (What will be done)	Behavior (Doing verb)	Learned capability, object, and action	Behavior
Condition (Under what)	Condition	Situation	Condition
Criteria (How well)	Criterion	Tools/Constraints	Degree
Learner (By whom)	(Implied)	(Implied)	Audience

From *Exercises in Instructional Design* (p. 136) by B. Seels and Z. Glasgow, 1990, Columbus, Ohio: Merrill Publishing Company.

They concluded that whatever the format one chooses in writing instructional objectives, the idea is that the objectives must be clear and specific.

Selection of Media

In the selection of appropriate media to support a training program, several factors have to be taken into consideration. For Gagne and Briggs (1979), these factors include the learning tasks involved, the learners, the learning environment, the development environment, the economy and culture, and other practical factors, such as

1. What size of group must be accommodated in one room at a single occasion?
2. What is the range of viewing and hearing distance for the use of the media?
3. How easily can the media be "interrupted" for pupil responding or other activity and for providing feedback to the learners?
4. Are necessary hardware and software items obtainable, accessible, and storable?

They proposed a media selection method that had ten components:

1. **Analyze objective** of a lesson to identify the essential pre-requisites needed and the skills to be learned;

2. **Classify objective** in terms of the domain of learning involved – cognitive, affective, or psychomotor;

3. **List instructional events** to be accomplished during the lesson;

4. **Select type of stimuli** such as words (written or spoken), programmed instruction, tape recording, still pictures, moving pictures, simulations, etc. for each instructional event, taking into consideration the objective and the learner characteristics;

5. **List candidate media** that may be used to convey the selected type of stimulus;

6. **Select theoretically best media**;

7. Decide on the **final media selections**;

8. Establish the **rationale for media choices**;

9. **Write prescriptions for media production** – incorporate communications to the learner which affect the conditions of learning relevant to the type of outcome implied by the lesson objective;

10. **Write script** – author and produce the media, often called a **script**.

Some researchers, such as Anderson (1976) and Kemp and Smellie (1989), forwarded media selection flow-charts to assist course developers in their media decisions.

In the case of a computer-related training program, hands-on practice is vital (Martin, 1990). Thus, the use of computers is inevitable. However, support by other media can further improve the effectiveness of the program. For instance, in implementing the computer application curriculum he developed, Pina (1992) used other media such as the liquid-crystal display (LCD) panel, overhead projector, overhead transparencies, pictures, and hypermedia-based presentations in addition to computers. For in-service training programs on IT for teachers, the incorporation of

such technologies is advisable, as the use of instructional technology is beneficial for adult learning (Office of Vocational and Adult Education, 1992).

Selection of Instructional Activities

Instructional activity is an important component of instructional programs. It sustains the interest of learners, motivates learning, and elicits learner's performance. Gagne and Briggs (1979) provides valuable ideas in the planning and selection of instructional activities. Based on cognitive theories of learning, they defined instruction as a set of events external to the learner which are designed to support these internal processes of learning.

According to Gagne and Briggs (1979), the events of instruction should be designed to make it possible for a learner to proceed from "where he is" to the achievement of the capability identified as the target objective. Nine instructional events are important in the process of instruction:

1. Gaining attention
2. Informing the learner of the objective
3. Stimulating recall of pre-requisite learning
4. Presenting the stimulus material
5. Providing learner guidance
6. Eliciting performance
7. Providing feedback about performance correctness
8. Assessing the performance
9. Enhancing retention and transfer.

Based on the knowledge of the events of instruction, various kinds of activities can be chosen to facilitate learning. Tan (1991) recommended that these instructional

events should be incorporated in the organization of content and instructional activities in computer courseware. In a training program on IT, Gagne's events of instruction is indeed a useful guide in planning meaningful instructional activities that will contribute to better learning outcome.

Formative Evaluation of Instructional Program/Materials

Formative evaluation is the process of determining the worth of a training package in order to improve its effectiveness. Dick and Carey (1985) defined formative evaluation as

> . . . the process instructors use to obtain data in order to revise their instruction to make it more efficient and effective. (p.198)

Although formative evaluation is considered one of the steps in the ID process, Thiagarajan (1991) stressed that it should be a continuous process throughout the different ID stages. In the long run, formative evaluation should be an ongoing procedure for updating and upgrading a training package after it has been implemented.

For the purpose of formative evaluation, Saroyan and Geis (1988) suggested that there are three data sources – the learners, the experts, and the users. The learners contribute to formative evaluation by conveying their general feeling towards the materials; the experts provide helpful recommendations intended to improve the content, presentation, and pedagogical value of the instructional materials; and the users of the materials (the teachers and instructors) contribute from yet another perspective. Information for formative evaluation should be collected from these three parties concerned.

Chinien and Boutin (1994) proposed that the effectiveness of instructional materials should be viewed within a framework of three major elements – learner's achievement, study time, and learner's attitude toward the materials. The effectiveness of instructional materials should be evaluated by first observing the learner's achievement. However, the instructional input – the training package, the complexity of content, the size of target population, etc. – should be taken into consideration. Thus, an instructional program which produce desirable learning outcome within a shorter study time is considered more effective. Another indicator of instructional effectiveness is learner attitudes. Effective instructional materials should be able to generate more positive learner attitudes.

Conventionally, formative evaluation follows a four-phase sequence – expert review, one-to-one trial, small group trial, and field trial (Dick and Carey, 1985; Leshin, Pollock, and Reigeluth, 1992).

Expert Review

The expert review is the stage where the materials developed are being evaluated by a pool of experts (Thiagarajan, 1991). Leshin, Pollock, and Reigeluth (1992) suggested that this review should cover at least two areas – content and instructional strategy; while Saroyan and Geis (1988) added another area to be considered – presentation format of the materials.

The experts should review and correct (if necessary) the training package for accuracy of content; proper sequence regarding pre-requisites; current, up-to-date information; appropriate use of media; and effectiveness of visuals. They should also provide advice for instructional strategies, such as good elaboration sequence; appropriate use of learning strategies; and appropriate tactics for each type of learning.

In addition to these, the text format, legibility, use of color and graphics for the materials should also be examined. Thiagarajan (1991) commented that target population experts should be consulted also so that the materials developed would be relevant to the target learners.

One-to-One Trial

The purpose of the one-to-one trial is to identify and remove the obvious errors in the instruction, and to obtain initial reactions to the content from learners (Dick and Carey, 1985). This is accomplished through the direct interaction between the course developer and individual learners. For one-to-one trials, the course developer selects three or more learners of different abilities – high, average, and low — from the target learner population (Dick and Carey, 1985; Leshin, Pollock, and Reigeluth, 1992). He prepares draft materials incorporating the results of the expert review and works on individual basis with each of the selected learners.

Some researchers conducted one-to-one trial only on one learner. Puvanendran (1992) tried out the courseware he developed on only one student during one-to-one trial before having a small group trial. Such attempts (one-to-one trial on one single learner only) must be done with extra care so that sufficient data will be collected to fulfill the purpose of the trial.

Small Group Trial

The results from the one-to-one trials is then used to revise the draft materials to produce a set of revised materials. In the small group trial, the revised materials are tested on a small group of learners, approximately eight to 20 in number (Dick and Carey, 1985; Leshin, Pollock, and Reigeluth, 1992). The sample of learners in this

stage should be selected at random, comprising representatives of each type of subgroup in the target population, such as (Dick and Carey, 1985)

- low, average, and high achievers
- learners with various native languages
- learners who are familiar with a particular procedure, such as computerized instruction, and learners who are not
- males and females
- younger or inexperienced learners as well as more mature learners.

After presenting the materials, the course developer collects feedback from the learners. This can be done by administering an attitude questionnaire, supported by in-depth interviews if possible. Dick and Carey (1985) suggested some appropriate questions to ask:

- Was the instruction interesting?
- Did you understand what you were supposed to learn?
- Were the materials directly related to the stated objectives?
- Were sufficient practice exercises included?
- Were the practice exercises appropriate?
- Did the tests really measure your performance on the stated objectives?
- Did you receive sufficient feedback on your practice exercises?
- Did you receive sufficient feedback on your test results?
- Were the enrichment or remedial materials satisfactory?

The small group trial can be repeated if the developer think it is necessary to further improve the materials before the field trial.

Field Trial

The final stage of the formative evaluation is the field trial. In this stage, the course developer attempts to use a learning situation that closely resembles that which is intended for the ultimate use of the instructional materials. Dick and Carey (1985) suggested that about 30 individuals should be identified to participate in the field trial. Again, the group selected should represent the target population as in the case of the small group trial.

Summary

The Internet has great potential as an instructional tool. As the government introduce Internet-related projects such as Jaringan Pendidikan (JP) and Pusat Sumber Elektronik (PSE) in schools, the move to introduce the Information Superhighway in our school system is getting closer to realization. The development of a training package like the BasIT is indeed timely and relevant.

In order to produce in-service training programs on the use of the Internet for teachers, attention should be devoted to their training needs. These includes their learning needs as adult learners, their preferences and interests in IT training, and their source of motivation in in-service training programs. The review of literature revealed that teachers commit to learn those skills they consider relevant to their work (Cline, Billingsley, and Farley, 1993; Robiah, 1992; Wood and Thompson, 1980). It also suggested that IT training for teachers should place emphasis on practical and less technical skills to create a more encouraging learning environment (Gan, 1991; Noordin, 1991; Oh, 1992). Besides having opportunities to interact with their colleagues (Bennett, 1994; Cline, Billingsley, and Farley, 1993; Wood and Thompson, 1980), teachers should have hands-on practices to achieve better learning

results in training programs on IT (Martin, 1990). Joyce and Showers (1980) proposed that a combination of various training components can increase the effectiveness of the training programs. It is also suggested that the assessment of participants in these IT-related programs should cover practical skills, and not merely theoretical knowledge (Noordin, 1991).

In the development of in-service training programs for teachers, researchers applied ID principles and practices in order to provide more effective training assistance (Cline, Billingsley, and Farley, 1993; Trohanis and Jackson, 1980). The theories and principles needed for the development and evaluation of the BasIT training package in this study are discussed in major ID models (Dick and Carey, 1985; Gagne and Briggs, 1979; Kemp, 1985; Leshin, Pollock, and Reigeluth, 1992; Seels and Glasgow, 1990; Tessmer and Wedman, 1990) and other supporting literature (Anderson, 1976; Chinien and Boutin, 1994; Ganske and Hamamoto, 1984; Kemp and Smellie, 1989; Martin, 1990; Minnesota Department of Education, 1989; Office of Vocational and Adult Education, 1992; Oh, 1992; Pina, 1992; Saroyan and Geis, 1988; Tan, 1991; Thiagarajan, 1990, 1991; Zoraini, 1985). The study of these literature provided the theoretical basis for this study.