UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

ICT APPLICATION IN TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

SPECIALIZED TRAINING COURSE

UNESCO INSTITUTE
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ICT Application in Technical and Vocational Education and Training. Specialized training course

The specialized training course has been prepared within the framework of the project *Information and Communication Technologies in Technical and Vocational Education and Training* (TVET) launched by the UNESCO Institute for Information Technologies in Education in 2002.

The course offers opportunities to acquire and develop the knowledge and practical skills necessary to establish, manage and appraise ICT-mediated teaching and learning in TVET. Each unit of the three-module course includes instructional objectives, relevant training materials for each objective and corresponding application exercises. Personal assessment of training needs at the beginning of the course helps learners to plan an individual programme of study. Training programme effectiveness is measured by means of evaluation questionnaires at the end of the course.

Designed especially for policy-makers, managers and administrators of TVET institutions, programme planners, training and programme development specialists, the specialized training course provides learners with theoretical and practical tools enabling them to promote and strengthen the technical and vocational education and training through the balanced use of Information and Communication Technologies (ICTs).

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INTRODUCTORY NOTES

Programme Aim

The goal of this training programme is to build the capacity of high-ranking vocational educational specialists to enable them to effectively promote and strengthen the use of ICTs in technical and vocational education and training.

Programme Goals

1. Enable high-ranking specialists to select strategies and develop policies for integrating ICT-mediated teaching and learning in TVET.

2. Enable high-ranking specialists to supervise the development and use of ICT-mediated teaching and learning for teaching in TVET.

3. Enable high-ranking specialist to promote the use of ICTs to enhance on-site and online learning.

Programme Objectives

- Develop an ICT strategy for TVET.
- Develop policies for acquisition, maintenance, and use of ICTs.
- Promote the use of ICTs in TVET.
- Familiarize with pedagogical considerations for ICT usage in TVET.
- Familiarize with instructional technology applied to ICT usage in TVET.
- Understand the process involved to convert existing resources to ICT-mediated learning materials.
- Understand the process involved to develop ICT-mediated learning materials.
- Troubleshoot ICT-based learning system.
- Plan the use of ICTs for learning in TVET.
- Assist learners to use ICTs for learning.
- Facilitate on-site learning in TVET using ICTs.
- Facilitate online learning in TVET using ICTs.

Structure of Thematic Modules

Each thematic module is divided into a number of appropriate units. Each unit will include instructional objectives, relevant training materials for each objective, and some application exercises designed for transformation through reflection on learner's own assumptions and perspective. A list of recommended literature will be provided for each unit.

Target Groups of Participants

This programme targets to the following TVET specialists:

- Policy-makers;
- Managers and administrators of TVET institutions;
- Programme planners;
- Training and development specialists.

Mode of Delivery

This instructional material can be used for self-directed learning or instructor-led training.

SPECIALIZED TRAINING COURSE OUTLINE

MODULE 1

IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

- **UNIT 1.1** ICT strategy for TVET
- **UNIT 1.2** ICT policies for TVET
- **UNIT 1.3** Promoting ICT integration in TVET

MODULE 2

ICT–MEDIATED TEACHING IN TVET

- **UNIT 2.1** Consider ICT usage in TVET
- **UNIT 2.2** Convert existing resources to ICT–mediated learning materials for TVET
- **UNIT 2.3** Perform various training design analyses
- **UNIT 2.4** Design ICT–mediated learning materials for TVET
- **UNIT 2.5** Develop ICT–mediated learning materials for TVET
- **UNIT 2.6** Evaluate ICT–mediated learning materials for TVET
- **UNIT 2.7** Use of ICTs in TVET

MODULE 3

ICT–MEDIATED LEARNING IN TVET

- **UNIT 3.1** Plan the use of ICT–mediated learning in TVET
- **UNIT 3.2** Assist learners to use ICTs for learning
- **UNIT 3.3** Facilitate on–site learning in TVET using ICTs
- **UNIT 3.4** Facilitate online learning in TVET using ICTs

Training Needs' Analysis

This instructional material can be used for self-directed learning or instructor-led training. If you are going to study this material by yourself please complete the Training Needs' Analysis Scan. This will enable you to assess your own learning need and assemble various segments of instruction into a learning package to assist you in meeting your learning needs.

We also encourage those who are participating in training programme, which is facilitated by an instructor, to complete the Training Needs' Analysis Scan. However, we recommend that you skip the part of the questionnaire dealing with "Decision". Your instructor will help you interpret your ratings and advise you on a course of action.

Please, use the following Training Needs' Analysis Scan to assess your training needs.

Read each competency statement carefully. Rate each competency statement in terms of Degree of Importance and Skill Level, as they relate to you, by circling the corresponding number.

Degree of Importance	**Skill Level**
5 - very high importance	5 - highly skilled
4 - high importance	4 - very skilled
3 - important	3 - skilled
2 - low importance	2 - low skilled
1 - very low importance	1 - very low skilled
0 - not important at all	0 - not skilled at all

After completing the Training Needs' Analysis, examine your paired responses for each competency statement – Importance and Skill Level. Use the following Decision Aid to assist you in selecting the appropriate units of instruction to meet your training needs.

Decision aid (for self-directed learners)

Degree of Importance based on self–rating	Skill Level based on self–rating	Decision
0, 1, 2, 3, 4, 5	5	Skip unit of instruction
3, 4, 5	0, 1, 2, 3, 4	Study unit of instruction
1, 2	2, 3, 4	Skim through the material
1, 2	0, 1	Study unit of instruction
0	0, 1, 2, 3, 4, 5	Skip unit of instruction

Training Needs' Analysis Scan

MODULE 1 IMPLEMENTATION OF ICT-MEDIATED TEACHING AND LEARNING IN TVET

Unit 1.1 ICT strategy for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**1.1.1**	Develop the institution's ICT vision, mission, goals and strategy	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.2**	Communicate the institution's ICT vision, mission, goals and strategy	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.3**	Develop awareness of the cost–effectiveness of ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.4**	Develop a budget for the implemen–tation of ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.5**	Identify funding sources to support ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.6**	Develop a funding proposal for the integration of ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**1.1.7**	Develop awareness of the training needs of teachers and trainers in the use of ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 1.2 ICT policies for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**1.2.1**	Develop specific policies for the implementation of ICT–mediated teaching and learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 1.3 Promoting ICT integration in TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	1.3.1	Promote the use of ICTs among TVET instructors and learners	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

MODULE 2 ICT-MEDIATED TEACHING IN TVET

Unit 2.1 Consider ICT usage in TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	2.1.1	Develop awareness of the pedagogical principles in the design and development of ICT–mediated learning materials	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	2.1.2	Develop awareness of the principles of adult learning for ICT–mediated teaching	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.2 Convert existing resources to ICT-mediated learning materials for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	2.2.1	Familiarize learners with the issues and concerns in adapting existing materials for digital delivery	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.3 Perform various training design analyses

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	2.3.1	Design and develop a needs' assessment/ analysis plan	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	2.3.2	Select and use various task analysis strategies	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	2.3.3	Select and use training needs' analysis strategies	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.4 Design ICT-mediated learning materials for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**2.4.1**	Develop an understanding of the principles of instructional design	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.5 Develop ICT-mediated learning materials for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**2.5.1**	Develop an understanding of the principles of systematic instructional design	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.6 Evaluate ICT-mediated learning materials for TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**2.6.1**	Develop an understanding of the principles of formative evaluation	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 2.7 Use of ICTs in TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**2.7.1**	Survey common usage of ICTs	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**2.7.2**	Survey the use of ICTs for programme support	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**2.7.3**	Survey the specialized use of ICTs	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**2.7.4**	Consider issues regarding the use of ICTs	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**2.7.5**	Develop awareness of the need for international cooperation in the use of ICTs	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

MODULE 3 ICT-MEDIATED LEARNING IN TVET

Unit 3.1 Plan the use of ICT-mediated learning in TVET

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**3.1.1**	Consider the effectiveness of ICT–mediated learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.1.2**	Consider the potential contribution of ICTs to learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.1.3**	Identify essential ICT literacy skills for learners	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.1.4**	Develop awareness of assistive technology to accommodate learners with special needs	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.1.5**	Consider ICT issues related to health and safety	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 3.2 Assist learners to use ICTs for learning

Importance	Competencies		Skill Level	Decision
0 1 2 3 4 5	**3.2.1**	Understand the need for assisting learners to transfer their learning strategies to ICT–mediated learning environment	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.2.2**	Develop awareness of differences due to learning styles in an ICT–mediated learning environment	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip
0 1 2 3 4 5	**3.2.3**	Develop awareness of the use of ICTs to facilitate self–directed and transformative learning	0 1 2 3 4 5	❑ Study ❑ Skim ❑ Skip

Unit 3.3 Facilitate on-site learning in TVET using ICTs

Importance						Competencies		Skill Level						Decision
0	1	2	3	4	5	**3.3.1**	Develop awareness of the use of ICTs to enhance on–site teaching and learning	0	1	2	3	4	5	❑ Study ❑ Skim ❑ Skip

Unit 3.4 Facilitate online learning in TVET using ICTs

Importance						Competencies		Skill Level						Decision
0	1	2	3	4	5	**3.4.1**	Develop awareness of the use of ICTs to enhance online teaching and learning	0	1	2	3	4	5	❑ Study ❑ Skim ❑ Skip
0	1	2	3	4	5	**3.4.2**	Develop awareness of the use of ICTs to facilitate the development of online learning communities	0	1	2	3	4	5	❑ Study ❑ Skim ❑ Skip

MODULE 1

IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

Unit 1.1 ICT STRATEGY FOR TVET

Objective 1.1.1 Develop the institution's ICT vision, mission, goals and strategy

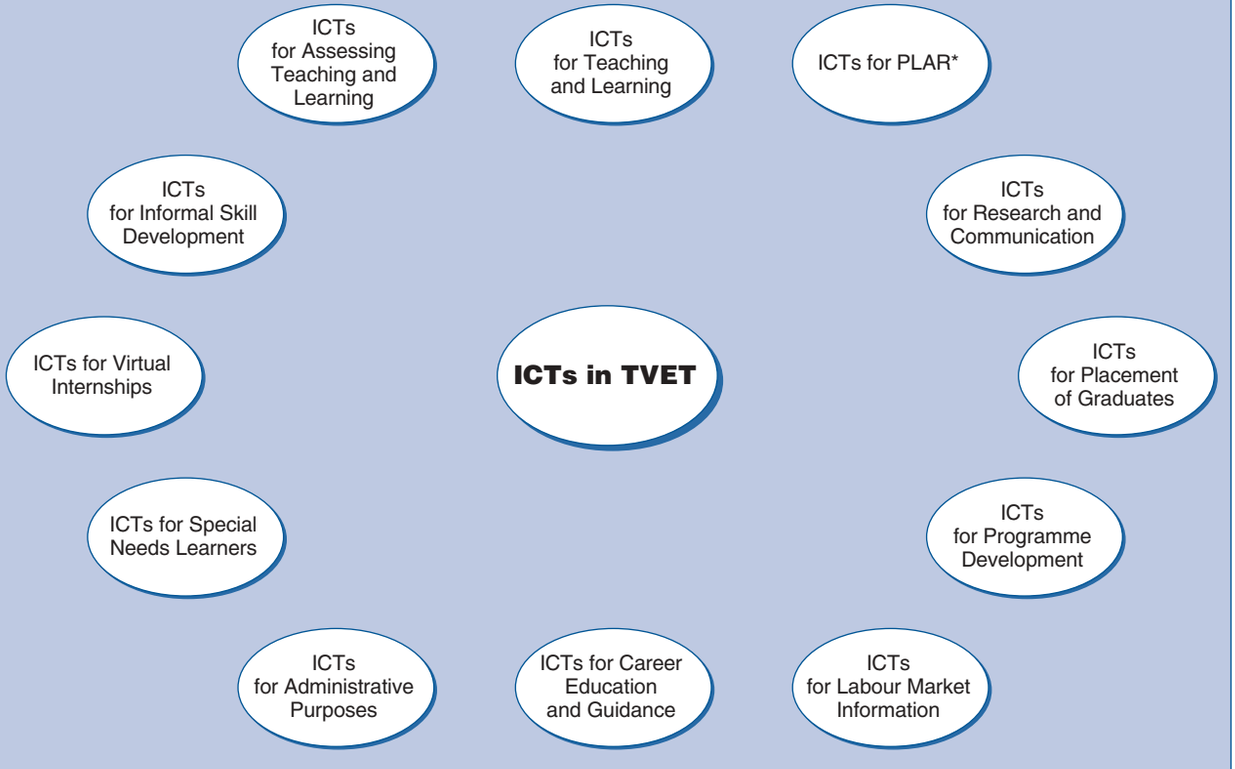
Has your organization established a vision for ICT–mediated teaching and learning?
Does this vision match the institution's activities,values and beliefs,and mission statement?
Has your organization established a mission for ICT–mediated teaching and learning?
Has your organization established a strategy for your ICT–mediated teaching and learning?
Has your organization established the financial viability for ICT–mediated teaching and learning?

The development of a strategic plan is essential for successful implementation of ICT-mediated teaching and learning in TVET. Latchem (2004)identified the advantages of the strategic planning process:

- Engaging management, staff and other stakeholders in dialogue about the vision, mission and goals of open and flexible learning within specific institutional contexts.
- Informing and shaping the curriculum, courses, teaching and learning practices and priorities.
- Directing organizational activities towards the overall attainment of medium- to long-term strategic objectives.
- Guiding staff development, research and quality assurance in open and flexible learning.
- Guiding policy-making bodies and institutional committees in their work related to open and flexible learning.
- Communicating the institution's intentions and commitment to internal and external stakeholders (p. 1).

Figure 1 shows some potential uses of ICTs in TVET. Various uses must be considered in developing the ICT vision, mission, goals and strategy for TVET. While the overall ICT vision, mission, goals and strategy should be developed, it is also necessary to develop specific ICT vision, mission, goals and strategy for each function adopted.

Figure 1. Potential uses of ICTs in TVET



** Prior Learning Assessment and Recognition*

Latchem advocates a four-stage strategic planning process:

Stage 1. Consultation with current and potential stakeholders – students, staff, employers and representatives of the wider community – in order to identify or anticipate external expectations, opportunities and threats, and match these to the internal capabilities and weaknesses.

Stage 2. Identification of the leading problems or opportunities – those elements that will have the greatest impact or exert the most leverage.

Stage 3. Sharing of views on the organization's strategic options how to implement and assure quality in policies and procedures.

Stage 4. Conducting of an environmental scan or analysis of the operating environment, the institutional mission, vision and value statements, strategic goals, key strategies and targets, accountability and quality assurance mechanisms. An operational plan is then needed to translate these ideas into reality (pp. 1–2).

The development of an ICT-mediated teaching and learning vision, mission, objectives and strategies must be based on the existing institutional mission, vision and values statements, and strategic goals.

VISION

"Everyone, everywhere should be enabled to participate in and no one should be excluded from the benefits of the global information society" (Okinawa Charter on Global Information Society, 2000). ICTs are a powerful tool for adapting to the everchanging demands of a global information society. There is a growing dependence on communication, learning and computing technologies to sustain potential learners. Without access to, and continuous development of innovative ICTs, many individuals, public and private institutions, and possibly entire countries, will fail to acquire the competitive edge that is needed to succeed. Given this imperative, it is necessary to develop best practices that encourage and sustain ICT-mediated teaching and learning in TVET. This can be made possible through the conception of a strategic ICT plan.

One of such best practices in the development of a strategic ICT plan is the creation of an ICT vision. A favorable ICT vision provides the institutional and conceptual framework necessary for the development of an environment that endorses creativity and sustainability within ICT-mediated teaching and learning. Visioning is the cornerstone of strategic planning, and is propelled by the mission, strategy and objectives of the institution. A lucid vision is based upon the preferred future of the institution, as well as culture, beliefs, individual identity, and goals of the institution (National School Board Foundation, key components of your vision). It is also fluid enough to accommodate a change, given rapidly changing technological demands. The process of creating a vision should culminate in a vision statement.

Institutional distinctiveness is one of the most notable benefits of creating a unifying vision that reflects the activities of the institution. Institutional distinctiveness results when both internal and external constituents support the values and vision that drive an institution's curriculum and educational practices (Townsend, 1992). Vision can also build continuity, cultivate loyalty, encourage ingenuity, improve efficiency, foster interest and commitment, fine tune focus, clarify purpose and generate attentiveness when change is needed (National School Board Foundation).

Conditions to create institutional vision

There are two key conditions necessary for an institutional vision to materialize, the creation of a mission statement and the inclusion of a belief system. First, a valued mission statement delineates the goals of the institution, and how

these goals will be achieved. Good mission statements typically exemplify common characteristics. The characteristics include statements that are:

- Straightforward, concise and memorable;
- Unambiguous, but broadly written;
- Reasonably stable, but flexible enough to adapt to the institution as it changes and responds to the demands of the world in which we live;
- Driven by principles and not limited to quantitative or qualitative evaluation;
- Futuristically oriented and not constrained by the present;
- Applicable to all for whom it applies;
- Inspiring, motivating, and meaningful.

The second condition to promote the creation of a vision is the inclusion of the institution's belief system. Institutions and belief systems are interdependent (Environmental Governance, Belief Systems and Perceived Policy Effectiveness, p. 2). It is arguable that people will believe in the vision if the structure of governance reflects congruency between the belief system and the espoused vision. Therefore, the belief system should support the goals of the institution and community at large; it should reflect the values of the institution; direct the activities of the people; guide the dissemination and sharing of knowledge; be apparent in future planning; be realistic;and be affirmed by outcomes (National School Board Foundation, Key components of your vision). Walter, Caplan & McElvain (2000) proposed a five-step visioning process (Table 1).

Table 1. The five steps of visioning process

Step 1:	Visioning – What is your vision and how will ICTs impact your institution in 1 year, 5 years, or 10 years?
Step 2:	Identifying Challenges – What are the challenges or barriers to achieve this vision?
Step 3:	Prioritizing the challenge – Which of these challenges are the most important? (Determine the top challenges by voting rather than discussing)
Step 4:	Identifying needs and assets – What are the needs that will affect our ability to address challenge? What resources or assets are available to help address these challenges?
Step 5:	Strategizing – Given our needs and assets,what strategies could we use to address the challenges? (Brainstorming)

Source: Walter, Caplan & McElvain (2000). Beyond the Bell: A Toolkit for Creating Effective After-School Programme. North Central Regional Educational Laboratory, Illinois

To develop an ICT specific vision as "the art of seeing things invisible " (Jonathan Swift), consideration must be given to strategic components needed for ICT development. The following are questions to consider when developing an ICT vision. By no means is this list of questions exhaustive but they may lead to other relevant questions.

- How do we create an enabling environment that encourages user-friendly and barrier-free technologies; access to telecommunications and information systems; policies on confidentiality, information security, and intellectual property rights; the development of ICT applications including ICT facilities and related infrastructure; and networks, priority being given to the more disadvantaged and marginalized ICT-poor? ICTs have particular potential for enriching and improving the quality and relevance of education provided to the poor.
- How do we increase ICT awareness among the disadvantaged and marginalized as well as other segments of society? Awareness-building programmes, as well as vocational training, through an information, education, and communication component should be incorporated in an ICT vision for the future.
- How do we support literacy development with a focus on lifelong learning as necessary for improving knowledge and skills? ICTs support and promote self-directed, informal, non-formal and transformative learning: important types of learning within the framework of lifelong learning.
- How do we support knowledge sharing and dissemination of information and knowledge? ICTs and the globalization of specialized communication and information networks support knowledge sharing, and the Internet is an important component and powerful communication tool that provides a means of distributing information and knowledge.

- How do we foster the development of human resources that is capable of responding to the rising demands of the information society?

The following Toolkit (Table 2) can be used to create an ICT vision.

Table 2. Toolkit to create an ICT vision

Action	Outcome
Select participants	
Exploit experience curves and review the purpose of your institution	Document institutional values and beliefs Document institutional strengths, weaknesses, opportunities and threats Document the needs of potential learners, customers and/or target audiences Document training gaps, staffing compliment, other employee needs Examine resource availability Examine revenue stream (if applicable)
Talk about innovation	Have an understanding of how technology and innovation are affecting your institution and industry Have an understanding of how technology and innovation will affect your institution and industry in future Document ideas about short– and long–term effects
Explore alliances and partnerships	Document potential partners, and opportunities they may present Document benefits or disadvantages of potential partnerships and alliances Document competitors and any innovative response strategies used by them
Exhaust questions related to creation of ICT specific vision	Document responses to questions and considerations
Create a priority listing of information collected in the above and write a vision statement	A statement that communicates the information collected from the above steps in a succinct, yet detailed manner. Qualify and quantify statements (see bolded statements in the sample below) so that results are observable or measurable by all involved in activity generation

Vision creation is only one of four steps in devising an ICT strategic plan. Consequently, the steps are vision, mission, goals and strategy. This sequence allows the goals to be derived out of the vision and mission and the strategy to support the goals.

MISSION

A mission statement is only effective to the degree that its premise is meaningful to those who follow its creed. What makes a mission statement unique is the identity of the institution for which the mission statement was written; the goal of the institution as expressed in the mission statement; the tasks of the people who will fulfill the goals; and the values of the institution whether they be implied or overtly stated in the mission statement (Magarrel, 1999, *Essential Elements of a Mission Statement*). The Gilbert (1978) ACORN test to assess the appropriateness of a mission statement at the policy level was used to develop the following TOOLKIT for mission statement formulation (Table 3).

Table 3. Toolkit to formulate mission statement

A	The statement must describe an Accomplishment, and not just a behavior
C	Those assigned to the mission have primary Control over it
O	The statement must reflect a true Overall Objective, and merely a sub–goal
R	The mission must be Reconciled with other goals of the institution
N	A Number can be put on it, that is, it can be measured

The ACORN test can be used to review the mission statement for ICT-mediated teaching and learning in TVET.

GOALS

Goal setting involves a reflective process because it requires people to examine what they want and what they do not want. One of the first steps in establishing goals is acknowledging that there is something that requires change (10 Steps to Get What YOU Want: Creating YOUR Reality, Why do people set goals). The following Toolkit (Table 4) can be used to formulate goals for the integration of ICT-mediated teaching and learning in TVET.

Table 4. Toolkit to formulate goals for the integration of ICT-mediated teaching and learning in TVET

Desired accomplishment	Conditions	Standard to be achieved

Latchem (2004, p. 9) provided the examples of Vision, Mission and Objectives statements resulting from the e-learning strategic planning process of Samuel Jackman Prescod Polytechnic (SJPP) in Barbados. SJPP could not longer meet the demands through the traditional face-to-face and off-campus methods. ICT-mediated teaching and learning was considered as a viable option. Following are the vision, mission and objectives for ICT-mediated teaching and learning.

Vision

- To be a regional leader in developing and delivering open and flexible technical education, nationally and internationally.

Mission

- To be proactive in providing quality, inclusive and cost effective open and flexible initial and continued education relevant to the needs and circumstances of the nation, region and widest possible range of learners.

Objectives

- To provide open and flexible courses, programmes, facilities and services that are responsive to demand, inclusive and provided at a reasonable cost.
- To serve group and individual needs, including those with special needs, by employing a variety of methods and media.
- To enable SJPP staff to keep abreast of developments in open and flexible learning and technology, and to recognize and reward endeavour in these areas.
- To assure quality in open and flexible learning through monitoring, evaluation, reflective practice and action research.

- To establish strategic alliances with other institutions, sectors and internationally for the purposes of information/resource sharing, collaborative course development and delivery, articulation, accreditation and credit transfer.

STRATEGY

Developing a clear strategy is critical because it is aimed at determining how goals will be achieved. A strategy facilitates the development of a plan of action by outlining the primary activities that will be undertaken to achieve the goals as identified. Strategies encompass the objectives or activities that are carried out in the day-to-day operations that produce actual results: this translates the goals into action. It is likely that there will be more than one strategy because there are often several goals. In addition, there may be more than one strategy for each goal.

Strategy development should be systematic, rational and iterative. Typically, it takes place over an extended period of time, allowing for additions, changes and modifications based on the interests of all relevant stakeholders. Further, it is subject to institutionalized political forces and should be modified accordingly.

Review the institution's ICT vision, mission, goals and strategy

Due to the turmoil and uncertainties that characterize the current environment in which TVET institutions operate, their ICT-mediated teaching and learning vision and strategy must be flexible and adaptable to changing ideas, technology and circumstances. Because of this fluid environment, it is also necessary to conduct periodic review and refinement the ICT vision and strategy. This review process can be performed in consultation with key stakeholders using a focus group or survey methodologies.

Strategic planning toolkit to integrate ICTs in TVET

The successful implementation of ICT-mediated teaching and learning requires careful planning as there are many pitfalls to be avoided, such as:

- Allowing decisions to be driven by technology;
- Jumping on the "everybody's doing it" bandwagon;
- Overlooking existing educational and ICT systems;
- Underestimating the front-end and ongoing funding requirements;
- Unclear statements of objectives to be achieved;
- Raising unrealistic expectations;
- Failing to keep stakeholders briefed and involved in the decision process (Farrell, 2001, p. 152).

The Conference Board of Canada (2001c) has developed a comprehensive planning model for the integration of e-learning in workforce development that addresses these pitfalls. This model (Figure 2) includes four distinct phases: Planning, Building, Integration, and Improvement. Each phase is briefly reviewed in this section.

Planning

The planning phase involves the needs' assessment of the organization and learners in relation to the capacity of the teaching and learning technologies. The planning phase includes the following steps:

1. Develop a team: bring all key stakeholders together to ensure buy-in and sound decision-making.

2. Assess organizational needs: assess previous e-learning experience, and assess support for e-learning and determine benefits.

3. Define learners' needs and expectations: establish benchmarks regarding computer literacy, language skills, access to information and communication technologies, and learning needs.

4. Understand how e-learning is different: analyze the differences between e-learning and other traditional delivery approaches, such as classroom-based, instructor-led training.

5. Define the work processes to be involved in e-learning: determine the work processes, programmes, or courses within which e-learning will be integrated, and how technology will be used.

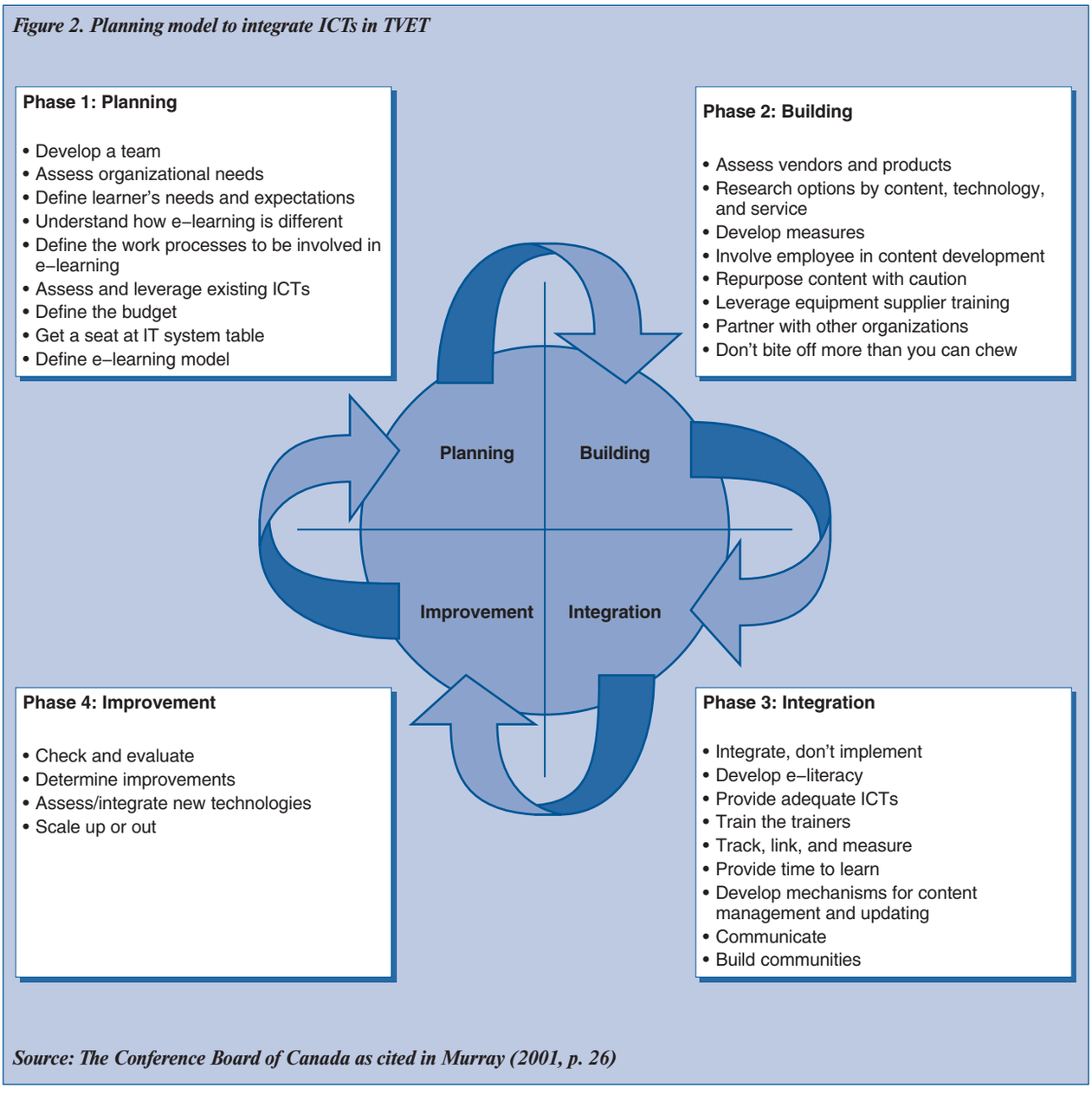
6. Assess and leverage existing ICTs: assess existing infrastructure, equipment, courseware, e-learning experience, and trainers and employee ICT literacy.

7. Define the budget: assess all costs and determine where the money will come from.

8. Get a seat at the information technology system table: build rapport and working relationship with IT colleagues.

9. Build or buy? Define your model of e-learning: determine if you are going to buy services, content, and technology externally, or develop them internally, or apply some combination of these two options.

Figure 2. Planning model to integrate ICTs in TVET



Source: The Conference Board of Canada as cited in Murray (2001, p. 26)

Naud and Bremner (2002, p. 5) described an Action Plan drawn up by the Province of Saskatchewan in Canada to implementing e-learning in TVET. Action Plan consists of six elements that define roles, responsibilities, and inter-relationships based on the following principles:

- Equity: enhanced access to educational opportunity.
- Quality: content and instructional strategies that meet academic, pedagogical, and industry standards.
- Choice: increased choice through flexible, responsive, relevant, and timely programmes and services.
- Coherence: increased opportunity and mobility for learners through a coherent and integrated delivery and programme array.
- Sustainability: long-term support by organizations and predictable funding.
- Partnership: working together on the basis of complementary and/or mutual interests.

Building

The purpose of the Building phase is to develop an e-learning model complete with external vendors, suppliers and outcome measures to assess programme success as described in the following steps:

1. Assess the vendor market and products: develop criteria for assessing vendors of e-learning products.

2. Research e-learning options by content, technology, and service: assess proposal of content providers, technology providers, and service providers; examine programme requirements to determine if content should be developed internally or externally.

3. Develop measures: identify key success factors and develop an evaluation plan.

4. Involve employee in content development: engage employees in the content development; they can be provided with a template that they can populate with their knowledge.

5. Re-purpose content with caution: assess existing instructional materials that can be used and packaged so they can fully benefit from the interactive possibilities of e-learning delivery.

6. Leverage equipment supplier training: develop partnership with equipment supplier to gain access to existing e-learning packages.

7. Partner with other organizations: develop partnership with other institutions/organizations to gain access to existing e-learning packages.

8. Don't bite off more than you can chew: begin with a small-scale project that can demonstrate the success of e-learning.

Integration

This phase is designed to promote e-learning to administrators, instructors, and learners, providing professional development as required and collecting data as the process evolves.

1. Integrate, do not implement: implementation is a top-down approach, integration is a more collaborative approach that can assist in building a successful e-learning community.

2. Develop e-literacy: develop an e-literacy programme to assist learners in becoming familiar with ICTs.

3. Provide adequate ICTs: ensure the availability and accessibility of ICTs in sufficient quantities.

4. Train the trainers: integration of e-learning requires a unique skill set, provide adequate training to instructors.

5. Track, link, and measure: use all data collected to monitor the success of e-learning.

6. Provide time to learn: time is a barrier to e-learning, it is imperative to provide adequate time to all.

7. Develop mechanisms for content management and upgrading: establish a system to manage and update content.

8. Communicate: communicate the importance of e-learning to all stakeholders.

9. Build communities: build e-learning communities on the basis of specific knowledge or content areas to solve problems, learn together, and construct and share knowledge.

Improvement

This phase of the e-learning integration process focuses on improvement by researching new technologies, approaches, strategies, and techniques.

1. Check and evaluate: analyse all data collected to identify strengths, weaknesses, successes, and failures.

2. Determine improvements: identify areas of e-learning needing improvement.

3. Assess and integrate new technologies: keep abreast of technological development in e-learning and integrate technologies that facilitate and enhance learning.

4. Scale up or out: successful organizations or institutions can at this point develop external partnerships to sell their training programmes in order to recover their e-learning investments.

The following case study briefly describes the effort of Saskatchewan Institute of Applied Science and Technology (SIAST) in Canada to accelerate the pace of faculty development and smooth integration of technology in TVET. The success of this model is based on a solid project plan, sound instructional design, high-quality interactive instruction, and rigorous evaluation strategies. In a period of 18 months SIAST has gained recognition as a leader in the online delivery of technical training through its impressive array of online programmes and services. This systematic approach has worldwide application and could assist developing institutions in achieving their goals more quickly with only a modest investment of resources (Naud and Bremner, 2002).

The key to success in building a technology-literate organization is to engage faculty early, develop a cooperative network through technology-enhanced learning, and capitalize on early successes to advance institutional goals. This experience at Saskatchewan Institute of Applied Science and Technology (SIAST) clearly demonstrates how an entrepreneurial approach to collaboration and partnerships can be leveraged in accelerating the pace of faculty development and smooth integration of technology.

Given Saskatchewan's relatively small population dispersed over a large geographic area, the establishment of a technological infrastructure and the development of a province-wide plan were deemed critical as springboards for action in technology-enhanced learning. Faced with these challenges, a consortium of universities, colleges, aboriginal institutions, SIAST, and the provincial government's Department of Learning was formed to develop a technology-enhanced learning plan for the province. The consortium created a vision that encompassed the following: "Saskatchewan post-secondary education and training sector works collaboratively to make appropriate use of technology to serve the learning needs of all residents of the province by enhancing the quality of programmes and extending access." The action plan defined roles, responsibilities, and interrelationships based on the following principles of equity, quality, choice, coherence, sustainability, and partnership.

Achieving a critical mass of champions was essential for institute-wide faculty orientation. SIAST used a collaborative model of skill transfer within the community of peers and a network of learning labs to familiarize faculty with technology, instructional resources, and techniques. SIAST recognized early in the process that the use of technology itself as a medium for teaching was changing the role of faculty and their interaction with students. Consequently, faculty participation was critical in creating an environment that would facilitate change in the use of technology in teaching and learning. That level of involvement occurred at the grass-roots level and promoted a sense of community, teamwork, and collaboration. In the first year of operation, 47% of employees took advantage of training.

SIAST also worked closely with partner institutions to build a technology-enhanced learning network that featured a common policy framework and quality standards for content development, design, interactive instruction, and consistent look and feel. Partnerships with industry and Apprenticeship Commission demonstrated the proof of the concept of delivering applied and skills-based training across the province. The outcomes of these initiatives were articulated in a five-year business plan and the establishment of the virtual campus. This step was important in

communicating to internal and external stakeholders that senior management fully endorsed this project, while ensuring that resources and appropriate timelines were in place.

In 18 months, SIAST has become a leader in the online delivery of technical training by developing an impressive array of online programmes and services. This systematic approach has worldwide application and can assist the developing institutions in achieving their goals faster with a modest investment of resources.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding visioning and strategic planning for the implementation of ICT-mediated education.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to visioning and strategic planning for the implementation of ICT-mediated education.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding visioning and strategic planning in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your transformative reflection experience, develop an ICT plan for your TVET programme. Your plan should include the following elements:
  - Vision
  - Mission
  - Goals and objectives
  - Strategy
- If your organization has already developed an ICT plan for your TVET programme, review and revise this plan as may be necessary.
- Ask a group of key stakeholders in TVET to review the plan.

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

UNIT 1.1 ICT STRATEGY FOR TVET

Objective 1.1.2 Communicate the institution's ICT vision, mission, goals and strategy

Has your organization communicated its vision for ICT–mediated teaching and learning in TVET to all key stakeholders?
Has your organization communicated its mission for ICT–mediated teaching and learning in TVET to all key stakeholders?
Has your organization communicated its ICT–mediated teaching and learning strategy for TVET to all key stakeholders?

A good communication plan is critical to the success of an ICT-mediated teaching and learning initiative. The communication plan should meet the information needs of all stakeholders and should specify when, what, how and with whom to communicate. Some critical elements to consider in the development of a communication plan include (http://www.isixsigma.com/library/content/c010304a.asp, Six Sigma (2004, p. 1):

Who – Person who is responsible for delivering the communication.

What – The type of communication that must be delivered.

Why – The purpose of the communication plan, i.e. to establish and enforce a contract for communication.

Where – The location where the recipient will find the communication.

When – The time and/or frequency at which the communication will be delivered.

How – The delivery mechanism that will facilitate the communication.

To Whom – The audience or recipients of the communication.

The following Toolkit (Table 5) can be used to plan the ICT communication strategy in TVET.

Table 5. Toolkit to plan the ICT communication strategy in TVET

What	To whom	When	Who communicates	How	Where

Adapted from: Six Sigma (2004). A project charter communication strategy is essential. Retrieved June 16, 2004 form http://www.isixsigma.com/library/content/c010304a.asp

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the ICT-mediated teaching and learning communication strategy for TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the ICT-mediated teaching and learning communication strategy for TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or

reinforced your initial assumptions regarding the ICT-mediated teaching and learning communication strategy for TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience and the communication toolkit provided, develop an ICT-mediated teaching and learning communication strategy plan for TVET.
- If your organization has already developed it, work out an ICT-mediated teaching and learning communication strategy plan for TVET, review and revise this plan as may be necessary.
- Ask a group of key stakeholders in TVET to review this plan.

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

UNIT 1.1 ICT STRATEGY FOR TVET

Objective 1.1.3 Develop awareness of the cost effectiveness of ICT–mediated teaching and learning

Is your organization aware of the cost effectiveness of ICT–mediated teaching and learning?
Does your organization have expertise in budgeting for ICT–mediated teaching and learning?
Does your organization have access to sources of funding?
Does your organization have expertise in developing funding proposals?

COST EFFECTIVENESS OF ICTs

ICT-mediated teaching and learning appear to hold great promise for achieving the goal of education for all. However, it is unclear at this stage whether ICTs is the cost-effective strategy to meet this goal. Blurton (1999, p. 20) (cited by Baalen and Moratis, 2001) argues that it is difficult, if possible, to assess the cost effectiveness of ICTs in education. They gave four reasons, namely lack of meaningful data, variability in the implementation of ICTs solutions, difficulties in making generalizations across programmes, and assessing outcomes. Curtin (2002) concluded that it is difficult to conduct research focused on comparative analysis of online delivery and face-to-face teaching. He gave four main reasons explaining these difficulties: (1) limited time allocated for study, (2) accounting system does not allow costs tracking; (3) reluctance of institutions to provide data perceived to be confidential, and (4) reliance on estimates rather that actual costs.

According to UNESCO (2002a), "Capital investments usually substitute for high recurrent costs, making economies of scale a decisive factor. Large distance–learning programmes may produce graduates at considerably lower costs than conventional institutions" (p. 12). UNESCO (Ibid) also identified some key factors affecting the cost effectiveness of distance learning systems. These are: number of learners enrolled, curriculum size, number of years over which courses are offered without change, containment of course development costs, sharing course development costs, technology choice, level of student support, and a range of working, labour market and structural practices.

Some studies have attempted to establish relative costs of ICTs in education (Potashnik and Capper, 1998) (cited by Baalen and Moratis, 2001, p. 103):

> Print, audiocassettes, and pre-recorded instructional television (lectures) are the lowest cost technologies for small numbers of students (fewer than 250), while radio requires 1000 students or more to achieve comparable per student costs. Computer conferencing is a low-cost approach to providing interactivity between teachers and students, but live interactive broadcasts and video conferencing are still very high-cost technologies, regardless of the number of students enrolled.

Research on cost effectiveness of ICT-mediated teaching and learning is inconclusive. While some studies demonstrate that ICT-mediated teaching and learning can be cost-effective, others suggest that technology is not a cost-effective solution, and that the implementation and maintenance costs will continue to climb.

Any discussions relative to the cost of ICTs naturally raise the fear that "information poverty will reinforce 'real poverty' in poorer countries" (Buckley, 2000, p. 1). In the analysis designed to assess if ICTs can promote education in developing countries, the author noted that telephone, television, and computers are in very short supply in developing countries, and "as the north-south digital divide expands, radio appears to be the only electronic medium that minimizes the constraints on access to information" (p. 1). Bates (1995) (cited by Stevens, 2001) analysis in the context of the British Open University demonstrated that instructional radio could be cost-effective:

> Radio costs per student for courses with over just 100 students a year are ten times higher than courses with 1,250 students or so per year...Courses needed to have over 1,250 students a year before unit costs dropped below $1.50 per student study hour; on the foundation courses, though, each with more than 6000 students a year, radio costs came down to 30 cents per hour.

The issue of economy scale is a major challenge regarding the integration of ICTs in TVET, since the training demand in most developing countries is for small numbers of graduates in a wide range of occupational profiles. Learning consortia must be created among developing nations to minimize purchase and maintenance costs.

Daniel (ibid) views the effectiveness of education within a framework encapsulating three elements: (1) access, (2) quality, and (3) costs. He defined quality as "fitness for purpose at minimum cost to society" (p. 2). This framework is extremely useful in any consideration of accessibility:

> When you express the basic challenge of education in terms of this triangle of forces, one uncomfortable fact is clear. Traditional methods of teaching and learning cannot produce the changes required. Try putting more students in each class. Access may go up, cost may go down, but everyone will accuse you of lowering quality. Traditional ways of improving quality tend to reduce access and raise costs. There is clearly a problem. Throughout history education has made an insidious link between quality and exclusivity. You can only have high quality if you exclude many people from access to it (p. 2).

Daniel (2002) pointed out that evidence shows that technology can increase access, improve quality, and lower cost-all at the same time. Research conducted by Curtin (2002) identified three models in current use by the VET system in Australia to achieve cost effectiveness outcomes in online delivery:

- Reduce costs while maintaining current levels of effectiveness and volume.
- Improve learning effectiveness while maintaining current cost and volume.
- Increase volumes while maintaining current levels of cost and effectiveness (p. 6).

These models validate Daniel's framework establishing the relationship between access, quality, and cost. It appears that cost-benefit analysis does not make the decision making process easier for adopting ICTs in educational institutions. Holt and Thompson (1998) cited by Bates (2000) noted: "It appears that investment in IT in universities is a highly politicized process often based at least partly on an act of faith that IT will help deliver on the quality and productivity agenda...Such investment processes and imperatives are not necessarily amenable to rationalistic cost-benefit investment models and techniques" (p. 125).

International copyright and intellectual property rights increased costs on high quality ICT training materials, making them less accessible to developing countries. Varoglu and Wachholz (2001) (cited by Stevens, 2001): "Express concerns with the effort by more advanced countries to "commoditize" knowledge and rigidly enforce international copyright and intellectual property rights."

COST OF TECHNOLOGY

Too often educators consider equipment purchase as the major cost of ICTs and tend to overlook other associated costs, which can be significant (National Association of Advisors for Computers in Education, NAACE, 2004). Technology costs can be classified in three main categories, namely: (1) initial purchase price of hardware and cabling; (2) cost of software and related resources, and (3) support and training costs. Bates (ibid) classified ICT costs as technology infrastructure, administrative applications, and academic applications.

NAACE proposed the Total Costs of Ownership (TCO) concept as a useful framework to consider the overall cost implications of ICT-mediated teaching and learning. Research shows that the TCO can be broken down as illustrated below (Figure 3).

NAACE noted that research indicates that one third of the cost of ICT-mediated teaching and learning can be attributed to each of the three elements shown, that is initial purchase price of hardware and cabling; cost of software and related resources, and support and training costs.

Research conducted by Johnson and Benson (2003) clearly indicates that economic concerns represent major barriers for offering distance learning courses in TVET in the United States of America. These concerns include: programme development costs (43.8); lack of perceived need-limited student market (37.5%); equipment purchase and/or maintenance costs (29.7%); and limited technological infrastructure to support distance learning (25%).

Figure 3. Total costs of ownership

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the cost effectiveness of ICT-mediated education in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the implementation of ICT-mediated education.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the cost effectiveness of ICT-mediated education in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a toolkit to assist senior TVET administrators in their deliberation regarding the integration of ICT-mediated education in TVET based on cost effectiveness considerations.
- If your organization has already developed some guidelines regarding cost considerations for ICT-mediated teaching and learning in TVET, review and revise these guidelines as may be necessary.
- Ask a group of key stakeholders in TVET to review this toolkit.

Has you organization already developed a budget for the implementation of ICT–mediated teaching and learning in TVET?

BUDGETING FOR ICT IMPLEMENTATION

As discussed in the previous section the decision to use ICTs in TVET involves major cost implications. Kruse (2004) noted that many training vendors will use rules of thumb to estimate the cost of developing ICT-mediated teaching and learning. These rules of thumb can be based on either per hour or per screen rate. Kruse noted that it takes 600 person hours to develop one hour of high quality ICT-mediated teaching and learning material as compared to only 300 hours to develop simpler web- or computer-based training without audio or video features. Considering that most training vendors charge is from $100 to $125 per hour of services, the development of multimedia CD-ROM training will vary from $60,000 to $75,000 per hour of instruction. Kruse argues that the flat rate estimate does not reflect the true costs of e-learning. He suggests the use of a ten-factor analysis approach in determining costs of ICT-mediated teaching and learning. These factors are:

- Mode of training delivery.
- Bandwidth requirements for web-based courses.
- Subject matter content.
- Duration of training.
- Special features, such as audio, video and animations.
- Source of content.
- Need for student-tracking capabilities.
- Project start and end dates.
- Nature of in-house contribution in training development.
- Life span of course.

It is essential to make careful estimates of both fixed and variable costs during planning stages. It is also important to consider the costs for students in relation to institutional policy for access and equity. According to Bates (2000) a good ICT-based, distance education budget should include the following cost estimates:

Fixed costs

- Subject matter experts.
- Internet specialists.
- Graphics and interface design.
- Copyright clearance.
- Direct overhead costs.
- Library.
- Technical infrastructure costs.
- Tutors.
- Administrative costs.

Variable costs

- Tutoring.
- Delivery costs-registration.
- Student administration.
- Printed materials, including postage.

Costs for students

- Fees.
- Required readings.
- Postage.
- Internet access.
- Computer.

Estimates of e-learning costs must also take into consideration whether the course will be developed in-house, as well as the purchase off-the-shelf materials or professional services to develop custom products. Bates (ibid) stresses the importance of building the life cycle of a course into the budget. He indicates that the maintenance and upgrading of print-based course has an annual price tag which is equal to 10 per cent of the initial developmental costs. He estimates that the maintenance and updating cost of web-based course is approximately 33 per cent of the initial costs.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding budget estimates for ICT-mediated education in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to budgeting of ICT-mediated education in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the costs of ICT-mediated education in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience develop a budget to integrate ICT-mediated teaching and learning in a specific trade.
- If your organization has already developed a budget to integrate ICT-mediated teaching and learning in a specific trade, review and revise this budget as may be necessary.
- Ask a group of key stakeholders in TVET to review this budget.

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

UNIT 1.1 ICT STRATEGY FOR TVET

Objective 1.1.5 Identify funding sources to support ICT–mediated teaching and learning

Has your organization identified appropriate funding sources to support ICT–mediated teaching and learning in TVET?

The great majority of TVET institutions integrate ICTs in teaching and learning to improve access to their programme and not as a strategy to increase revenues. Research conducted by Johnson and Benson (ibid) in the USA indicates that TVET institutions adopt ICT-mediated teaching and learning to reach new and non-traditional students, increase student access and improve instruction. Bates (ibid) argues that institutions committed to the use of ICTs for teaching and learning will use their base budget to allocate resources ICT development. Given the high costs of ICT-mediated teaching and learning, TVET institutions must develop a sound funding strategy during the planning stage.

Bates (2000, p. 153) identifies several funding strategies that can be considered:

- Using external grants;
- Charging student technology fees;
- Increasing general operating grants from government to support the use of technology for teaching;
- Reallocating internal funds;
- Centralizing or decentralizing funding;
- Balancing funding between infrastructure, administrative applications, and educational applications;
- Developing partnership or consortia.

In many countries there is a vast array of funding sources available to support the integration of ICTs in teaching and learning. British Educational Communication and Technology Agency (BECTA) (2004, p. 1) provides a listing of potential funding sources that support development and training in ICTs in the UK:

- BECTA / The Guardian UK Education Web Site Awards
  [http://www.becta.org.uk/schools/websiteawards/index.html]

- BT / The Guardian Schools Awards
  [http://www.groupbt.com/ict/bt_schools_awards/index.html]

- Education Extra Excellence Awards 2002
  [http://www.educationextra.org.uk/]

- ICT Innovation Awards from National Grid for Learning Scotland
  [http://www.ngflscotland.gov.uk/innovationawards]

- Sources of charitable and foundation funding
  [http://www.ids.ac.uk/eldis/fund/fun3.htm]

- Tesco Computers for Schools
  [http://www.tesco.com/TalkingTesco/cfs.htm]

- Sainsbury's
  [http://www.jsainsbury.com/csr/community.htm]

- Using ICT to help achieve regeneration objectives – a good practice guide
  [http://www.odpm.gov.uk/stellent/groups/odpm_urbanpolicy/documents/page/odpm_urbpol_608054.hcsp]

- UK online centres
  [http://www.dfes.gov.uk/ukonlinecentres/]

- Wired Up Communities
  [http://www.makingthenetwork.org/common/wuc.htm]

- Curriculum Online
  [http://www.curriculumonline.gov.uk/]

- Anytime Anywhere Learning
  [http://www.microsoft.com/uk/aal/]

- Independent/State School Partnership scheme
  [http://www.dfes.gov.uk/indstatepartner/]

- Socrates II
  [http://europa.eu.int/comm/education/programmes/socrates/socrates_en.html]

- New Opportunities Fund
  [http://www.nof.org.uk]

- TeacherNet, Funding Organisation
  [http://www.teachernet.gov.uk/professionaldevelopment/]

- British Council
  [http://www.britishcouncil.org.uk/]

- Tools for Schools
  [http://www.tfs.org.uk/]

- Microsoft Authorised Refurbisher Scheme
  [http://www.microsoft.com/uk/refurbishers/]

- CAP
  [http://cap.becta.org.uk/]

- Teachers Online
  [http://teachersonline.ngfl.gov.uk/awards.php3]

- Cash for Schools
  [http://www.optimuspub.co.uk/public_pages/cash_for_schools/overwiew.html]

- Practical Funding for Schools
  [http://www.practicalfunding.com/]

- RM Funding Ideas and Opportunities for expanding ICT provision
  [http://www.rm.com/Primary/Articles/ArticleDetail.asp?cref=HA5854&?em=130901]

- Times Educational Supplement – ICT Noticeboard
  [http://www.tes.co.uk/your_subject/noticeboard.asp?subject=ICT]

- Funding sources
  [http://www.becta.org.uk/leas/leas.cfm?section=5_1&id=1252]

Global Opportunity Channel provides an extensive list of donors who support ICT projects in developing countries: [http://www.digitalopportunity.org/article/archive/4893/].

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding potential sources of funding for the implementation of ICT-mediated education in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the funding of ICT-mediated education in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the funding of ICT-mediated education in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience conduct a search designed to identify agencies and foundations that are interested in funding ICT projects in TVET. Make a directory of these potential funding agencies.
- If your organization has already developed a directory of potential funding agencies, review and revise this directory as may be necessary.
- Ask a group of key stakeholders in TVET to review this directory.

Objective 1.1.6 *Develop a funding proposal for the integration of ICT–mediated teaching and learning*

Has your organization been successful in generating competitive grants and contributions to support the integration of ICT–mediated teaching and learning in TVET?

If your funding strategies for ICT-mediated teaching and learning include funds generated from external sources, you will most likely be required to develop an elaborate funding proposal. The development of grant proposal is an art and a science.

A good funding proposal will include the following sections:

- Project summary.
- Brief description of your organization.
- Significance of the project.
- Beneficiaries.
- Project description.
- Project responsibility framework.
- Project management framework.
- Budget.
- Project en-route and final evaluation.
- Reporting and deliverables.

Environmental Protection Agency (EPA) has produced a self-instructional, web-based tutorial to help those communities and non-profit organizations developed to make it easier for applicants to produce more competitive grant applications. Although the focus is on environmental issues, the mechanics and guidelines are also applicable to ICT proposal development. This tutorial can be accessed at the following URL: http://www.epa.gov/seahome/grants/src/grant.htm

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the development of funding proposals for the implementation of ICT-mediated education in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the development of funding proposals for the ICT-mediated education in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding funding proposals for the integration of ICT-mediated education in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Complete the EPA tutorial. Identify a funding agency interested in funding ICT projects in TVET. Using the knowledge gained from the EAP tutorial and your transformative reflection experience develop a funding proposal to integrate ICTs in TVET.
- Ask a group of key stakeholders in TVET to review the proposal.

Objective 1.1.7 ***Develop awareness of the training needs of teachers and trainers in the use of ICT–mediated teaching and learning***

Has your organization identified the teacher training needs for using ICT–mediated teaching and learning in TVET?

Teachers commitment is among one of the most important elements for the successful integration of ICT-mediated teaching and learning in TVET. Research conducted by Johnson and Benson (ibid) suggests that the most faculty inhibitors for not using ICT-mediated teaching and learning in TVET are lack of interest, lack of expertise, lack of reward and concerns over workload. Therefore, in planning to implement ICTs in TVET it is very important to include teacher development in the strategic plan.

ICT LITERACY FOR TVET TEACHERS

It appears that ICTs have made little impact in schools in spite of the seemingly great potential to improve teaching and learning (Miller, 1997). Dyril and Kinnauman (1994) noted: "Technology has transformed every segment of American society – except education... schooling today remains much the same as it was before the advent of personal computers." The lack or inadequate training of teachers is considered to be one of the major barriers for the integration of ICTs in TVET (Miller, 1997). Cuneo and associates (2000) argued that lack of staff training in ICTs is a major cause of the digital divide among Canadian post-secondary institutions. Research indicates that the computer literacy of TVET teachers can decrease computer anxiety (Birkenholz and Stewart, 1991) and improve attitudes toward computers (Fletcher and Deeds, 1991). On the basis of these findings, Fletcher and Deeds (1991) recommended implementing additional pre-service and in-service ICT training for TVET teachers. According to Allen, Walker & Morehead (1999, p. 5), "many educators are limited in the technological skills needed for successful technology integration in career and technical education curriculum due to the lack of recent training in the professional field."

There is now a general consensus that teachers are principal agents integrating technology in education and training. A study conducted by Jasinski (1998) involving 80 TVET educators indicated that technology does not improve or cause changes in learning. It is well-designed instructions and how teachers make use of the new capabilities, potentials, and options offered by ICTs that can improve learning significantly.

In spite of the importance of ICT literacy skills for TVET teachers, it appears that they are not being adequately prepared to meet the challenge. A study conducted by Miller (1997) indicated that only 50% of teacher education institutions surveyed had implemented a required course in ICTs. The most striking finding of this study is that computers were most frequently used as "glorified typewriters" in vocational teacher education. A forum on trainer training and e-learning hosted by CEDEFOP Electronic Training Village (ETV) in 2001 indicated that "basic technology skills are often acquired by trial and error learning in day-to-day teaching practice" (Australian National Training Authority (ANTA), 2001a, p. 33).

In discussing ICT literacy skills for TVET teachers two main skill dimensions must be considered: technical and pedagogical ICT literacy, and occupational ICT literacy. Technical and pedagogical ICT literacy refers to the technical literacy skills for the equipment being used and the specialized skills necessary in its pedagogical application. Occupational ICT literacy refers to the competencies related to the vocationally specific use of technology-based equipment and control systems.

PEDAGOGICAL ICT LITERACY FOR TVET TEACHERS

International Training Centre of the International Labour Office (ILO) (2002) in Turin, Italy has developed a set of Training Technology Competence Standards for TVET personnel involved in distance education and learning technology applications. This comprehensive competency profile includes four major standards and 24 subcategories, as well as specific performance indicators as follows:

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

A. ANALYZING TRAINING REQUIREMENTS

A.1. Define a training problem within a geographical area

A.2. Define a training problem within an organization

A.3. Identify and analyse competence standards

A.4. Assess training needs within a geographic area

A.5. Assess training needs within an organization

A.6. Analyze the population targeted by a training programme

A.7. Analyze the resources available and the constraints to design and implement a training programme

B. DESIGNING A TRAINING PROGRAMME

B.1. Select the training modalities for a training programme

B.2. Define the learning objectives, pre-requisite, and content of a training programme

B.3. Design the teaching/learning strategies and the learning assessment strategies for a face-to-face training programme

B.4. Design the teaching/learning strategies and the learning assessment strategies for a distance learning programme

B.5. Validate a face-to-face training programme

B.6. Validate a distance learning programme

C. DESIGNING, ADAPTING, AND PRODUCING LEARNING MEDIA AND ENVIRONMENTS

C.1. Define a project to produce learning media and environments

C.2. Define the modifications to be introduced in learning media and environments and their integration into a training programme

C.3. Design learning media and environments

C.4. Organize the production of learning media and environments

C.5. Produce learning media and environments

C.6. Validate learning media and environments

D. DELIVERING A TRAINING PROGRAMME

D.1. Plan the delivery of face-to-face training

D.2. Plan the delivery of distance learning

D.3. Facilitate face-to-face learning

D.4. Facilitate distance learning

D.5. Assess the individual achievement of competence

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding teacher development for the implementation of ICT-mediated education in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to teacher development for the integration of ICT-mediated education in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding teacher development for the integration of ICT-mediated education in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using the knowledge gained from transformative reflection experience develop a questionnaire to assess the current and desired level of competencies of TVET teacher in ICT-mediated teaching and learning.
- If your organization has already developed a questionnaire to assess the current and desired level of competencies of TVET teacher in ICT-mediated teaching and learning, review and revise these guidelines as may be necessary.
- Ask a group of key stakeholders in TVET to review this questionnaire.

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

UNIT 1.2 ICT POLICIES FOR TVET

Objective 1.2.1 ***Develop specific policies for the implementation of ICT–mediated teaching and learning***

Has your organization developed a general policy for the implementation of ICT–mediated teaching and learning in TVET?

GENERAL ICT POLICY

An ICT policy is an essential management tool that can facilitate the successful implementation of ICTs in TVET. ANTA (2001a) analyzed country policies integrating ICT-mediated teaching and learning in TVET in Botswana, Canada, China, European Union, Republic of Korea, and Malaysia. Results indicated that country policy for the ICT integration evolved around three main categories, namely: people, infrastructure, and content. The people policy included the elements dealing with workforce development, equity, culture, society and lifelong learning. The infrastructure policy was focused on issues related to access of technology, affordability, digital divide, and bandwidth. Finally the content policy was directed to integration of flexible learning into the mainstream and generation of content.

British Educational Communications and Technology Agency (BECTA, 2001b) defines an ICT policy as "a statement of the beliefs, values, and goals of a school's staff working cooperatively in the context of using ICTs in the operation of that school."

According to BECTA (2001b), the following areas should also be included in an ICT policy statement:

- The aims of ICTs and how they relate to or contribute to the school's aims;
- The distinctive contribution of ICTs to the curriculum;
- The contribution ICTs make to other subjects;
- How the subject will be monitored and evaluated;
- A strategy for implementation;
- Teaching and learning styles;
- Recording, assessment, and reporting;
- Monitoring and review;
- Classroom and resource management;
- Inclusion and Special Education Needs;
- Continuity and progression;
- Staff development and training issues;
- Leadership and management roles;
- Links to the Management Information System (MIS);
- After-hours and community use.

Has your organization developed a policy for the acquisition of ICTs in TVET?

TECHNOLOGY INFRASTRUCTURE REQUIREMENTS

The key elements of ICT infrastructure include (Bates, ibid):

- computers,
- mainframes or servers,
- networks,
- operating software,

- routers,
- telecommunication links,
- telephone services,
- videoconferencing equipment.

PURCHASING POLICY

A transparent purchasing policy must be established to ensure ethical, accountable and efficient use of the resources committed to ICT development. This purchasing policy should include the following elements:

- distinction between capital investment and consumables,
- assessment of needs,
- requisition of ICTs,
- approval of requisition,
- request for quotations from suppliers,
- selection of suppliers,
- submission of purchase orders,
- mode of payment,
- receiving and placing ICT equipment on inventory,
- negotiating site licenses.

Has your organization developed policy for the maintenance of ICTs in TVET?

The policy for the maintenance of ICT infrastructure should include four essential components, namely:

- backup of data,
- maintenance of ICT infrastructure,
- infrastructure upgrading and replacement,
- training of technical staff.

Provision must be made to backup critical information and important databases. The policy should clearly state the frequency with which different types of data backup should be performed, and who is responsible for the operation.

The policy for scheduled maintenance should focus on prevention of ICT infrastructure breakdown. A plan should be developed to outline the nature and frequency of preventive maintenance that should be performed on all hardware and software. The policy should also specify who is responsible for troubleshooting, maintaining and repairing the ICT infrastructure.

Appropriate policy must be formulated regarding the periodic upgrading and replacement of ICT infrastructure, including both hardware and software.

All technicians need to participate in ongoing professional development training to help stay abreast of technological change.

Has your organization developed a policy governing the use of ICTs in TVET?

The policy governing the use of ICTs in TVET should include the following key elements:

- approved users,
- acceptable use of ICTs,
- ethics in the use of ICTs,
- consequences of unauthorized use of ICTs.

The policy should specify:

- who are entitled to use the systems: students, faculty and staff;
- procedures for assigning user ID and password;
- maximum access time on site and off site, if applicable;
- user fee, if applicable;
- procedures for giving access to various system components;
- criteria for having access to various system components.

A description of what constitute acceptable use of ICTs must be included in the policy:

- acceptable use for students;
- acceptable use for faculty;
- acceptable use for staff.

The ICT policy should be drawn to ensure that all system users conform to copyright requirements with respect to software and digitalized materials.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding ICT policies in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to ICT policies in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding ICT policies in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your transformative reflection experience, develop the following ICT policies to govern the use of ICT-mediated teaching and learning in TVET:
  - general policy;
  - acquisition policy;
  - maintenance policy;
  - usage policy.
- If your organization has already developed specific policies governing the use of ICT-mediated teaching and learning in TVET, review and revise these indicators as may be necessary.
- Ask a group of key stakeholders in TVET to review these policies.

MODULE 1 IMPLEMENTATION OF ICT–MEDIATED TEACHING AND LEARNING IN TVET

UNIT 1.3 PROMOTING ICT INTEGRATION IN TVET

Objective 1.3.1 Promote the use of ICTs among TVET instructors and learners

Has your organization developed a strategy to promote the use of ICTs among TVET instructors and learners?

BENEFIT OF ICTs IN TVET

Lifelong learning is the only way to prevent obsolescence and remain competitive in a job market where work is becoming increasingly knowledge-intensive (Pritchett, 1995). One of the challenges with regards to lifelong learning is to provide recurrent opportunities for access to education and training throughout the life of a person (IITE, 2001a). The need for recurrent education and changing labour market conditions call for flexible access to TVET. Continuing education models that will meet workers' lifelong learning needs have to be relevant and flexible to provide just-in-time learning without distance (Manitoba Education and Training, 1998). In response to this need some institutions are implementing open-entry/open-exit programmes in TVET. For example, UNEVOC (1998) reports that Sweden has a very extensive system of adult education, one that is flexible enough to allow adults to acquire their education at different stages in life through various modes of delivery.

While there is an official discourse about the need for lifelong learning, accessibility is still a major issue. John Daniel, former UNESCO Assistant Director-General for Education, recently noted:

> The problem in education today is that hundreds of millions of the world citizens do not receive it. Many more do not get enough of it... Over 100 million children never see the inside of a school. And many more do not stay in school long enough to gain useful skills. 800 million adults have their lives blighted by illiteracy (2002, p. 1).

In the context of TVET, Stevens (2001) pointed out: "Distance education is believed by many to hold promise in addressing critical problems facing skills development at present, namely: a lack of qualified instructors, the need to greatly increase the delivery of skills training on a wide scale, and the need to deliver training at a much lower unit costs owing to constraints on financing." (p. 3).

In commenting on the use of ICTs to increase access to education, Haddad and Draxler (2002) noted:

> It is going to be very difficult, if not impossible for countries to meet the objective of *effective learning, for all, anywhere, anytime*. Our inability to meet this challenge, however, is self-inflicted because we tend to think of linear scaling, that is using the same model of education (a school constrained by space and time) but more of it and on a larger scale. What we really need is to think differently and radically. The education model developed for the Industrial Age cannot achieve educational empowerment effectively in the Information Age. With ICT tools, we should be able to evolve the components of the conventional model into the corresponding components of the new model (p. 8).

Limited access to TVET, particularly in rural areas and for disadvantaged groups, continues to be a major issue for most countries in Asia-Pacific region. The following suggestion was made to address this issue at Regional Planning Meeting of TVET experts (UNESCO-UNEVOC meeting, 2002):

> The TVET system should introduce poor-friendly training, delivered at their doorsteps at times convenient to them through appropriate modes of training. It may take the form of mobile training, distance learning, strengthening training by master craftsmen, and such other innovative modes of training delivery (p. 1).
>
> TVET has an important role to play in developing the computer literacy of students. Most vocational students are from disadvantaged working class or minority students having limited access to home computers. The integration of computer-based technology in TVET would provide equality of opportunity for these students.

There is a perception that distance education is not an appropriate method to delivering vocational and technical skills. However, "... for many occupations within the emerging 'knowledge economies' the cognitive and affective learning domains are becoming more substantial relative to psychomotor skills"(Stevens, 2001, p. 52). Providing distance education in these two domains is much less challenging than teaching manual skills at a distance.

The efficacy for distance learning in vocational education will keep improving with upgrade and improvement of: learning technology, instructional design, adaptive learning models, simulation of workplace environment, learners support systems, access to e-learning, and development of intelligent tutoring. Greater emphasis on a self-directed style of learning and an increase in computer literacy among stakeholders will further enhance the efficacy of distance learning in TVET (Stevens, p. 52).

ICTs are revolutionizing education by removing distance from education and making knowledge more accessible to all (Industry Canada, 1997). Technology-enhanced learning will play a crucial role in the development of a lifelong learning culture, and has the capacity to empower learners by providing them with multiple pathways that offer choices and channels to meet their education and training needs (Human Resources Development Canada, 1998). It is not surprising, therefore, to see a growing interest in Technology-Based Learning (TBL) across the world. TBL may be defined as the array of hardware and software used in the teaching and learning systems that include computer-based training systems, multimedia systems, electronic performance support systems, telecommunication systems, as well as the Internet with World Wide Web systems. The rate at which the Internet is being accessed keeps increasing at lightning speed. TBL can enhance teaching and learning; it has the potential to become cost-effective as it offers greater flexibility regarding time and location of training delivery (Furst-Bowe, 1996). Additionally, TBL may facilitate institutional policy regarding access and equity (Lafreniere, 1997).

ENCOURAGING LEARNERS TO ACCESS SERVICES THROUGH THE USE OF ICTs

The following conditions must be met to encourage TVET learners to access services through the use of ICTs:

- Ensure that all instructors and students possess the essential ICT literacy skills;
- Ensure that all instructors and students have access to ICTs;
- Provide user-friendly ICT environment;
- Provide reliable ICT infrastructure;
- Keep information up to date;
- Provide an ICT-mediated teaching and learning environment that can accommodate students and instructors with varying learning styles;
- Assist instructors to transfer their learning and teaching strategies to the ICT-mediated teaching and learning environment;
- Assist students to transfer their learning strategies to the ICT-mediated teaching and learning environment;
- Assist instructors and students to develop a personal learning plan;
- Assist instructors and students in becoming self-directed learners.

It is important to assist instructors and students in developing ICT literacy necessary to access, manage, integrate, evaluate, and create information. Following is a breakdown of these skill sets according to Educational Testing Service (2001):

- Access: knowing about and how to retrieve information;
- Manage: applying an existing organizational scheme;
- Integrate: interpreting and representing information, summarizing, comparing, and contrasting information;
- Evaluate: judging the quality, relevance, usefulness, or efficiency of information;
- Create: adapting, applying, designing, inventing, or authoring information (p. 3).

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding different strategies in common use to promote ICT-mediated teaching and learning among teachers and learners.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship of these strategies promoting the use of ICTs in TVET.
- Consider your learning experiences while completing this segment of instruction. Critically reflect on extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding appropriate strategies for promoting the use of ICTs for TVET among teachers and learners.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your transformative reflection experience, develop a strategic plan for promoting the use of ICT-mediated teaching and learning in TVET.
- If your organization has already developed a strategic plan for promoting the use of ICT-mediated teaching and learning in TVET, review and revise that plan as may be necessary.
- Ask a group of key stakeholders in TVET to review that strategic plan.

MODULE 2 ICT–MEDIATED TEACHING IN TVET

UNIT 2.1 CONSIDER ICT USAGE IN TVET

Objective 2.1.1 Develop awareness of the pedagogical principles in the design and development of ICT–mediated learning materials

Review pedagogical principles applied in the design and delivery of ICT–mediated learning
Examine methods of mapping pedagogic theory and its application to design and delivery for enhanced use in a mediated environment
Consider case study materials highlighting the need for informed design

Psychologists often approach the debate on pedagogy by highlighting the individual learning strategies of the student, and for the need to design and deliver methods of pedagogy which meet the individual learner's preferences and needs. In TVET environment this is paramount, given the diverse community of learners in terms of ability, skills, attitude, motivations and provision. Debate related to the use of pedagogic principles to the design and delivery of ICT teaching and learning has largely been between those, who favour the more traditional instructionalist or didactic approach, and those, who support pedagogies based on the contemporary theory of constructivism.

It is, therefore, important to examine the diverse pedagogic principles that must underpin the design and delivery of ICT-mediated teaching and learning in order to ensure effective and appropriate methods of practice. In relation to these principles, there exists a broad range of educational schools of thought and learning theories, many categorised into three main educational approaches: behaviourism, socio-culturalism and constructivism; although there are those that exist outside of these. Kolb's experimental learning cycle (Kolb, 1984), Jarvis' model of reflection and learning (Jarvis, 1987), and Laurillard's conversational framework (Laurillard, 2002) are examples of models that exist outside the main approaches' taxonomy. Each model has a specific focus, and relates to a particular set of theoretical perspectives, which can focus on specific aspects of learning.

One explanation of the apparent lack of application of models and theories for the design and delivery of materials, is that the practitioners outside the educational field find the diverse theoretical perspectives alien and overwhelming (McNaught, 2003). This can explain why many designs reflect "common-sense" rather than a theoretically informed design (Conole, 2004). However, the key elements of each theory and model (as outlined in Table 6) highlight the potential for an enhanced application to ICT-based learning.

Before examining the array of theories and models that can be applied in design and delivery, consider which of pedagogic principles you feel are the most appropriate for application to ICT-mediated teaching and learning and provide reasons for your choice (Table 6).

Table 6. Appropriateness of pedagogic principles to ICTs

Pedagogic principle	Appropriate for ICTs?	Reasoning

Table 7 summarizes the main theoretical perspectives and their application to ICT-mediated learning.

Table 7. Key learning theories and models, characteristics and possible applications in an ICT-mediated environment

Key learning theories and models, characteristics and possible applications in an ICT–mediated environment			
Theories	**Characteristics**	**ICT application**	**Literature**
Behaviourism	• Trial and error learning • Learning via association and reinforcement • Behaviour modification through stimulus–response • Teaching is concentrated upon control and adaptive response • Observable outcomes are paramount	• The majority of ICT learning development stems from the process of didactic methods online related directly to assessment and feedback	B.F. Skinner M. Tennant
Cognitive	• Learning as transformation of cognitive structures • Teaching is based upon the transfer of information through communication, explanation, problem solving and inference • Human development is the key outcome of learning • Designs are often based on sequences of conceptual material which builds from existing information structures	• Development of intelligent and learning systems and the concept of personalised agents • Salomon's concept of distributed cognition (Salomon, 1993) could create a shared knowledge structure between individuals environments rich in contacts and resources	J.R. Anderson E. Wenger E. Hutchins J. Piaget
Constructivism	• Learners create their own mental structures through interaction with an environment • Teaching is task–orientated • Supports hands on, self–directed activities focused on design and discovery • Use structured learning environments engaging learners in self–directed learning tasks	• Toolkits and support systems guide and inform learners via a process of activities • Access to resources and expertise potentially develops a more student–centred, active, and authentic learning world • Micro worlds and simulations	S. Papert T.W. Duffy and D.H. Jonassen
Activity based	• Sees structures of activities as historically created entities • Action is through mediating artifacts within a framework of activity based within the broader socio–cultural context of rules and community • Teaching is based on narrowing the divide between the historical stage of a person and the developmental stage of a person in relation to the activity at hand, e.g. current language acquisition and the ability of the child to speak a language • The Zone of Proximal Development states that assessing current ability provides limited insight into an individual's potential for development. This is better applied by assessing the work of an individual alongside a more able peer	• Over the last decade there has been a shift in focus from information (including ICTs) to an emphasis on communication, collaboration and understanding the factors that uphold the development of communities • Understanding that the development of content alone does not correlate to more effective learning and that there is a need to nurture learning environments for communities to progress • Networking via the web has enabled communities to develop and has provided access to a diverse range of knowledge and expertise	L.Vygotsky, '34 J.V.Wertsch, '85 Y. Engestrom, '87

Key learning theories and models, characteristics and possible applications in an ICT–mediated environment			
Theories	**Characteristics**	**ICT application**	**Literature**
Socially situated learning	• Emphasis on social interaction and learning through social participation • Focus on interpersonal relationships involving imitation and modeling • Language serves as a tool for learning and the joint construction of knowledge • Language has dual functions: 1. As a communicative or cultural tool, used for sharing and developing knowledge 2. As a psychological tool for organizing thought processes in relation to reasoning, planning and assessing our actions • Dialogue between teacher and learner can be catalogued into 12 levels of engagement–external and internal • Knowledge is our ability to experience the world, and that our engagement within it is meaningful. This is ultimately what learning is to produce	• Numerous forms of asynchronous and synchronous communication lead to diverse forms of dialogue and interaction for all involved in the learning process • Various online communication tools and learning environments offer the potential for new forms of communities of practice, or provide facilities to support and enhance existing communities	N. Mercer L. Vygotsky D. Laurillard J. Lave E. Wenger
Experimental	• Experience is the foundation for learning • Learning is the acquisition of experience into knowledge, skill, attitudes, values and emotions • Reflection is a medium for transferring this experience into knowledge • Focus on problem–based learning: 1. Experience: problem situation, identification and definition 2. Gathering of and reflecting on information 3. Theory formation and assessment in practice 4. Experience through primary and secondary 5. Reasoning and reflection 6. Evaluation (Dewey 1916)	• Asynchronous communication allows a new form of discourse which is not bound by time and, therefore, offers time for reflection • Archive and numerous forms of representation from different communities provide an opportunity for reflection	J. Dewey D.A. Kolb P. Jarvis
Systems theory	• Emphasis on organizational learning or on modeling learners in response to feedback	• Models of learning account adaptation in response to both discursive and active feedback	P. Senge D. Laurillard

Adapted from: G. Conole et al. / Computers and Education 43(2004) 17-33

TOOLKITS – DESIGN FOR LEARNING

Conole et al. (2004) assert that a more theoretically consistent approach to learning design is to interrelate theory with the desired features, and then to map relevant tools and resources (human and technical) against these. This is to enable practice to reflect theory, also advocated is the use of toolkits, model-based resources, which can enable non-specialists to engage with such theories in a way that supports careful design and prompts productive reflection and engagement (Oliver & Conole, 2002, Oliver, MacBean, Conole, & Harvey, 2002).

This model for learning encompasses the key components of learning theories, reveals their interrelationships and offers a means of mapping them against each other. The approach toward a design for learning consisted of the following stages:

1) Reviewing learning theories.

2) Identifying common characteristics across different learning theories.

3) Building a model for these theories.

4) Mapping learning theories to the model and identifying learning theory clusters.

5) Applying and testing the model and developing learning design toolkits for mapping learning theories to bring activities, tools and resources.

This toolkit can then be applied where a range of learning theories could be used, and there is no single right answer to the problem. The toolkit does not decide which approach is best; rather it provides a guiding framework, which enables the practitioners to make an informed evaluation of their own practices and pedagogic approaches.

The framework for this learning model has six components, each illustrating key learning characteristics. Pedagogic principles can then be identified and applied to the design and delivery of the learning and curriculum design.

1) Individual – the individual is the focus of learning.

2) Social – learning is facilitated as a result of interaction with others through discourse and collaboration and the wider social context in which the learning takes place.

3) Reflection – this is where conscious reflection on experience is the basis by which experience is transformed into learning.

4) Non-reflection – learning is explained with the reference to processes that involve conditioning, preconscious learning, skills learning and memorization (Jarvis, Holford, &Griffin, 1998).

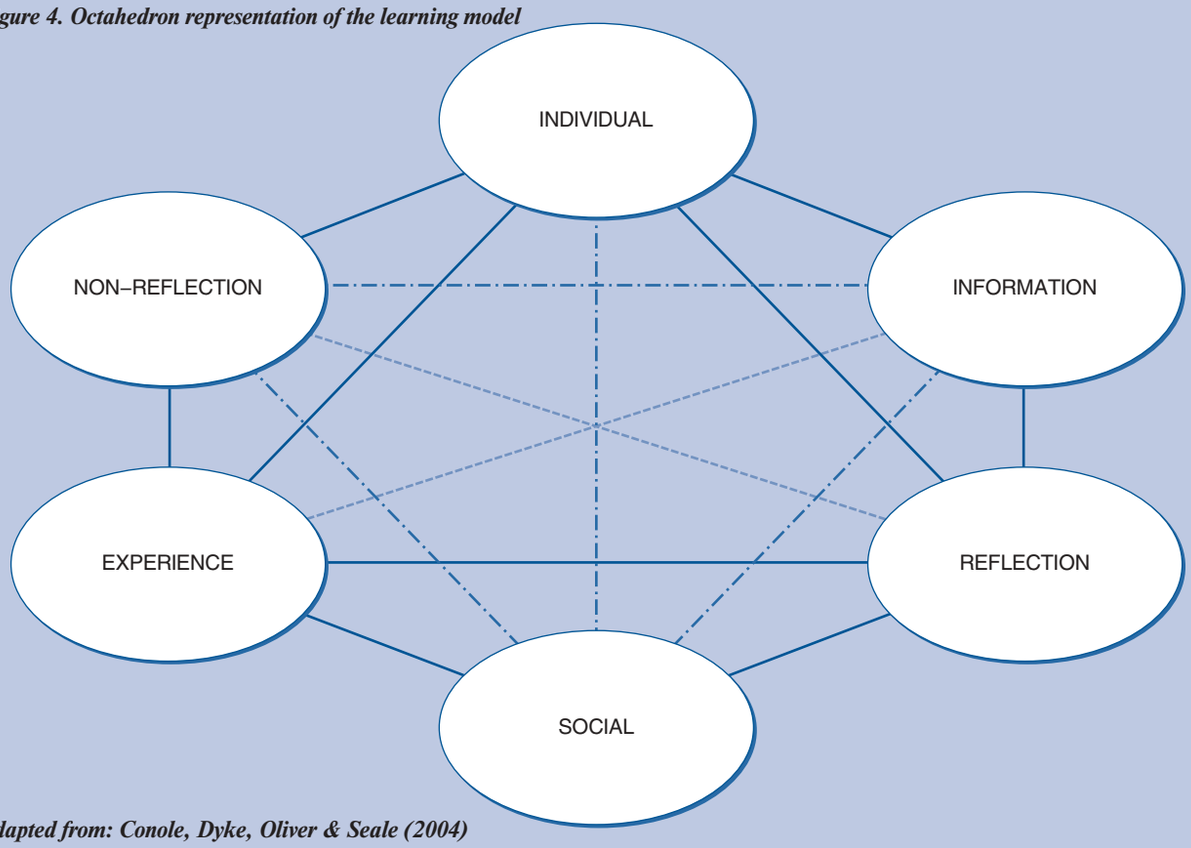
5) Information – this occurs when an external body of information, i.e. text and artifacts, form the basis of experience and raw material for learning.

6) Experience – learning derives from direct experience, activity and practical application.

The components that make up the framework are illustrated in the diagram (Figure 4).

This representation of the model enables practitioners to visualize the interlinking relationship between approaches and to identify individual learner activities to aid effective design and delivery. The bold lines show the three axis of interpretation: individual – social, non-reflective – reflective and information – experience, against which different learning theories can be mapped. Despite being represented as a linear process, the toolkit can be applied as an interactive one where overall learning activity and associated outcomes can be outlined. As a result of using this method to map pedagogic theory and apply it to pedagogic design and delivery, it ensures the appropriate use of mini activities, resources and learning tools. Table 8 illustrates the way in which this can be applied to the learning design.

Figure 4. Octahedron representation of the learning model



Adapted from: Conole, Dyke, Oliver & Seale (2004)

Table 8. Method of mapping of pedagogic theory and applying it to pedagogic design and delivery

Method of mapping of pedagogic theory and applying it to pedagogic design and delivery		
Learning Theory	**Characteristics**	**Highlighted aspect of the model**
Behaviourism (Tenant, 1992)	• Individualized • Information Stimulus • Non–reflective Reflex Reinforcement Association	• Non–reflection • Information
Experimental learning (Kolb, 1984)	• Experience • Reflection • Theory building • Testing theory in practice	• Information • Reflection • Experience
Pre–conscious learning (Jarvis, 1972:74)	• Incidental learning • Low level of consciousness • Memorization • Recall	• Individual • Non–reflection • Experience

Adapted from: G. Conole et al. (2004)

According to Conole et al, planning the design process should involve the following:

1) Outline the current course structure.

2) Identify areas of learning that could be supported more effectively.

3) Compare different teaching techniques and select those that can improve the weak areas within the course.

4) Create a final course specification and design the final format.

5) Select mini activities and appropriate use of tools, artifacts and resources based on overall pedagogic theory.

6) Plan the actual learning activity.

Within this the following process can be applied:

1) Activity
   a) Document learning activity (brainstorming, self-assessment, discussion, presentation).
   b) Identify stages of the activity and proposed learner outcomes.
2) Context
   a) Consider the nature of the learner (motivation, cognitive ability, level of computer literacy).
   b) Consider the context in which the learning will take place.
   c) Consider the tutors.
   d) Pay attention to other influences, issues and constraints (time, funding).
   e) Preferred pedagogic approach (Constructivist, Behaviourist, Cognitive).
3) Actions
   a) Identify possible mini activities that need to be completed (research, presentations, project development).
   b) Identify possible tools and resources to be used (CD-ROMs, Internet, database).
4) Coordinating actions
   a) Mapping of mini activities, tools and resources in relation to the preferred pedagogic approach to the learning activity.
   b) Selection of mini activities, tools and resources.
   c) Final pedagogic profile of the overall learning activity.

Designing mini activities based on this process can help practitioners adapt learning resources or approaches to individual learners or support the overall learning scenario. The method of mapping enables the practitioner to design a programme of study, which provides the right balance between levels of guidance and individualized learning. Table 9 illustrates how activities can lie at intervals along the axes of the toolkit.

For example, seminars can be placed on varying points along axes:

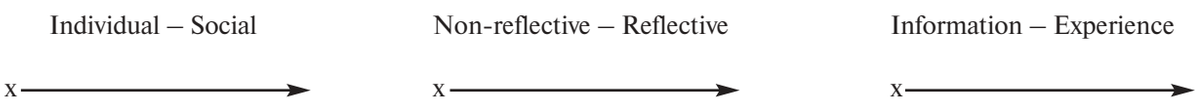


Table 9. Potential use of mini-learning activities

Mini–learning activities	Potential means of application using varying mediating tools and resources			
Brainstorming	Discussion in an online group	Discussion through a timed online chat	In a one hour face–to–face seminar	(Individual) Individual work, using a concept map
Research and gathering resources	Individual work using a search engine	Group work utilizing a range of sources	Shared experience	Individual work through CAL tutorials
Self–assessment	One–to–one discussion	Through peer assessment in a group	Completion of an online self–assessment audit	Inclusion in a shared online benchmarking tool

Adapted from: G. Conole et al./Computers and Education 43 (2004) 17-33

CASE STUDY

To illustrate how this has been used in practice, one can look at the Post Graduate Certificate in Education in the United Kingdom. This was traditionally taught using a vast array of professionals allied to education. In practice much information was in the form of lectures that the students assimilated to practice through essays and teaching observation. As a mainly didactic approach it could be defined as existing somewhere along the axes of information and non-reflection (based on the model). Evaluation of the module highlighted the need for reflection, greater use of the teaching experience of the students within the group. Online syndicates set up by students published issues that they had faced, which empowered students to learn from their own experiences. Tutors worked closely with students to identify information for research, text books and views of expert practitioners were collated. The final findings were published online for analysis, reflection and to make recommendations based on their initial assumptions and newly formulated ones. This process reveals how the course design evolved to create an opportunity for individual activity, experimental and reflective learning.

Zinn (1999) identified five relevant philosophies of education for adult educators. These are:

- Behavioural – Education for competence.
- Liberal – Education for intellectual development.
- Progressive – Education for practical problem solution.
- Humanistic – Education for self-actualization.
- Radical – Education for social change.

Zinn (ibid) further noted that "a philosophy of education provides an integrated, consistent basis for making choices in the practice of education, and offers insight into relationships: (a) between teachers and learners, (b) between learners and learning content/activities, (c) between learning content/activities and the world at large" (p. 24). Zinn also argued that "identifying one's personal philosophy of education can enhance the degree of congruence between teacher's beliefs/values and action in the practice of teaching" (p. 24). Zinn has developed the Philosophy of Adult Education Inventory (PAEI) to allow adult educators to identify a personal philosophy of education and compare it with prevailing philosophies of adult education. The PAEI is self-administered, self-scored, and self-interpreted. You can access the PAEI at the following URLhttp://www.cals.ncsu.edu/agexed/aee523/paei.pdf.

Complete the PAEI, score your responses, interpret the scores and reflect critically on your philosophy of education.

The diverse range of approaches common to ICTs can prove challenging to researchers and practitioners alike. This model of mapping approaches to the design and delivery of ICT-based learning, attempts to make the link between pedagogy and practice more explicit. In addition, the model can help explain how theory can influence practice. It can be applied as a check on existing approaches or as a tool at the learning design stage. This can prove beneficial in terms of assessing affordability of technology and guidance as well as ensuring achievable learner outcomes. In a vocational context, this can be of great importance.

Overall, the simplification of each pedagogic approach fails to highlight weaknesses that exist in this debate. Firstly, like any taxonomy, clear divisions between approaches do not always exist. Rather, it is preferable to view the pedagogic approaches as different axes on a scale where different approaches to pedagogic design may lie at one end of the scale or at the same point along that scale.

Furthermore, learners or teachers can apply different pedagogies or learning strategies based upon the nature of the learning at hand. Secondly, it is relevant to point out that there is a school of thought that exists namely within higher education which questions whether different pedagogies are applicable to different types and levels of learners (with reference to those in a vocational environment). This assertion can be contested in that, rather than being the approach, that is the issue, it is the design of the learning activity, e.g. the level of support required for the beginner in contrast to the learner with more experience. This is certainly the case in vocational education, which draws learners from a diverse population.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the pedagogic principles applied to the design of learning in an ICT-mediated environment for TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to how pedagogic principles are applied to the delivery of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you identify and explore alternative assumptions or reinforced your existing assumptions regarding application of pedagogic principles to the design and delivery of ICT-mediated learning in TVET.
- If this reflection has enabled you consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a toolkit for the application of pedagogic principles to design and delivery of ICT-mediated learning in TVET.
- Ask a group of key stakeholders in TVET to review this toolkit.

Objective 2.1.2 *Develop awareness of the principles of adult learning for ICT–mediated teaching*

Consider examples of ICT delivery based on adult learning principles
Evaluate the effectiveness of this application
Review personal characteristics as an adult learner

Self-Directed Learning as a concept was first discussed as early as in 1926. In Lineman's words: "Adults are motivated to learn as they experience needs and interests that learning will satisfy ... adults have a deep need to be self-directing; therefore the role of the teacher is to emerge in a process of mutual inquiry". Indeed, it is estimated that 70 % of learning is self-directed. Later research undertaken by Houle in the1960's developed a typology of learning styles; he discovered that people were generally either:

Goal-orientated: some specific goal or objective serves as the learning stimulus.

Activity-orientated: being with others in the pursuit of learning is the primary motivation.

Learning-orientated: enjoyment of learning for it's own sake is the stimulator.

This pioneering study paved the way for a plethora of research, which developed an understanding of pedagogic principles (in this instance related to self-directed learning). As a result it influenced numerous changes in educational and training practices with adult learners. The increased understanding focuses on the view that the individual learner is capable of assuming considerable responsibility for and control of learning activities when such opportunities are created. It appears that "affirmation of self and its accomplishments, sense of satisfaction and pleasure and a high level of enthusiasm" are important factors for adult learners (Fisher, 1995).

Knowles (1975) describes self-directed learning as where the individuals can diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes. Knowles asserts that adults want to see and use the benefits of their learning experience immediately as opposed to learning for use in the future. Mocker and Spear's descriptive model of lifelong learning (1982) asserts that it is this feel of autonomy in the decision-making process that is paramount to the success of a self-directed learning situation. Mocker and Spear go on to conclude that optimal self-directed learning occurs when the learner is in control of all aspects of the learning experience and does not happen during traditional formal learning experiences (common in vocational education settings). These theories help illustrate the importance of understanding how pedagogic principles can underpin learning and reiterate the need for appropriate and informed design.

The effectiveness of self-directed learning is an important factor when considering delivery. Lowery (1989) has put forward numerous suggestions for adult educators in order to enhance instruction and methodology. Some suggestions are cited below:

- Help the learner to identify learner outcomes and goals for a learning project.
- Be a manager of learning experience rather than an information provider.
- Encourage critical thinking skills by incorporating appropriate activities such as seminars and online discussions.
- Obtain the necessary tools to assess learners' current performance.
- Provide opportunities for self-directed learners to reflect on what they are learning.
- Promote learning networks and experience-based learning.

It is also important to recognize that the delivery and methodology of approach is different with adults as it is with children. Indeed the term "Andragogy", the science of teaching adults (Knowles, 1990), is largely understood outside of academic circles. The reality is that when pedagogical methodology is inappropriately used adult learners may feel alienated or intimidated, and this may be a significant factor in their quest to achieve their desired goals. As Brookfield

(1985) asserts, there must be a shift in the traditional philosophy that the education of adults is simply adding content or skills mastery... Self-directed learning is more than a form of learning. It is a component of human development.

Self-directed learning has many advantages over traditional forms of classroom-based provision, particularly in the workplace. It enables the learner to pursue learning activities that correspond to their particular needs. It provides a flexible approach to learning in terms of pace, content, and the environment in which the learning occurs. Indeed, self-directed learning can reduce the financial and time constraints that traditional methods of pedagogy present. Probably, the biggest impact within vocational education and training has been the support materials for classroom instruction. Students are able to use computers for a wide range of pedagogical applications such as searching for resource material, online databases, CD-ROMs as well as video and print media. The use of ICT-mediated learning has led to a profound change in the pedagogic design and delivery of learning with traditional classrooms becoming increasingly virtual in nature.

However, there are also issues with the emergence of this pedagogic approach: the issue of access and availability of computers can lead to an increase of inequality. Self-directed learning requires very high levels of student motivation and a level of competence of technological applications. Programmes available over the Internet on a distance learning often have a high drop-out rate as learners fail to realize the level of time and work commitment required. It can be argued that self-directed learning skills might be thought of as a combination of internal and external factors, not as independent characteristics. Both internal (psychological readiness, application of the learning process) and external (pedagogic skills, actual participation in and control of the learning process) are conflicting aspects of self-directed learning. Optimal learning conditions can be said to exist when a learner's level of self-direction is balanced with the extent to which self-directed learning opportunities are possible in the environment.

Gibbons (1980) examined the biographies of 20 high achievers and found creativity and self-confidence were commonly cited characteristics amongst those that had undertaken self-directed learning.

TRANSFORMATIVE LEARNING

Transformative Learning based on psychoanalytical theory was first introduced by Jack Mezirow in 1978 and has developed into a topic of research and theory building in the realm of adult education. Centrality of experience, critical reflection and rational discourse are three central themes that coexist within Mezirow's theory.

The theory developed the concept of meaning schemas that are based on experience (specific beliefs, attitudes and emotions) and changed as a result of learning and critical reflection; this change is referred to as Perspective Transformation. According to Mezirow, perspective transformation is the process of becoming critically aware of how and why our assumptions have come to constrain the way we perceive, understand and feel about our world; changing these structures of habitual expectation to make possible a more inclusive, discriminating and integrating perspective; and finally, making choices or otherwise acting upon these new understandings. This process of de-constructing and transforming of meaning schemes occurs in a rational, analytical and logical way. This occurs through a series of phases beginning with the disorientating dilemma then, self-examination, critical assessment of assumptions, recognition of other similar transformations, exploration of new roles or actions, developing a plan of action, implementing the plan, developing competence and self-confidence in this new role, and reintegration into life on the basis of the new perspective. It is a process of reflection that changes the way in which people define their worlds (Mezirow, 1991).

Critical responses to Mezirow's theory have emerged over time, one of the main criticisms being the emphasis on critical reflection and rationality. One of the main critics of Mezirow's theory is Robert Boyd (Boyd and Myers, 1998), though Boyd does not disregard the importance of rationality in the transformative process; he believes that too much emphasis has been placed upon it. For Boyd, transformative education is based on emotion, creativity and intuition as well as rational and logical thought. Unlike Mezirow's emphasis on the ego being central to perspective transformation, Boyd and Myres see the process as more psychosocial in nature. Despite the seemingly contradictory views of transformative learning, both theories share common characteristics, such as autonomy, critical reflection, discourse, communication and self-knowledge.

Probably, the most important skill for today's competitive workforce is skill of self-reflection. The highly motivated, self-directed learner with skills of self-reflection can approach the workplace as a continual classroom. In an ICT-mediated learning environment this may present a challenge to the teacher and student alike. However, the use of

online discussion, one-to-one seminars and encouraging critical reflection within course design can ensure that the application of this learning principle occurs.

Cranton (1994) postulates considerations that should occur during the application of transformative learning in delivery such as:

The teacher's role in establishing of an environment that builds trust and care and facilitates the development of sensitive relationships among learners, is a fundamental principle of fostering transformative learning (Taylor, 1998). Loughlin (1993) talks about the responsibility of the teacher to create a "community of knowers", individuals who are "united in a shared experience of trying to make meaning of their life experience". As a member of that community, the teacher also sets the stage for transformative learning by serving as a role model and demonstrating a willingness to learn and change by expanding and deepening understanding and perspectives of both subject matter and teaching (Cranton, 1994).

The role of the learner. Taylor (1998) believes that too much emphasis has been placed on the role of the teacher at the expense of the role of the participant. Although it is difficult for transformative learning to occur without the teacher playing a key role, participants also have a responsibility for creating the learning environment. As a part of a community of knowers, learners share the responsibility for constructing and creating the conditions, under which transformative learning can occur.

According to Taylor (1998), "teachers need to consider how they can help students connect the rational and the affective by using feelings and emotions both in critical reflection and as a means of reflection".

Transformative learning may not always be the main focus of adult education, but its importance should not be overlooked, and all adult educators should attempt to understand it, even if they do not choose to embrace it.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the application of adult learning principles in the design of ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions application of adult learning principles in the design of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the application of adult learning principles in the design of ICT-mediated learning in TVET.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a toolkit to the application of adult learning principles in the design of ICT-mediated learning in TVET.
- Ask a group of key stakeholders in TVET to review this toolkit.

Objective 2.2.1 ***Familiarize learners with the issues and concerns in adapting existing materials for digital delivery***

TO ADAPT OR TO DESIGN

Professional instructional designers are more likely to use the sequential model described in the previous section. There is some evidence which indicates that instructors begin to tackle with the instructional design task with the evaluation process. They would first look for an existing material that can meet a learning need rather than designing an original material.

William J. Rothwell and Hercules C. Kazanas provide a model that instructors can use to choose an instructional material.

1. Prepare a working outline or syllabus wich will contain the content of learning of the programme.
2. Conduct research wich will attempt to identify existing materials available both inside and outside of the organization. If materials already exist for use, there is no point in reinventing the wheel. Begin by speaking with specialists in the field and talking to others in and outside the organization who may have a role in planning of a similar programme. There is a variety of instructional design organizations that may be able to provide assistance or materials to you. Searching print-based texts and using the World Wide Web are also excellent sources for instructional design information.
3. Review existing materials to be evaluated to ensure that they are consistent with the programme. It is likely that some modifications will have to be made as each planner will design a programme differently.
4. Arrange or modify existing materials wich may require the programme planner to obtain permission from the author or publisher to do so. Most, if not all, pre-packaged materials are copyrighted. Materials should be rearranged to fit the programme to be offered. It should fit the programme's objectives. There are two possible scenarios for adapting existing materials to meet a specific programme need:
   – adapting an ICT-mediated learning materials, and
   – converting a print-based material in ICT-mediated learning format.

A comparative analysis of the efficiency and cost-effectiveness must be used to decide whether to adapt an existing material or to design new materials.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the adaptation of existing instructional materials for digital delivery.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions regarding the adaptation of existing instructional materials for digital delivery.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the adaptation of existing instructional materials for digital delivery.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a toolkit to adapt existing instructional materials for digital delivery.
- Ask a group of key stakeholders in TVET to review this toolkit.

Objective 2.3.1 *Design and develop a needs' assessment/analysis plan*

The process used to develop any form of instructional materials can be classified in five distinct stages:

- Analysis
- Design
- Development
- Implementation
- Evaluation

Three types of analyses are performed:

- Needs' assessment
- Task analysis
- Training needs' analysis

NEEDS' ASSESSMENT AND NEEDS' ANALYSIS

There is considerable confusion in the training literature regarding needs' assessment, needs' analysis and training needs' analysis (Kaufman, 1985). All three terms are at times used interchangeably although they have specific functions.

Needs' assessment is a systematic procedure identifying the needs of an organization to place these needs in priority order and to select the needs for closure. Needs' assessment procedure does not provide any tentative solution of problems identified. Needs' analysis on the other hand is a systematic procedure designed to analyze the needs selected for closure by the needs' assessment activity, and to identify alternative solution for these needs. In the training context, training interventions, consequently, the needs' analysis enables the determination of training and non training solutions.

Once training has been identified as a viable solution to a training problem, the training needs' analysis enables trainer to determine where training is needed in the organization, what kind of training is needed, and who needs the training.

Definition of needs

Cafferella (1994) defines a need as a discrepancy between an actual state of affairs and a desired state of affairs. Kaufman and Stone (1983) more precisely defines a need as a "gap between **what is** and **what should be** in terms of results". They insist on the definition of needs in terms of results to avoid proposing tentative solution to observed symptoms instead of identifying the real problem. The word "need" can be used as a noun and/or verb. Kaufman (1983) indicates that in the context of needs' assessment "needs" should be used as a noun and not as a verb, otherwise instead of stating the needs, we might be proposing tentative solution to symptoms, e.g. the machinist needs' training.

Five types of needs:

- Felt need, which is a discrepancy between what one wants and what one has.
- Anticipated need, which is a discrepancy between what one has now as compared to some anticipated future needs.
- Normative need, which is a discrepancy between what one has as compared to a norm or standard.
- Comparative need, which is a discrepancy between what one group has as compared to what another group with similar characteristics has.
- Expressed need, which is expressed when one takes action to remove the gap between what he has and what he wants.

NEEDS' ASSESSMENT MODEL

Kaufman and Stone (1983) provide a needs' assessment model that they claim can be equally effective and efficient in both business and industry, as well as in educational settings. They named this model Organization Element Model. Before discussing this model it may be informative to see how Kaufman and Stone view the organizational functions and how they relate needs' assessment to these functions in organizational planning.

Kaufman and Stone (1983) identify five functions of an organization: input, process, product, output and outcome. They consider the input and process functions as organization efforts; the product and output functions as internal results and the outcome function as external organizational results. Since they define need as a gap in what is and what should be in terms of results, they argue that at the level of input and process, one can only perform a quasi needs' assessment; the true internal needs' assessment is performed at the product and output levels, and finally the true external needs assessment is performed at the outcome level.

The basic concept of needs' assessment is fairly simple, and consists of identifying **"what is"** and **"what should be"**; placing the identified needs in priority order and selecting the needs for closure.

Procedure of Needs' Assessment

1. Identify the key informants. Key informants should de drawn from implementers, recipients and society.
2. Get the commitment of the key informants.
3. Get the commitment of the key informants for the needs' assessment.
4. Get each key informant to identify **what is. What is** must be specified in a similar way used when writing performance objectives, performer, performance, conditions, and standards (Mager).
5. Get individual group consensus on **what is.**
6. Obtain overall group consensus on **what is.**
7. Get key informants to identify **what should be** using the format as when specifying objectives.
8. Obtain individual group consensus on **what should be.**
9. Obtain overall group consensus on **what should be.**
10. Identify the change and continuation requirements by comparing **what is** and **what should be.**
11. Place change requirements in priority order.
12. Obtain group consensus.
13. Select needs for closure. The typical questions asked when determining which needs to select are:

    a) What will it cost to solve this need?
    b) What will it cost to the organization if this need is not solved?

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding needs' assessment and needs' analysis.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to needs' assessment and needs' analysis.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding needs' assessment and needs' analysis.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a detailed plan to conduct a needs' assessment and training needs' analysis for ICT-mediated learning materials in TVET.
- Ask a group of key stakeholders in TVET to review the plan.

TASK ANALYSIS

There is a strong demand on TVET to impart, retool and enhance job-related skills. If the purpose of a TVET programme is to improve the job performance, it is then important to use the job requirements as a basis for programme design and development. Job analysis is a strategy developed to breakdown a job into parts and components. Any job can be divided into duties, tasks, and subtasks. Duties are the major work activities performed by workers. Tasks are specific work activities, while subtasks are the steps that must be completed in the accomplishment of a task. Lack of front-end analysis is the single most common error in programme planning. Analysis is a very important phase of the programme planning process. It influences all underpinning assumptions used in the decision-making process and provides the basic foundation for programme design and development. The process and product of the analysis (analyses) also provide an audit trail to validate the programme planning activities as well as programme outcomes after its implementation. Additionally, job or occupational analysis is the only valid source of information to make programme-planning decisions.

Occupational analysis is the strategy used to identify the duties, tasks, and subtasks performed by job incumbents. The product is used to design job description, task inventory, performance systems, performance assessment system, compensation systems, and training design and development. Job analysis is expensive and time-consuming. Consequently, it is warranted only after the needs' assessment activity has demonstrated a performance gap, and training analysis has established that an instructional solution will close that gap (Rothwell & Kazanas, 1992). Canada has made significant contributions to the job analysis techniques by the introduction of Developing a Curriculum (DACUM), which is an innovative method that has revolutionized programme planning. DACUM is an objective and cost-effective technique to conduct job or occupational analysis using a brainstorming process involving from 8 to 12 expert workers. Following is a brief description of the DACUM process:

- Generate job description;
- Identify duties;
- Identify tasks;
- Identify subtasks;
- Identify supporting knowledge, skills and attitudes;
- Identify tools and equipment used.

The need for continuous training and retraining has given adult education a strong focus toward vocationalism. There is a strong demand in adult education for imparting, retooling and enhancing job-related skills. If the purpose of an adult education programme is to improve the job performance, it is then important to use the job requirements as a basis for programme design and development. Task analysis is a strategy developed to identify job content and skills, knowledge and attitude requirements.

Michalak and Yager (1979) defined task analysis as a method specifying in precise detail and in measurable terms the human performance required to achieve specific job objective, the tools and conditions needed to perform the job, skills and knowledge required of the employee. It is an intensive examination of how people perform work activities (American Society for Training and Development, 1985).

Definition of a task

- A task is a discrete unit of work performed by an individual.
- A task is a group of related work activities directed toward a goal.
- A task has a definite beginning and an end.
- A task involves people's interaction with equipment, other people and/or media.
- A task results in a meaningful product or service.

There are four types of tasks:

- Procedural/action tasks.
- Process tasks.
- Troubleshooting tasks.
- Mental tasks.

Procedural tasks are also called action tasks. An action task consists of a series of actions or behaviours.
Example of an action task: Maintain patients' records.
Process Tasks involve the interaction of people and an existing process, such as a management information system.
Example of a process task: Reconcile a bank statement.
Troubleshooting tasks are similar process charts. However, in performing a troubleshooting operation the performer works backward to determine the cause of the problem.
Example of a troubleshooting task: Troubleshoot a car engine.
Mental or cognitive tasks, as the name suggests, are performed mentally.
Example of a mental task: Select a desktop computer.

SUBTASKS

Tasks can be divided into subtasks. A subtask is a step in a task. Analysis of the knowledge, skills and attitude requirements are performed at the subtask level.

TASK ANALYSIS PROCEDURE

DACUM or the CAP system enables the programme developer to breakdown a job into duties, tasks and subtasks. Once this process has been completed the task analysis procedures described here will allow the programme developer to identify the underlying skills, knowledge and attitudes that support the efficient accomplishment of specific tasks. These analyses are performed with the assistance of subject matter experts.

Programme developers employ (four types of strategies analyzing job tasks) four ways of job tasks' analysis (four types of job tasks' analysis) to derive instructional content (Sage and Rose, 1985):

1. Task safety analysis;

2. Literacy task analysis;

3. Object analysis;

4. Action analysis;

5. Process/troubleshooting analysis;

6. Subject matter analysis.

TASK SAFETY ANALYSIS

Each year accidents continue to take a toll on workers in all industries. Health and safety education will ensure that people live and work in a safe and health environment. The task safety analysis is used to identify the content of health and safety education and training programmes.

PROCEDURE

1. Analyze each subtask.

2. Identify the tools, equipment and materials used to perform these subtasks.

3. Identify the hazards and health and safety issues associated with the use of the tools, equipment and materials used to perform these subtasks.

4. Identify prevention measures to eliminate hazards or protect performer.

LITERACY TASK ANALYSIS

Research indicates that typical workers on average spend two hours reading work-related information. At the same time International Adult Literacy Survey showed that a significant segment of Canadian adults lacks the minimum literacy requirements for daily living. Consequently, it is becoming increasingly important for programme developers to pay particular attention to the enhancement and reinforcement of workplace literacy. Literacy task analysis is designed to identify the literacy requirements of a particular job tasks. Literacy task analysis focuses on the language, mathematics and related science and technology.

PROCEDURE

1. Work with you subject matter experts to identify the critical literacy skills that support effective and efficient accomplishment of each subtasks.

2. Gather authentic reading materials used at the workplace and perform a content analysis of the same.

3. Conduct a literature search and synthesize results.

4. Describe the literacy requirements.

OBJECT ANALYSIS

If the goal is to train a person to use an object, that object must be analyzed in order to determine that training content. Object analysis is used to describe the relationship between parts, subsections and sub-assemblies of an object. The user manual accompanying most manufactured products provides a good example of object analysis.

PROCEDURE

1. Examine the object.

2. Identify its parts, subsections and sub-assemblies.

3. Represent the relationships between the parts, subsections and sub-assemblies using diagrams, pictures, exploded views, and sketches.

4. Label all parts, subsections and sub-assemblies.

ACTION ANALYSIS

Action analysis is the procedure used to identify and record a performer's motion while he/she is interacting with a piece of equipment.

PROCEDURE

1. Select performers for observation.

2. Observe performers.

3. Record actions, motions or operations.

PROCESS/TROUBLESHOOTING ANALYSIS

The process/troubleshooting analysis is used to identify the knowledge, skills and attitudes used to make decisions, monitor processes or troubleshoot complex, abstract tasks involving employee/system interactions.

PROCEDURE

1. Identify performers.

2. Assist performers to generate the steps in a procedure.

3. Identify and record all cues, decision points, decision-making logic and error patterns.

4. Convert the information gathered in a flow chart.

SUBJECT MATTER ANALYSIS

Workers convert content knowledge into useful practical knowledge underlying efficient and effective task performance. Content analysis enables programme developers to capture this practical knowledge. This information is useful to assist learners to translate facts, concepts, processes, procedures and principles into work-related knowledge, skills and attitudes.

PROCEDURE

Rothwell and Kazanas (1992) outline the steps to perform content analysis.

1. Identify the subject or topic.

2. Investigate what experienced performers know about the topic.

3. Investigate how people perform the mental activity by (1) asking them; (2) observing results of work activities; and (3) using other appropriate methods.

4. Conduct a literature search on the topic.

5. Synthesize results.

6. Describe the subject or content.

CRITICAL INCIDENT TECHNIQUE

Some jobs, especially those with a high degree of interpersonal skills, cannot be analyzed using traditional job analysis methods. Critical Incident Technique developed in Flanagan in 1954 provides a good alternative strategy.

PROCEDURE

1. Identify approximately 30 job performers.

2. Collect critical incidents from the performers using a structured interview format. Use the following template:

   - Ask performers to collect incidents when performers felt that they were effective or ineffective;
   - Ask performers to describe the circumstances surrounding the incident;
   - Ask performers to describe what they did that was effective or ineffective;
   - Ask performers to specify why the incident is an example of effective or ineffective behaviour;
   - Collect approximately 300 incidents;
   - Analyze incidents for recurring themes that will disclose the job content and skill requirements.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding various task analysis strategies.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to various task analysis strategies.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding various task analysis strategies.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a toolkit to select various task analysis strategies.
- Ask a group of key stakeholders in TVET to review this toolkit.

TRAINING NEEDS' ANALYSIS

Performance discrepancies can be the results of: (1) inadequate information regarding task requirements and performance expectations; (2) lack of appropriate tools; (3) inadequate knowledge and skills; (4) equipment; and (5) lack of incentives or rewards. Every human performance problem cannot be addressed by an educational intervention. Education and training interventions can only address human performance problems that are due to inadequate knowledge and skills. Mager and Pipe (1970) have developed a model to analyze performance. Zemke and Kramlinger (1984) identified 12 key questions and sub-questions that can be used to analyze performance problems. These are:

1. What is the performance discrepancy?

   - What is the difference between what is being done and what is expected?
   - What is my evidence?
   - How reliable is my evidence?

2. Is the discrepancy important?

   - Why?
   - What happens if we do nothing?
   - Is it worth making it better?

3. Is it a lack of skills?

   - Could the performers do it if their lives depended on doing the job correctly?
   - Are present skills adequate at least?

4. Were they able to perform successfully in the past?

   - Have they forgotten?
   - Do they know it is still expected of them?

5. Are the needed skills used frequently?

   - Do they get regular feedback on how well they are/are not doing?
   - Exactly how do they find out how they are doing?
   - How do they view the way they are told?

6. Is there a simpler way to do the job?

   - Would job aids clear up the problem?
   - Can they learn/relearn by watching others?
   - Can the job be changed in some way?

7. Do they have what it takes to do the job?

   - Is the physical and/or mental potential there?
   - Are they overqualified?

8. Is the desired performance inadvertently being punished?

   - What's in it for the performer to do it right?
   - Is doing it somehow self-punishing?
   - Is there some pressure not to perform?

9. Is not doing the job rewarding in some way?

   - Is there some reward for doing it wrong?
   - Does doing it wrong draw attention?
   - What rewards the wrong performance?

10. Does doing the job right really matter?

    - Is there a favorable outcome for doing it?
    - Is there an unfavorable outcome for not doing it?
    - Is there self-pride in doing? Not doing?

11. Are there any obstacles to performing?

    - Do they know what is expected?
    - Are there too many competing demands?
    - Are time and tools available?
    - Are there tradition, policy or ego barriers?
    - Is the job physically a mess?

12. What are the limits on possible solutions?

    - Are there any solutions that would be considered unacceptable to the organization?
    - Do decision-makers have preferred solutions?
    - Are there any solutions beyond the organization's time and money resources?

The decision to proceed in developing an educational programme can be made only if needs' analysis indicates that the performance problem is related to a knowledge and skill deficiency. Other non-training solutions to performance discrepancy could include job redesign, reassignment, retooling, provision of appropriate incentives and feedback etc.

FEASIBILITY ANALYSIS

Feasibility analysis is becoming less of an option for programme planners as budgets for development and training come under increased scrutiny by organizations looking to cut costs at all levels of the organization. It is no longer enough to say that adult education is required. It is imperative that programme planners be able to substantiate the claims that they make regarding the changes in behaviour and positive outcomes made by this new learning. Using this type of analysis can also increase efficiency by reducing programme expenses, increase effectiveness by tracking programme results and allow the programme planner to compare and prioritize adult education programmes.

It is important to do a here feasibility analysis in the programme planning process. At this point, a major go/no decision will be made about the programme being offered to adult learners. We make this decision prior to setting in motion any major commitments of time and money for the development, delivery and evaluation of the programme.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding training needs analysis strategies.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship training needs' analysis strategies.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding training needs' analysis strategies.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience prepare a detailed plan to conduct a training needs' analysis.
- Ask a group of key stakeholders in TVET to review the plan.

DESIGN ICT–MEDIATED LEARNING MATERIALS

In the previous section we assessed the needs of the learner and analysed the tasks and activities undertaken by the learner in his or her work environment. Having identified the gaps in skills and knowledge required by the adult learner, we use this information to form the core of our programme design and development activities. This section focuses on the role of programme design in the programme-planning model. Programme design is broken down into three sub-sections:

- Programme Objectives.
- Learning Objectives.
- Objective Analysis.

Programme objectives

It is in the design phase that programme and learner objectives are defined and delineated. These objectives are essential to the implementation of the programme of instruction that is developed for the adult learner. The development of objectives is not a neat, sequential process. It is the analysis and synthesis of the results of the needs' assessment, the needs' analysis and the training needs' analysis. Programme objectives provide statements of results that one can expect to achieve from an educational programme. They also provide the basis for instructional design and for programme evaluation. Programme objectives may focus on the individual learner outcomes and/or on programme operations outcomes. Programme objectives can be composed of both measurable and unmeasurable achievements.

In *Developing Programmes in Adult Education* (1985), Boone speaks of the need for a hierarchy of objectives. These educational objectives are a result of the needs' assessment and analysis done in Step 2 of the programme planning. Boone noted that all programme-planning models point to the importance of developing learner needs into educational objectives. Hirst, in particular, points to the use of a hierarchy to order these objectives. Programme objectives form the top of the hierarchy with specific objectives and enabling objectives forming its base. The objectives flow in a rational, ordered sequence so that in fulfilling the enabling objectives, the specific objectives are fulfilled and they in turn fulfill the general or programme objectives. The programme objectives provide the overall aim or goal of the programme, and as such, set broad parameters for the programme. They will determine the limitations of the budgetary requirements, the instructional design requirements and the evaluative form of the programme.

Programme objectives are used to:

- provide the organization or the educational institution with a means of tracking the overall development of the human resource or education activity;
- provide the organization with a means of evaluating the effectiveness of the educational activity;
- provide a clear means of communicating the intent of the programme with the participants, including the adult learner, the instructor, the learners' superivisors, human resource staff and management;
- develop the link between the overall goals of the programme and specific tasks of the learner;
- create a focal point for the development of adult education instructional materials and methods;
- motivate adult learners with clear expectations of the behavioural changes that will result from the learning programme.

When developing programme objectives for adult education, the programme planner should analyze the objectives for both measurability and intention. Measurability refers to the ability the planner has in evaluating concrete terms, the success of meeting the programme objectives. The programme objectives may also be unmeasurable if they deal more with attitudes and feelings adult learners may have toward the programme, rather than with behavioural change or knowledge application. Intention refers to the analysis of the programme objectives regarding intentional and unintentional outcomes. The intentional outcomes of the objective are those which the programme planner has developed as the primary focus for behavioural change. Unintentional outcomes are those unforeseen achievements

that result from the implementation of the programme and/or the interaction of the adult learners with each other and with the instructor.

Programme objectives should be developed with the input of a wide variety of participants. These participants should include departmental managers to review and approve the objectives, the human resource staff to ensure fit with related organizational training, supervisors of those taking the programme to ensure accurate representation of the objective to the work environment, and the adult learning participants to reflect their needs regarding objective development.

Learning objectives

Learning objectives are descriptions of activities or actions that the learner must perform or achieve in order to ensure mastery of content or skills. Learning objectives describe what the learners will do, how well learners will perform the activities and whether assistance will be given, or constraints will be imposed. They are stated in terms of the adult learner's knowledge, skills and attitudes. Learning objectives allow the learner to focus on the intended outcome of the learning process. Also, the objectives allow the instructor to focus on the needs of the learner through specific statements of intent. Learning objectives are developed at three different levels or stratas.

- General objectives are stated regarding the overall learning activity and/or job or occupation.
- Specific objectives outline the requirements to meet specific tasks within the learning activity or occupation.
- Enabling objectives describe the activities that allow the learner to come closer to performing of the specific required task.

Objective writing and development is critical to the programme-planning process.

What are the purposes of learning objectives?
What are the advantages of developing and using specific and enabling objectives?
What are the similarities and differences between three different formats of learning objective development?
What are the three necessary components of a learning objective?
What is the relationship between the three levels of objectives in the programme–planning process?
What is the process of developing and writing learning objectives?

The programme or general objectives set a broad level of performance measurement required for an occupation. Specific objectives are those objectives which identify a particular skill, knowledge or attitude set that must be performed in order to fulfill the general occupational objective within an educational or training programme. Enabling objectives are formulated for the specific steps or subtasks into which the specific tasks are broken down. Mastery is necessary in order to become proficient in performing the whole task.

Learning objectives provide more than just a means to outline required skills, knowledge and attitudes. They also:

- help adult learners facilitate and organize their own learning;
- provide the educational institution or organization with guidelines for choosing course content, teaching strategies and learning activities;
- allow for the consistent development of instructional design from one programme to another;
- provide a communication tool between the instructor and the learner;
- provide for the development of learner and programme evaluation.

Given the pivotal role of learning objectives, it is important to formulate the objectives correctly. There are three general formats for developing learning objectives. Each learning objective must contain at least these three elements:

- A statement of conditions under which the learner behaviour will be taken. These conditions outline the cues or stimulus that will be used to search for the information, the characteristics of the resource material required to perform the task and/or the scope and complexity of the task.
- A measurable action or behaviour to be undertaken by the learner. These behaviours may be affective, cognitive or psychomotor in nature, depending on the task to be completed. Cognitive and psychomotor behaviours are easier to measure and evaluate than affective behaviours.

- Criteria which specify acceptable performance on the part of the learner. The criteria convey to the learner the acceptable level of standards required for the mastery of the skill or task.

Formats

Mager Format

Robert Mager developed a format that taught the learner how to achieve behavioural objectives through the use of a multiple choice, branching technique. Mager's requirements for a behavioural objective are:

- Identify the terminal behaviour or performance by name.
- Decide under which conditions the behaviour will occur.
- Specify the criteria of acceptable performance.

Mager describes the audience of the objective as the learner or the student and uses the phrase "you will be able to" to introduce the learning objective.

ABCD Format

Developed by Instructional Development Institutes as a part of its instructional systems design, the ABCD format uses a mnemonic method to help the programme planner remember the four elements to be included in the specific objective. The Institutes were created from a consortium developed in the 1960s by a number of United States Universities and United States Office of Education. These four elements of learning objective development are:

- Audience – as specific as possible.
- Behaviour – the specific behaviour to be performed by the audience.
- Condition – the conditions under which the behaviour will occur.
- Degree – the degree to which the performance of the behaviour must be found acceptable.

Gagne and Briggs Format

Gagne and Briggs have developed a five-element constructive tool to write specific objectives. The stress on specifying the content or object of the behaviour emphasizes specific learning domains within the activity. The five elements are:

- Situation – the situation under which the activity will occur.
- Learner Capability – behaviour as described by one of the five categories of learning outcomes (intellectual skills, cognitive strategies, verbal information, motor skills and attitudes).
- Object – the specific object to which the actions will be applied.
- Action – the behaviour to be undertaken.
- Tools/Constraints – the criteria under which the action will be taken.

Notice that regardless of the format, condition, behaviour and criteria for success are to be present within the specific objective.

Writing objectives

The process of developing and writing objectives may be taken in a sequential manner flowing out of the needs' assessment and analysis. In the needs' analysis, the programme planner has developed a core of tasks that the learner must master. It is from these tasks and their associated subtasks that specific and enabling objectives must be written. In *Planning Instruction for Adult Learners*, Patricia Cranton describes the steps in the objective writing process as follows:

- List the tasks that the learner is required to perform in the programme. Under each task, list the subtasks that must be performed by the learner to master the complete task. These subtasks should be comprehensive and significant to the completion of the task. Each subtask will be listed under its respective task. Keep in mind the intended audience as you prepare the objectives. Differences in age, maturity, reading and education levels will have a significant impact on objective development. Also look to outside sources for previously developed objectives in the

particular content area being developed. This may save you time and allow you to verify your listing of tasks and subtasks based on existing programme plans.

- Reviewing each task group, translate each task and its associated subtasks in measurable and/or observable terms. What behaviours will adequately represent the learning of the task and each subtask? Use the appropriate verb for cognitive, psychomotor and affective learning outcomes. That is, the outcome will be based on knowledge, skills or attitude, respectively. This is the behaviour content of the objective.
- For each task and subtask that has been translated into an observable and measurable outcome, determine the degree of detail or specificity. Depending on the programme content, the subtasks may be quite specific and the detail much greater for entry level programmes than on programmes where course content focuses on concepts and synthesis of information and ideas. This will form the criteria content of the objective.
- For each task and subtask determine the conditions or circumstances under which the learner will perform the tasks and subtasks. Will the learner require equipment, previous knowledge, a particular physical setting? Will there be constraints placed on the performance of the behaviour in terms of time, efficiency or effectiveness? This will form the condition content of the objective.
- Once the objectives have been written, have them reviewed by a colleague, individuals who have already completed the programme, or by instructional design professionals in the organization, if available. The purpose of this review is to ensure that the objectives are clear and unambiguous. Using outside reviews provides a fresh look at the objectives and avoids the "Can't see the Forest for the Trees" syndrome. Reviewers should be asked to review for clarity, content and learning outcome coverage.
- Discuss the objectives with the learners and be prepared to change them if the learners find them unclear or not comprehensive, given the course content. Remember, they are being developed for the benefit of the adult learner. Sensitivity to adult learning needs is a key criteria in the development of programme objectives.

Objective analysis

Effective human performance involves three essential elements. Objective analysis is undertaken in light of the three domains of learning. These domains of learning correlate to the skills, knowledge and attitudes of learners. Simpson's taxonomy for psychomotor skills relates to the skills element, Bloom's taxonomy for cognitive levels relates to the knowledge element and Krathwohl's taxonomy for affective levels relates to the attitude element of the task or activity. The categorization and analysis of the learning objectives assure the programme planner that all domains of learning have been covered in the instructional plan.

The objectives should also be analyzed in terms of both frequency of occurence and level of difficulty. The instructor and/or programme planner will require this information to plan effective teaching strategies and learning strategies in the development phase of programme planning.

Analysis of Objectives

What are the purposes of analyzing learning objectives?
What are three domains of adult learning?
What are three taxonomies related to the domains of learning?
What is the process of objective analysis?
What are the impacts of objective analysis on task and programme development?

Objective analysis is a process that allows the programme planner to assess tasks and subtasks in terms of the types of learning each task represents, the frequency of task performance and the time spent on each task. This analysis allows the programme planner to identify any gaps in the learning domains within the programme plan. It will highlight those tasks and subtasks that may require more training time. The results of the analysis will have significant impacts on the design and development of instructional activities. Tasks that are skill-based or psychomotor in nature and that are identified as frequent in occurrence within the analysis, will require different treatments in instructional activities than those tasks which are knowledge-based or cognitive in nature and infrequently performed. Evaluation of these objectives will also vary according to the domain in which they are classified. Affective objectives that deal with emotion and values will be much more challenging to evaluate than those based on cognitive or psychomotor abilities.

Domains of Learning

The tasks and subtasks identified by the programme planner in the needs' analysis phase are used as a basis for formulating programme and instructional objectives. These tasks and subtasks may be placed into three categories. Each task and subtask is predominately linked to either a skill, knowledge or an attitude. Three taxonomies of educational objectives have been developed which represent these three different learning outcomes. The educational taxonomies provide an appropriate framework to classify educational objectives into the psychomotor, cognitive or affective domains, respectively. It is highly unlikely that any task will be of only one domain, but one domain may dominate.

The three taxonomies used to classify learning objectives are:

Skill objectives – Simpson's Psychomotor Domain (1972);

Knowledge objectives – Bloom's Cognitive Domain (1956);

Attitude objectives – Krathwohl's Affective Domain (1964).

Simpson's Taxonomy for Psychomotor Levels

In 1972, Elizabeth Simpson developed a method to classify educational objectives that were skill-oriented or psychomotor in nature. This taxonomy assumes that learner develops skills in distinct order and that this order is hierarchical in nature. The learner progresses through the following seven different steps with each step being mastered before moving to the next:

1. Perception – The learner uses sensory cues or stimuli to guide himself/herself through the motor activity. He/She determines whether or not to respond to the stimuli and if responding, performs the skill required. Some of the verbs associated with this step include chooses, describes, detects, distinguishes, identifies, selects, separates.

2. Set – A readiness or perception on the part of the learner to perform the skill. This readiness can be classified in terms of mental, physical and emotional preparation. Some of the verbs associated with this step include begins, develops, explains, moves, reacts, responds, proceeds, and states.

3. Guided Response – Given a set of criteria (either self-defined or instructor-defined), the learner performs the skill through imitation or trial and error. Verbs associated with this step include assembles, builds, displays, manipulates, organizes, performs.

4. Mechanism – The development of a habitual response to the practice undertaken at step 3, Guided Response. The skill is performed with a level of confidence and proficiency. Verbs associated with this step are similar to those of step 3.

5. Complex Overt Response – Complex motor skills are performed by the learner in an accurate, quick and proficient manner without hesitation. Skills are performed automatically by the learner. Verbs associated with this step are similar to those of step 3, except that the level of proficiency is much higher and objectives are labeled to reflect these abilities. These include accurately, proficiently, competently, skillfully.

6. Adaptation – Given a change in the condition of the problem, the learner changes the skill as required to solve the problem. Verbs in this step include adapt, alter, change, reorganize, revise, vary.

7. Origination – Based on the experience and training in steps 1–6, the learner creates new methods to perform the skill or solve the problem. Verbs in this step include combine, compose, construct, create, design, originate, arrange.

Bloom's Taxonomy for the Cognitive Domain

This method classifying the levels of intellectual learning was developed in 1956 by a group of educational psychologists (Engelhart, Furst, Hill and Krathwahl) headed by Benjamin Bloom. The taxonomy covers all three domains, but for our purposes we will discuss only the cognitive domain in this series.

Cognitive learning involves the skills of the intellect and the recall or recognition of knowledge, comprehension, analysis, synthesis of information and ideas. Six levels of competence were identified in the taxonomy.

- Knowledge – Involves the observation and recall of information. It focuses on such items as knowledge of dates, events, and places from previously presented information. Verbs used in this level include list, define, tell, identify, outline, match, name, label, tabulate.
- Comprehension – The ability of the learner to understand the meaning of information. Verbs used in this level include summarize, describe, interpret, predict, estimate, discuss, explain, infer, distinguish.
- Application – The use of previously learned information in a new context or situation. Verbs used in this level include demonstrate, compute, modify, operate, relate, show, solve, examine, illustrate.
- Analysis – The recognition of patterns and the separation of information into segments or components to understand its structure. Verbs used in this level include order, explain, classify, analyze, compare, diagram, deconstruct, contrast and differentiate.
- Synthesis – The development of something new with particular emphasis on the creation of new meanings, patterns or structures. Verbs used in this level include combine, integrate, create, design, invent, generate, devise, compose, revise, plan, modify.
- Evaluation – The judging of information based on a set of given criteria. The verbs included in this level are assess, appraise, conclude, evaluate, critique, defend, compare, support.

"The major purpose in constructing a taxonomy of educational objectives is to facilitate communication. In our original consideration of the project we conceived of it as a method of improving the exchange of ideas and materials with educational research and curriculum development." (*Taxonomy of Educational Objectives, The Classification of Education Goals, Handbook 1: Cognitive Domain*, Benjamin Bloom, ed. 1956, p. 10.)

Krathwohl's Taxonomy for the Affective Domain

The taxonomy for the affective domain was part of the original development of the Taxonomy of Educational Objectives developed by Bloom and associates in 1956. It examines those educational objectives that emphasize feeling and emotion and are internally driven by the character and conscience of the learner. These objectives may also be identified by terms such as attitudes, interests and values. The authors point to a slow and gradual shift in the reaching of the affective levels. "Even more complex abilities may be learned in a one-semester or one-year course, and the evidence of the learning may be seen in the examination given at the end of the course. Its contrast, interests, attitudes, and personal characteristics are assumed to develop relatively slowly and to be visible in appraisal techniques only over long periods of time, perhaps even years." (*Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook 2: Affective Domain*, Krathwohl et al., 1964, p. 19)

- Receiving – The learner is aware of or attentive to stimuli in the learning environment. Verbs in this level include ask, choose, reply, follow, hold.
- Responding – The learner actively participates, showing some sign of new behaviour. Verbs in this level include answer, assist, practice, discuss, tell, write, comply, present.
- Valuing – The learner show definite commitment or involvement through the attachment to a particular object, phenomenon or behaviour. The valuing is internalized and expressed in the student's behaviour. Verbs included in this level are complete, explain, join, share, study, initiate, invite, propose, describe.
- Organization – The altering of the learner's value set to include newly learned beliefs, attitudes and values. Verbs included in this level are alter, combine, generalize, integrate, modify, synthesize, organize, arrange.
- Characterization by a Value or Value Complex – The new value system is adopted by the learner and changes the behaviour of the learner to ensure consistencies between the actions and feelings of the learner. The verbs that are included in this level are act, display, perform, question, verify, use, serve, influence.

Although it is common practice in education and training to formulate distinct learning objectives in three domains separately (psychomotor, cognitive or affective), all three are in constant interaction during any task performance. The degree of interaction may vary according to the nature of the task. The cognitive element is the domain in writing a letter while the physical act of writing is a subordinate domain. The subordinate affective domain has implications for the tone of the letter or the accuracy and use of spelling, grammar etc. The degree of interaction of the three domains of learning in task performance will also be influenced by contextual and environmental factors. For example, driving a car with a standard transmission in a busy city during rush hour may require an equal amount of psychomotor, cognitive and affective ability.

Analysis

Having reviewed the programme objectives in terms of the respective taxonomies, we should also analyze the objectives in terms of the frequency of occurrence and level of difficulty of the task. Frequency of occurrence will help the programme planner to allocate the appropriate amount of time and instruction for each task. Instruction activities and time on tasks should be proportional to actual task occurrence. Analyzing the task difficulty requires the programme planner to respond with more instructional activities and time allocated for practice. This will also influence the budget required for training and development and the evaluation of the learning outcomes. Objective Analysis Matrix allows the programme planner to analyze tasks with reference to both learning domain and task frequency and difficulty. This analysis should enable the programme planner to develop appropriate learning strategies for the adult learner. In this example, several of the tasks are predominantly psychomotor in nature and of medium or high difficulty. These indicators suggest that any instructional development for these tasks should contain multiple physical manipulative activities to practice the skills required to complete these tasks.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the design of ICT-mediated learning materials in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the design of ICT-mediated learning materials in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the design of ICT-mediated learning materials in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience develop an institutional toolkit for the design of ICT-mediated learning materials in TVET.
- Ask a group of key stakeholders in TVET to review the toolkit.

DEVELOPMENT OF ICT–MEDIATED LEARNING MATERIALS

In the programme development phase, we move from the abstract view of concepts to a more concrete look at implementing the programme through instructional content analysis, sequencing and material development. We are transforming our plans into activities that will allow the adult learner to meet not only our programme objectives but his/her personal learning needs and goals.

Programme objectives developed during the design stage are used to develop programme content, teaching strategies, learning activities, instructional aids and learner assessment.

Content analysis

The content of the learning programme must convey the knowledge, skills and attitudes necessary to fulfill these objectives. In this module, content has been artificially separated from the other process steps to allow for a more detailed review of the topic. In reality, content and its sequencing, the teaching strategies and materials used to deliver the content are interwoven, and much of the analysis made by the programme planner will occur simultaneously among the three. However, it is important that the programme planner reviews each step in the process to ensure that the pieces of the programme development puzzle are not overlooked, and conscious and deliberate decisions are made regarding each in the programme development phase.

Sequencing

Sequencing is the ordering of programme activities in a logical sequence in order to achieve maximum programme outcomes. Two theories of sequencing will be reviewed and a variety of formats will be discussed. Sequencing allows the programme planner to present information to the adult learner in a logical way that is compatible to his/her learning style as assessed in the initial step of programme development.

Teaching strategies

Strategies for delivering information to adult learners are based on the prior assessment of the learner, the needs of the instructor and the environment in which the learning is situated. Learning strategy analysis through inventories such as Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) or ATLAS, (Assessing the Learning Strategies of Adults) allow the programme planner to develop teaching strategies to address the learner's strategy of learning. What are the characteristics of the adult learner? What impact will learning styles have on how we develop our learning programmes? Do all adult learners learn in the same manner? The answers to these questions are important in developing a comprehensive and effective learning programme. Learner assessment is the first step in the programme development phase. We will examine how learning styles influence our instructional programme design. Age, gender and ethnicity are also important issues in adult learning.

We will examine the importance of prior knowledge and its impact on the programme development process.The more the programme planner can tie the needs of the adult learner into the development of the programme, the more successful the transfer of information to the adult learner is. Teaching strategies come in a variety of forms from lectures to experiential exercises. The use of each is dependent on a variety of factors, including the environment and the content of the programme. It is important to select teaching and learning activities that will enable the achievement of specific programme outcomes and facilitate the transfer of learning.

Teaching and learning aids

Given the analysis undertaken to this point, the programme planner should have an understanding of the learner and the environment in which learning is to take place. The programme planner must select the most appropriate teaching

and learning aids to facilitate the achievement of programme outcomes. A wide array of materials exist through which the message is transferred to the adult learner. Again, these materials must be selected in light of a variety of factors such as learner style, timing, group size, facilities and resources available etc. Learning aids for the adult learner are an important tool in the arsenal of the programme planner. Many adult learners may have been away from formal learning environments for some time, and having learning aids available to them will facilitate the learning process.

Learner assessment

The final step in the programme development process is that of learner assessment. Assessing the learner allows the instructor to verify the mastery of the programme content but also provides the learner with information regarding his or her accomplishments. If properly applied, it can become a motivational tool for both learners and instructors. Assessment will take a number of different forms depending on the learning outcomes being evaluated. Assessment should be both formative and summative and should include both instructor-driven and student-driven assessment.

CONTENT ANALYSIS

What are the inherent factors in the analysis of instructional content?
What process is used for content analysis?
What is the role of the content analysis process within the programme development phase?
What is the impact of content analysis in terms of the adult learner and the programme development process?

The content of any programme must be focused on the achievement of the programme objectives. The specific and enabling objectives allow the programme planner to generate content to be taught. The content of the programme will influence the nature of the materials to be used, the teaching strategies and learner assessment. In developing the content of the programme, one must analyze what skills, knowledge and attitudes are needed to perform specific job tasks. Subject matter content for an education or training programme must be derived from the programme objectives and from various analyses performed during the Analysis phase including the job/task, knowledge, task safety and literacy analyses. The goal is to identify the critical content that must be included in the instructional process to enable the learner to meet the programme outcomes.

The programme planner should not provide content expertise but should work with managers, supervisors and learners to develop appropriate programme content. This can be accomplished using face-to-face interviews. As outlined in "Selecting Programme Formats and Designing Learning Experiences (Part 2)", when analyzing content, Swanson and Gradous (1988) suggest the following steps be used:

1. Identify a topic area.

2. Investigate what experienced performers know about the topic. This may require the programme planner to question experts in the field to discover knowledge about the content area, and how the experts in the field would orient a new person to the subject.

3. Determine how people perform the activity through questioning and/or observation. Your research should allow you to answer this question: "What would a person need to know or be able to do in order to perform the activity?"

4. Conduct a literature review of the topic from organizational, academic and government sources.

5. Describe the topic area in a way that will facilitate learning by others.

In analyzing the content of a programme, the programme planner must also keep in mind the objectives of the adult learners. Are the learners seeking certification of a particular programme? Are the learners intending to go onto a more advanced course in the subject matter? As the programme planner, you will be required to examine all factors that may influence content, including those programmes which may build upon or be a prerequisite to the programme you are developing.

In developing programmes, the programme planner will have to rely on a variety of sources for the content information. Specialists in the field, employees who have taken previous related training, managers or supervisors, human resource personnel and others are good sources of information from which the programme planner may obtain content information. Content should be prioritized in terms of its relevance and importance. Leonard Nadler (1982) believes that content materials can be categorized as either essential, helpful, peripheral or unrelated. Essential material is the absolute minimal content that the programme must contain in order to fulfill the objectives. If information can be omitted and still the objectives can be met, then the content may be valid but not essential to the curriculum. Helpful material is supplemental to the essentials of the training. The programme can stand on its own but would, perhaps, be better or fuller with this material. Resource limitations will usually dictate the amount of "helpful" content available to the programme. Peripheral and unrelated material results from content, which is being suggested by others in the organization, who may be outside of the programme planning process. The content may be unrelated directly to the programme but may be necessary to include if the politics of the organization dictates its inclusion.

Once the content has been selected, the programme planner should also consider how much of the content to present to the learner at one time. Although the objectives have been broken down to micro levels, it may be possible to teach to more than one of these enabling objectives at one time by "chunking" the contents. By chunking, we mean optimizing the size of the instructional unit to be the most accessible and useful for the learner. In their book *The Systematic Design of Instruction* (1996), Walter Dick and Lou Carey suggest five factors that should be taken into account when chunking instructional material.

1. The age level of the learners;

2. The complexity of the material;

3. The type of learning taking place;

4. Whether the activity can be varied;

5. The amount of time needed to include all of the instructional strategy events for each chunk of information presented to learners.

Having analyzed the objectives of the programme, the content of the programme can then be organized to match these objectives.

SEQUENCING

What factors are inherent in the analysis of instructional sequencing?
What are various methods of sequencing?
What is the role of the sequencing process within the programme development phase?
What is the impact of sequencing in terms of the adult learner and the programme development process?

Having established the instructional content of the programme, the programme planner must now consider the sequencing of the material to maximize teaching and learning outcomes. Sequencing of content should be done so that adult learners are systematically introduced to activities that are consistent with the programme objectives developed by the planner. Sequencing of the content will depend on factors such as the content itself, the motivational needs of the learner and the interests of both the learner and the instructor.

While it may seem logical to sequence material for any learner, the process of analyzing the most effective sequencing for a given content of a programme is rarely done. Sequencing content will have a major impact on the learning that you impart to those engaged in the programme study. In *Mastering the Instructional Design Process*, W.J. Rothwell and H.C. Kazanas (1992) provide nine approaches to sequencing content. They are:

1. **Chronological sequencing.** Concepts and information are provided in terms of the time sequence in which they occurred so that later events are understood in context of earlier ones.

2. **Topical sequencing.** Topics are the focus for the provision of the instruction with learning occurring within each topic.

3. **Whole-to-part sequencing.** Learners are presented with the complete model or theory before they are broken down and studied individually.

4. **Part-to-whole sequencing.** Using this process, learners are introduced to parts of the model or theory and study each before the instructor brings the parts together into a unifying concept.

5. **Known-to-unknown sequencing.** Prior learning experiences and knowledge are the key to this sequencing process. Learners are first introduced to information of which they have prior knowledge and gradually moved toward information of which they have little or no knowledge. This is especially important when dealing with adult learners as they have much prior experience and knowledge on which the instructor may draw.

6. **Unknown-to-known sequencing.** Learners are deliberately introduced to material that illustrates their lack of knowledge about the content of the material. It attempts to motivate the learner to accept their lack of knowledge and seek to learn more.

7. **Step-by-step sequencing.** Tasks or job activities are analyzed to determine how each is performed. The learning is then sequenced around each step of the task. Learning may also be provided by using aids such as check-lists or flow charts showing the tasks in sequential order in the overall activity.

8. **Part-to-part sequencing.** Learners are introduced to a variety of topics but not in great depth. Each topic is covered superficially before moving onto the next. In this way, the learner is introduced to all topics before returning to each topic for a more in-depth review. In the initial review, learners must be provided with whatever prerequisite knowledge may be needed in proceeding rounds. This is also known as the "spiral curriculum".

9. **General-to-specific sequencing.** This approach to sequencing introduces all learners to the same basic knowledge of the same skills. As the learners gain more information, they will specialize in a particular area of that knowledge. This is also known as the pyramidal or core structure method of sequencing.

This listing is not an exhaustive set of sequencing possibilities. Programme planners have others from which to choose, including easiest-to-hardest sequencing, logical content sequencing, random order sequencing and learning domain sequencing (Dean, 1994). Sequencing does not entail choosing one process for the programme. A combination of sequencing process may be required depending on the material being provided to the adult learner in the programme.

Two theories regarding the sequencing of instructional materials are Elaboration Theory, developed by Reigeluth, Merrill, Wilson and Spiller in the late 1970's and Posner and Strike Sequencing scheme.

These examples of sequencing offer the programme planner a variety of methods by which to introduce programme information. One method programme planners may use to decide which means should be used in sequencing material to lay out the enabling objectives and content surrounding them in a conceptual map or flow chart. This method allows you to "see" all material at one time and may suggest the most appropriate way of seguencing.

Whatever method is chosen, the sequencing process should match the content, learner needs, including motivation, instructor interest, training or learning facilities, and should bring about the successful attainment of the enabling, specific and programme objectives developed earlier in the programme planning process.

TEACHING STRATEGIES

What is the role of teaching strategy selection within the programme development phase?
What is the relationship between teaching strategies, learning styles and learning activities?
What factors are inherent in the choice of teaching strategies?
What are the categorization methods involving teaching strategies?
What is the impact of the selection of teaching strategies in terms of the adult learner and the programme development process?

Think of the last learning activity in which you participated. What teaching strategy was used by the instructor? Did it match your learning style? Was it a good choice in terms of the skills, attitudes, aims of the course and your own learning objectives? Teaching strategy analysis can be the "make or break" of the programme planning process, especially if our focus is that of the adult learner. How many learning programmes or courses have you attended where a percentage of learners dropped out of class? The way of delivering the training programme to the learner is fundamentally important for the success of the programme and the optimization of the learning process. The selection of appropriate teaching strategies is also critical for the transfer of learning.

Factors influencing choice

A number of factors will influence the teaching strategy which the programme planner will choose for a particular programme. These factors are:

1. **The objectives of the programme** include the specific and enabling objectives and whether these objectives are primarily cognitive, psychomotor or affective in nature. Tasks that are primarily psychomotor in nature will suggest different teaching strategies than those that are affective or cognitive in nature.

2. **The needs and characteristics of the learner** include their learning style, their age, culture and prior learning experiences. Learning styles have been idenitified in the literature as having an impact on successful transfer of learning to the adult learner. Factors such as the age and culture of the learner will also impact our choice of strategy. Age can influence the choice of teaching strategies. Many older adult learners may have not participated in any type of formal education for many years and are used to learning in highly structured, instructor-oriented environments. Adult learners are different in many respects from children. Malcolm Knowles' theory of andragogy attempts to theorize the learning assumption for adults. In general, adult learners have the following characteristics:

   - They are more self-directed in their learning;
   - They are problem-centred in their educational focus;
   - They are result-oriented and have specific results in mind for their education;
   - They are skeptical about new information prefering to try before accept it;
   - They seek out education that relates or applies directly to their own needs;
   - They accept responsibility for their own learning if it is perceived as timely and appropriate.

3. **The content** chosen by the programme planner will dictate the instructional strategies which can be used to implement the programme of instruction. In our example of specific and enabling objectives, cooking students would need to practice with real materials and real food. Discussion panels or debates would be of little use in that particular programme.

4. **The needs and characteristics of the instructor** must also be taken into consideration. Does the instructor have the capability or experience to use the case method of study to facilitate learning? The instructor will also have teaching style and strategy preferences, and these should be acknowledged by the programme planner.

5. **The resources** available to the programme planner in terms of time, money, materials, people, facilities and so on. The availability of resources will be a limiting factor on the choice of teaching strategies. Larger amounts of time are required to demonstrate tasks and skills than to read and examine various pieces of information. Instructional material availability will also impact the choice of teaching strategy. Tight budgets and the need of greater control on spending within institutions imply limitations on the type of instruction available to adult learners.

6. **Programme size** will influence the type of teaching strategy that may be chosen by the programme planner. Is the programme likely to attract one hundred participants in a large facility or will it be held in a small classroom on a local campus with a maximum class size of 25? Each example will have a variety of techniques that will maximize learning for the participants.

Categorization methods

Different authors have suggested a variety of ways in which teaching strategies may be categorized. These are presented in Table 10 with the author and accompanying text. Each of the above-mentioned authors categorizes the use of

teaching strategies somewhat different, but the outcomes essentially are the same. There is also a crossover that occurs between the use of a strategy and the environment for which it has been chosen. This categorization is not cast in stone and only provides a means of organizing the methods and providing the programme planner with a method by which to choose teaching strategies.

Learning activities are directly related to teaching strategies and may in some cases be seen as one in the same. There is some crossover between two categories as they are woven together in the process of programme development. Teaching strategies are defined as the approach taken by the instructor to facilitate learning. Learning activities are actions taken by the adult learner which allow to acguire the skills and to facilitate the transfer of knowledge.

Table 10. Programme content and teaching strategies

Text	Author	Categories
Planning Programmes for Adult Learners	Cafferella, Rosemary	Acquisition of Knowledge Enhancement of Thinking Skills Psychomotor Skills Development Affective Skills Development
Teaching for Learning at University	Chalmers, Denise and Fuller, Richard	Strategies for acquiring information Strategies for working with information Strategies for confirming learning
Effective Strategies for Teaching Adults	Seaman, Don and Fellenz, Robert	Presentation Strategies Action Strategies Interaction Strategies
Planning Instruction for Adult Learners	Cranton, Patricia	Instructor Centered Interactive Individualized Experiential
On Instructional Strategies (http://www.coe.usu.edu/it/id2/DDC197.htm)	Merrill, David	Parts of … Strategy Concepts or Kinds of … Strategy Process, Principle or How does Strategy work?

Types of teaching strategies

As Merrill et al wrote in *Reclaiming Instructional Design* (1996), "There are known instructional strategies. The acquisition of different types of knowledge and skills require different conditions for learning (Gagne, 1985). If an instructional experience or environment does not include the instructional strategies required for the acquisition of the desired knowledge or skill, then effective, efficient and appealing learning of the desired outcome will not occur." These strategies come in a variety of forms. As mentioned previously, they are applied depending on the factors within the learning environment. Many of these strategies may be found in Leonard Nadler's *Designing Training Programmes: The Critical Events Model* (1983).

Strategy	Description
Action Maze	Written exercise where problems are presented sequentially as a result of previous decisions made by the learner
Alter Ego	One learner observes another in a situation and provides feedback to the first learner on behaviour or communication skills
Apprenticeship	Experienced worker works with learner on the job to train in new skills
Audience Reaction	A small group of learners work with a guest speaker to ask questions or make comments on topic

Strategy	Description
Brainstorming	Groups of individuals provide ideas, thoughts, opinions in a less structured format. These are not evaluated for relevance or content
Buzz Group	Small groups meeting simultaneously to react to idea or topic. Short duration time with feedback following
Case Study	Oral or written account of a situation for learner's evaluation to develop critical thinking skills
Clinic	Session where learners react to a common experience
Coaching	One–to–one intensive demonstration and practice between learner and instructor
Colloquy	A panel with six to eight participants to discuss issue with rest serving as resource persons
Computer–Assisted Instruction	Structure, self–paced learning segments using a computer that provides feedback to a learner's response
Conference	Large gathering of learners to discuss a common issue or need
Confrontation, Search & Cope	Learner is faced with problem and is responsible for developing and applying solution
Correspondence	Self–directed learning with interaction between instructor and student by mail, e–mail, fax or telephone
Critical Reflection	Thinking about and reflecting on one's actions and beliefs in light of new information
Critique	Learner analyzes strengths and weaknesses of a learning experience and suggests ways to improve it
Debate	Two sides form to orally present the tow opposing sides of a chosen issue
Delphi Technique	Organizing large groups of people into smaller groups by systematically narrowing choices
Demonstration (and Practice)	Presentation of how to perform a skill or procedure, directly or through visual aids with learner to repeat and practise skill
Diagnosis, Prescription & Treatment	Learner's needs and weaknesses are revealed by special means, a plan of action developed to address them, and this plan is implemented by the learner to remedy weakness
Dialogue	Conversation between two individuals in front of larger group that observes and/or acts as a resource
Discussion	Unstructured exchange of ideas among learners regarding a particular topic
Drill	Repetitive, structured practice of a particular skill
Dyad	Pair of learners who work together
Exercise	Structured learning experience using some form of guidance or sheets
Field Trip	A carefully planned visit to an object or place for on–site learning
Fish–bowl	A discussion group with an inner circle discussing and an outer circle observing

Strategy	Description
Forum	After formal presentation, presenter is questioned by audience
Games	Structured competition implementing previous learning
Home Study	Self–directed learning with interaction between instructor and student by mail, e–mail, fax or telephone
In–Basket	Learner responds to a variety of memos, directives and problems arising from the job
Incident Process	Case–study format where student is given limited information and must question the instructor to obtain additional information
Internship	Supervised, practical skill development for advanced learners who are entering new position
Interview	Resource person is asked questions by learner to uncover knowledge
Job Rotation	One job training that rotates learner to new jobs for specified period of time
Lecture	Presentation by instructor to provide knowledge to learner
Listening Group	Learners are divided into groups whose task is to listen and observe a particular skill or activity
Metaphor Analysis	Learners create metaphors that parallel and describe the meaning of the issue being addressed
Observation	Learners observe and report on an action or incident
Panel	A small group of people have a purposeful discussion on an assigned topic in front of an audience
Peer–Mediated Learning	Learners are grouped with their peer and help each other learn under the guidance of a group leader or instructor
Practicum	A study programme under which a learner pursues a special project with the guidance of an instructor
Programmed Instruction	Self–paced learning in which subject is presented in a series of small, sequential steps to achieve mastery
Project	An assigned task in which learners study independently
Reaction Panel	A group of three or four learners react to a presentation
Reading Assignment	Assigned readings followed by a written report, class discussion or other activity
Role Play	The dramatization of a given situation with learners assuming various parts followed by a group discussion
Seminar	Learners come prepared to discuss issue or information with instructor mediating activity
Sensitivity Training	Participants are thrust into a learning situation without predefined roles. Group struggles to fill leadership roles, agenda and norms with discussion of following activity
Skill Practice Exercise	Learners practise skill with or without an instructor present

Strategy	Description
Simulation	Learning environment developed to represent real life scenario. Learner practises desired performance without incurring risk
Skit	Short, rehearsed dramatization to illustrate a problem or situation
Story Telling	Learners relate their experiences to each other regarding a common theme
Symposium	A number of quaified “experts” speak to a large group on a common theme or closely related topics
Team Building	Group interaction exercises that aim at developing team thinking and socialization
Testing	Any method for measuring skills, knowledge or attitudes against a set of criteria
Think Tank	An ongoing group of people who generate new ideas and strategies
Trial and Error	Hands–on learning technique with participants finding solutions by performing task
Tutorial	Tailor made activity to help leaner in self–directed learning with periodic consultation on learner’s progress and problems
Work Group	Small groups assigned to work together to produce a single product or outcome
Work Study	Students work on the job part of the time and study part of the time to reinforce learning as soon as possible to the job

Learning strategy selection must also take into account three basic approaches to adult learning. These approaches are active or experiential learning, self-directed learning, and transformational learning. Adult learning should occur in one of these three contexts for learning to be maximized. Each of the learning strategies above can be tailored to fit adult learning requirements. It is important to recognize and facilitate the needs of the adult learner in developing and choosing teaching strategies. Teaching strategies must be adapted to the ICT-mediated learning environment.

TEACHING AND LEARNING AIDS

The selection of teaching and learning aids to communicate visually, auditorially and kinestheticaly with the learner is of prime importance to the programme planner. Whether the adult learner receives the message and through what medium depends on a number of factors. Instructional material includes all teaching materials as well as any remedial or enrichment materials needed by the adult learner. The effectiveness of instructional material should be viewed within a framework which encapsulates three major elements: level of achievement the material helps develop, study time needed to complete the objectives and the learner’s attitude toward the material.

Factors affecting material choice

1. **Learning Strategy.** The learning strategy identified by the programme planner will influence what type of teaching and learning aids may be used by the instructor. If the strategy is for a role play, then it is unlikely that overhead visuals will be the medium of choice. Rather, written or verbal instructions for the role play would be a more appropriate choice.

2. **Learner Characteristics.** As discussed in the previous unit, learning style will impact any material decisions the programme planner will make. It is also very important how the learner receives information. Howard Gardner has outlined eight different intelligences. These intelligences describe how we learn “best”. Gardner affirms that everyone has every intelligence to a certain degree, but each of us has a primary intelligence. It is to this intelligence in an adult learner that the programme planner will focus his/her attention. If we can choose learning and teaching

aids that direct our message to these particular intelligences, then we will be more effective in relating the information and its meaning to the adult learner. Gardner's eight intelligences are:

Verbal/Linguistic	Visual/Spatial
Mathematical/Logical	Bodily/Kinesthetic
Musical/Rhythmic	Intrapersonal
Interpersonal	Naturalist

3. **Sensory Stimuli.** Learning is more effective when a variety of senses is used in the delivery of information. Much instructional material is either based on two-dimensional representations or on symbols used to convey meaning. Two-dimensional representations can be visual or auditory (e.g. drawings or pictures or taped sounds). Symbols can be visual (printed material) or auditory (the spoken word). Real objects can add a dimension of understanding to the adult learner that is difficult to find in either two-dimensional or symbolic representations. Using our nursing example, it is one thing to show, using a set of diagrams, how to give an injection but it is quite another to use a model or a live volunteer. Real objects allow the learner to tap into a greater variety of intelligences and will help to increase the transfer of learning and the retention of information.

4. **Experience and Prior Knowledge.** Knowing how much prior knowledge an adult learner has about a topic will greatly influence the choice of learning and teaching aids. A learner who has little experience with a topic should be provided with as much direct, concrete experience as possible. Those learners who have more experience with the concept and are looking to study the subject in depth may require less direct experience and could be provided with more symbolic material in the form of written and spoken information.

5. **Physical Setting.** The facilites that are available to the programme planner will also influence the choice of materials. Room size, furniture, lighting and other factors will dictate the use of aids. For example, if the room does not have appropriate structure for an overhead projector, this type of aid cannot be used to convey information to the learner.

6. **Resources.** Probably one of the most limiting factors when considering which type of instructional material to employ will be the budget of the programme. Although computer-assisted learning may be the optimal choice for an adult learner in a particular programme, the programme budget may not allow for this high-end material choice. Resources will also be a factor in whether one buys pre-packaged instructional materials or creates a set specifically for the programme.

Guidelines for choosing material

Caffarella (1994) provides seven selection criteria for choosing teaching and learning aids.

1. Materials fit with the maturity, interests and abilities of the learner;

2. Materials fit with the learning strategy;

3. A balance is maintained in the types of materials used;

4. Material overuse is avoided;

5. Selected materials should complement not duplicate other resources available;

6. Material choice should fit what is being taught;

7. Choose material that is currently available or can be created within the chosen time frame.

In providing instructional materials to the learner, it is important that the programme planner has some idea as to the preferences of the learner. The programme planner can look to three categories of design to garner information

about learner's opinions. The first is the elements of instruction design, the second is writing style and the third is programme format.

From study of learners in their own classes, Dick and Carey (1996) suggest the elements of instructional design that learners most desire:

- Focus of instruction to be explained in the introduction;
- Objectives to be stated in the beginning of the programme;
- Required entry behaviours to be explained;
- Relevant examples to be provided;
- Feedback to be provided after practice sessions;
- The programme information to be provided in manageable steps.

In the area of writing style, they found that learners like:

- Straightforwardness.
- Conciseness.
- Use of appropriate vocabulary.
- Avoidance of jargon.
- Use of humour.

The format of the information provided to the learner should include the following:

- Headings to guide learners;
- White or unused space on each page;
- Highlighted key words and definitions;
- Various cues to help the learner remember the material;
- Appropriate supporting graphics and illustrations.

To this list, we would add the following factors that add to the effectiveness of instruction:

- Feedback to the instructor from the adult learner during the programme.
- Active learner involvement in the programme.
- Effective organization of the learning strategies and materials.
- Flexibility within the programme to "change gears" when necessary to facilitate learning.

Nine events of instruction

Successful instruction should be structured according to Gagne's nine events of learning. The purpose is to support the internal process of learning. Following is a list of nine events of learning:

Preparation for Learning

1. Attending – gain learner's attention.

2. Expectancy – inform learner of objectives.

3. Retrieval – recall relevant information and/or skills to working memory or stimulate recall of prior learning.

Acquisition and Performance

4. Selective perception – remembering stimulus features, distinctive features.

5. Semantic encoding – provide learning guidance.

6. Retrieval and responding – elicit a performance.

7. Reinforcement – provide informative feedback.

Retrieval and Transfer

8. Cueing retrieval – assess performance.

9. Generalizing – applying learning to a new situation.

The material should also be developed to accommodate the adult learners.

Characteristics of adult learners

- Impatient.
- Definite needs and goals.
- Need quick success.
- Bring experience to learning.
- Ego threatened.
- Easily frustrated.

The use of ICTs for TVET Programme Design and Development

Does your organization use ICTs for TVET Programme Design and Development?

Good vocational education programmes are designed using a system approach. This approach includes various systematic processes, such as job analysis, task analysis, curriculum design and development, and instructional system design and development. These are very complex, time-consuming, and laborious processes. This section provides a discussion on the use of ICTs to automate some of these processes and to facilitate the decision-making process during TVET programme design and development.

The use of ICTs for Occupational Analysis

There is a strong demand on TVET to impart, retool and enhance job-related skills. If the purpose of a TVET programme is to improve the job performance, it is then important to use the job requirements as a basis for programme design and development. Job analysis is a strategy developed to breakdown a job into parts and components. Any job can be divided into duties, tasks, and subtasks. Lack of front-end analysis is the single most common error in programme planning. Analysis is a very important phase of the programme-planning process. It influences all underpinning assumptions used in the decision-making process and provides the basic foundation for programme design and development. The process and product of the analyses also provide an audit trail for validating the programme-planning activities as well as programme outcomes after its implementation. Additionally, job or occupational analysis is the only valid source of information for making programme-planning decisions.

Canada has made significant contributions to the job analysis techniques by the introduction of DACUM, which is an innovative method that has revolutionized programme planning. DACUM is an objective and cost-effective technique to conduct job or occupational analysis using a brainstorming process involving from 8 to 12 experts to identify the duty, task, subtasks as well as the supporting knowledge and abilities of an occupation or a job. The software ANALYZE IT was developed to conduct paperless DACUM workshops. ANALYZE IT captures all job analysis data during the process and, using a multimedia projector, projects the information on screen (Source: Dr Chris Chinien, Director, National Centre for Workforce Development. Chinien@ms.umanitoba.ca)

Wisconsin Technical College System Foundation has developed a software to facilitate programme design and development. Worldwide Instructional Design System (WIDS) incorporates proven teaching, learning theories, and best practices in the development of the software. WIDS offers educators a set of tools to facilitate learner-centred, competency-based curriculum design and development. It provides a consistent framework for the design of course and programme outlines, learning plans, syllabi, and assessment tasks. This software will store learning outcomes, related assessments, occupational analyses, and programme design information, such as competencies, performance standards, learning objectives, and learning activities. WIDS is currently being used to design and develop TVET

programmes in the US and many other countries. A free trial version of WIDS is available from the following URL: http://www.wids.org

Automated Instructional System Design and Development

Past surveys have determined that over 200 development hours are required to produce one hour of online learning (Kemske, 1997 as cited in Chapman, no date). For highly interactive lessons, the number of hours can jump to 800, even 1000 hours (Chapman, no date). This significant time commitment to programme design and development warrants the use of instructional design tools to increase efficiency and productivity. The whole instructional development process can be separated into two major phases: design and development (authoring).

Automated instructional design (AID) tools assist professionals, especially people with limited instructional design expertise, to create instructional products. Abby (1998, p. 2) classified these tools into four categories:

1. Expert Systems: Expert systems facilitate decision-making and instructional analysis process using a built-in knowledge base.
2. Advisory Systems: These tools assist or coach the designers in the instructional design process.
3. Instructional Design Environment: This tool supports an instructional design methodology for teaching the use of software in real-life problem-solving context.
4. Electronic Performance Systems: These are self-instructional electronic environments that provide just-in-time information, guidance, data, tools and assessment to support instructional design tasks.

There are several authoring tools on the market such as Authorware, Quest, and ToolboxII. The tool Designer's Edge focuses on the design phase of the process. Authoring tools are designed to simplify programmeming during the instructional development of ICT-mediated learning. The most commonly used authoring tools include Macromedia Authorware; Aim Tech IconAuthor; WBT Systems TopClass; and Asymetrix Toolbook (Abby, 1998).

Learning Objects

Learning objects is a new concept that will greatly facilitate programme development in TVET. Ausburn (2002) argues that the demand for mass customization of technology-based learning (TBL) will require a shift from a traditional model of instructional design and development. The concept of the learning object is central to this new paradigm. The author defines learning objects as "learning components that can be used, reused, revised, and reshuffled as needed to become part of any number of larger learning materials or course" (Ausburn, 2002, p. 35). Downes (2001) as cited in Ausburn (2002, p. 36) also provides an operational definition of learning objects as "a learning objective and all instructional components (text, graphics, test items, activities etc.) associated with the objective." Learning objects are placed in a learning object repository, which is essentially a computer database and an information management system. These objects can be retrieved for modification, reuse, and reassembly into specific instructional products.

The key feature of learning objects is that they are reusable. Ideally, a basic concept can be made into a learning object that can be used in a variety of contexts. It can be as simple as a single image, or as elaborate as an interactive presentation. Learning objects can include applets, animations, video and audio clips, etc. They must have one clear, define purpose, and not encompass a wide range of information, and their use is restricted to only one particular context (Online Learning Resources..., no date). Learning objects help avoid the "monolith" problem, where courses are treated as a single entity. Learning objects alleviate the problems with the "monolith" methodology. They provide several benefits: flexibility and versatility, cost savings, ease of updates, searches, content management, and interoperability. They also facilitate competency-based learning.

Flexibility and Versatility. It is easier to reuse material that is designed for multiple contexts from the outset, than to reuse material that has to be re-designed for each new context (Longmire, 2000). For example, material used for medical students could be suitable for other healthcare workers or medical technologists (Online Learning Resources..., no date). The learners also have flexibility since they can determine their own learning path based on their learning style.

Cost savings. Money is saved every time an object is reused since time and resources are not spent on re-design. Companies or educational institutions may also decide to sell these objects resulting in increased income (Longmire, 2000).

Additionally, companies and institutions may collaborate and develop objects together, resulting in decreased costs.

Ease of updates, searches, and content management. Metadata that is associated with each learning object "facilitates rapid updating, searching, and content management by filtering and selecting only the relevant content for a given purpose" (Longmire, 2000, para. 4). Rapid and easy updating mechanisms ensure that information is current and up-to-date.

Interoperability. With standards currently being developed by groups, such as the IEEE (Institute of Electrical and Electronics Engineers), Learning Technology Standards Committee (LTSC), and Advanced Distributed Learning Initiative, learning objects will be able to be used in other learning systems and contexts around the world (Longmire, 2000).

Facilitation of competency-based learning. The competency-based model of teaching and learning, as used in TVET programmes, is based on the idea of a "competency" being a function of three components: attitudes (behaviour), knowledge, and skills (Williams and Hua, 2001). Thus, a competency in Planning and Design involves the knowledge of the principles of design, the skills required for planning and design (for example, computer-aided design and communication skills), and the required attitudes (for example, accuracy and quality) (Williams and Hua, 2001). Truly modular learning objects can be used to fill the gaps in competencies (Longmire, 2000).

Metadata

Metadata can be simply defined as information about an object or "data about data" (Nunes and Gaible, 2002, p. 111). Learning object metadata provides a general outline and description of the learning object itself. The draft standard for Learning Object Metadata put forward by the IEEE LTSC states that "a metadata instance for a learning object describes relevant characteristics of the learning object to which it applies. Such characteristics may be grouped in general, life cycle, meta-metadata, educational, technical, educational, rights, relation, annotation, and classification categories." (Draft Standard..., 2002, p. 5). Downes (2000, p. 17) describes metadata metaphorically: "We might think of authoring learning objects as akin to authoring pieces of a puzzle, in which case the content is the image or picture on the surface of the piece, while the metadata is the shape of the piece itself which allows it to fit snugly with the other pieces." Metadata is important since it is potentially this information that will be stored in a system of learning objects repositories around the world, according to Downes (2000, p. 26). In his scenario, there will be central database(s) containing the "tens or hundreds of thousands of individual objects". These databases will be multifunctional with information for online courses, online journals, magazines, knowledge management applications etc. Each object in the database will contain metadata and the learning object repositories will access the relevant metadata for online courses (Downes, 2000). In the case of TVET, the learning object repositories can potentially filter for only TVET-related metadata.

TVET educators have had a head start with regard to the adoption of learning objects. Many TVET programmes are competency-based and in many countries specific standards have been developed for these specific competencies. These competencies and standards can be used as a basis for developing learning objects for TVET programmes. Research conducted by International Labour Organization (ILO) in connection with Modules of Employable Skills (MES) has also promising potential in the context of learning objects.

Developed back in 1992, MES models for vocational training programmes "are based on the competencies required to perform the tasks of given jobs and/or national training standards where such standards exist" (Chrosciel and Plumbridge, 1992, p. 4). ILO defines a modular unit as "a logical acceptable division of the Work of a particular job or occupation, having a clear start and finish and which would not be further subdivided" (ibid, 1992, p. 5). For example, the job of car servicing in automotive engineering may consist of the seven modular units: Servicing ignition system, Servicing battery, Servicing cooling system, Changing engine oil, Cleaning car body, Servicing tires, and Servicing brake system (Chrosciel and Plumbridge, 1992). These modular units combine together to form the MES for the job of car servicing. Learning Elements (or instructional units) are "self-contained instructional booklets, each covering a specific item of skills or knowledge" that are used in MES training programmes (ibid, 1992, p. 7). They contain a specific objective, a list of required equipment, materials and aids, a list of other related learning elements, instructions

with text and illustrations, and a progress check that precisely matches the learning objective (Chrosciel and Plumbridge, 1992).

A modular unit is made up of different learning elements that train a person to perform the required steps of the modular unit. The common and basic learning elements can be linked to several different modular units. For example, the learning element "Measuring – Using Rules and Tapes and Straight Edges" can be used in the modular units of the area of Building Construction, and reused in the Electrical/Electronic Engineering and Plumbing and Pipe Fitting areas. The idea of modular units and learning elements cater perfectly to the learning object concept as defined by IEEE LTSC. Massaging a learning element (as referred to in the context of MES and TVET) into a learning object structure and storing it in a widely available repository has enormous potential in revolutionizing the way TVET programmes are developed.

The Generic Skills study conducted by the government of Canada (Smith, 1979) is also of significant importance in considering the implementation of learning objects in TVET. This study was based on the use of 588 trade tools (such as portable hand tools, shop machinery and equipment, wheeled vehicles etc.) by 1,600 workers (such as tradesmen/women, trade supervisors, technicians, technologists etc.) in 131 different occupations (Smith, 1979).

The workers identified the skills that they used in their work duties. The data were organized by occupation and by skill "to determine which skills 'belonged' to which occupations and which skills were required in all or most of the occupations" (Smith, 1979, p. 2). A threshold of 30% whereby "if 30% or more of the job holders responded to a particular skill, it was recorded as an occupational requirement" (Smith, 1979, p. 2). The "reusability" of these skills was determined as each pair of occupations was "compared to determine the percentage of skills held in common (COMMUNALITY FACTOR) and the percentage of skills which each occupation used of the total skills held by the other occupation (TRANSFERABILITY FACTOR)" (Smith, 1979, p. 2). For example, Aircraft Mechanics use 93% of the tool skills of a Body Repairer and Body Repairers use 72% of the tool skills of an Aircraft Mechanic (transferability factors). The communality factor between the two is 68% (Smith, 1979). This type of research is useful in determining what learning elements (or learning objects) should be included in a TVET programme and how they can be shared between different programmes; this will consider-ably cut down the time required for programme planning. This quick and inexpensive approach for designing TVET programmes also means that a programme could be designed for only one student to meet a labour market need instead of using the traditional model where the break-even point for a programme requires an instructor-trainees ratio of 1:20.

Figure 5 presents a specific example of how the duties of a specific occupation can be broken down into smaller, modular sections. Each occupation has explicit duties that must be performed. Each duty can be broken down into a number of tasks. These tasks can be structured into specific steps. To perform each step satisfactorily, the worker must possess specific knowledge and abilities. The required knowledge and abilities can be formalized into a general instructional objective that must be taught to the worker. Each general instruction objective can be subdivided into specific instructional objective(s). Further, there are "enabling objectives" that the worker must learn to achieve a specific instructional objective.

The full impact of learning objects will manifest itself when educators begin to share and exchange these objects. Downes (2001, p. 1) as cited in Ausburn (2002, p. 36) noted: "The economics are relentless. It makes no financial sense to spend millions of dollars providing multiple versions of similar learning objects when single versions of the same objects could be shared at a much lower cost per institution. There will be sharing, because no institution producing its own materials on its own could compete with institutions sharing learning materials."

However, before the wide scale implementation of learning objects, there are some issues that must be resolved, including: What standards are used for metadata? Will the learning object information be available in languages other than English? (Shata, 2001), and what will it cost?

Learning Object Standards

Standards and specifications attempt to universally define the best way to describe and handle learning objects. The development of standards for metadata allows objects to be "searched, evaluated, acquired, and combined" (Nunes and Gaible, 2002, p. 111). The Australian National Training Authority presents the benefits of "open and internationally consistent technical standards" (ANTA, 2002b, p. 6). They can:

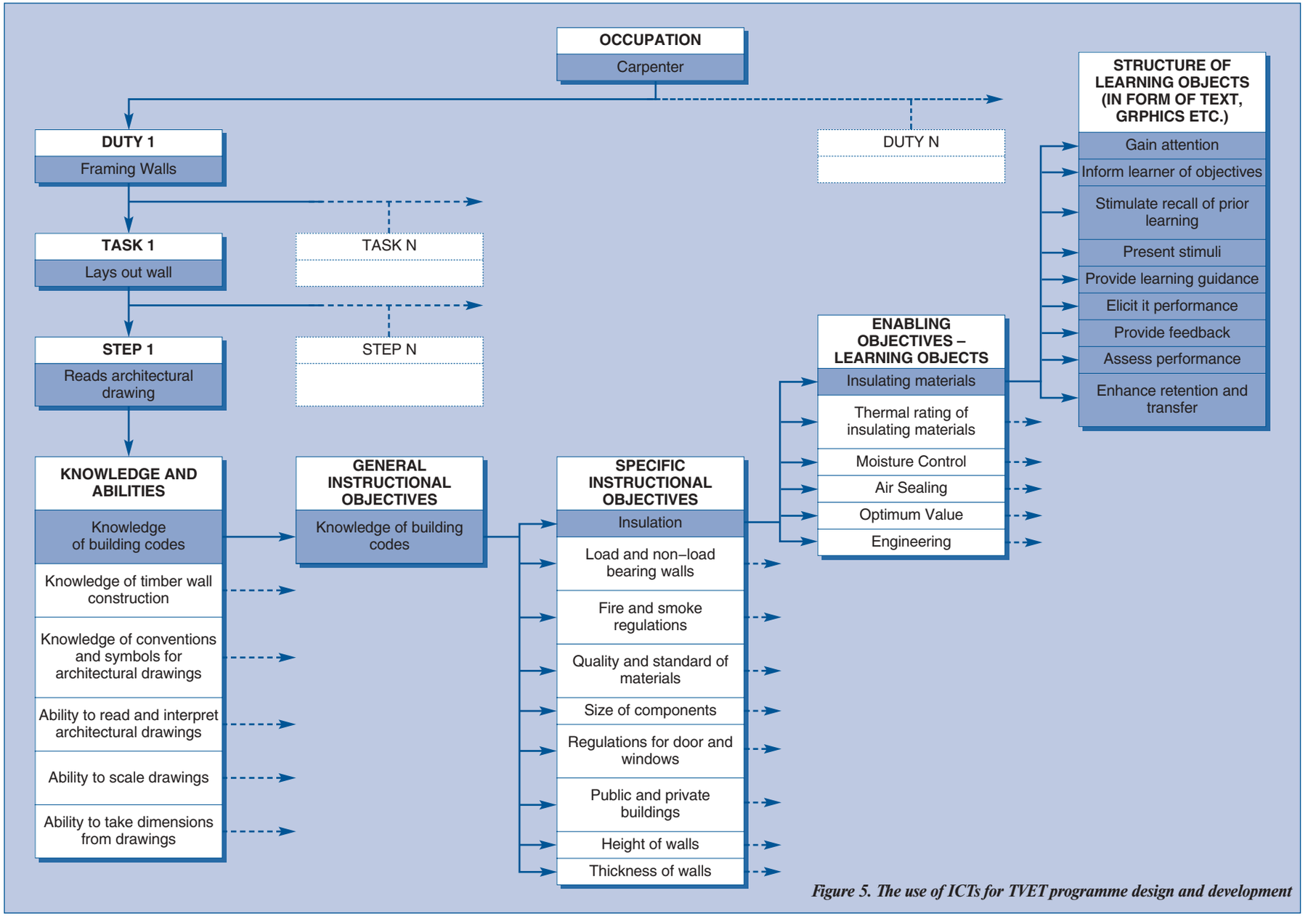


Figure 5. The use of ICTs for TVET programme design and development

- help make training available online and thus avoid problems of place, time, working arrangements, or equity group;
- reduce the risk and cost in making purchasing decisions at all levels;
- ensure the maximum interoperability (compatibility) and scalability of technical infrastructure;
- increase the ease with which quality teaching and learning resources can be found, obtained, transferred, adapted, and used by teachers and students;
- ensure that teachers and students can participate in teaching, learning, and professional development activities across organization, sector, and state/territory boundaries;
- allow competition and cooperation as appropriate (ANTA, 2002b, p. 6).

The major players in devising learning object standards include:

- IEEE LTSC P1484 (http://ltsc.ieee.org/wg12/s_p.htm),
- IMS Global Learning Consortium,
- Inc. (http://www.imsproject.org/specifications.cfm),
- Advanced Distributed Learning Initiative which created the Sharable Content Object Reference Model (SCORM) (http://www.adlnet.org/index.cfm?fuseaction=scormabtandcfid=367799andcftoken=97864349),
- European Union-based group ARIADNE (http://www.ariadne-eu.org),
- Aviation Industry CBT Committee (AICC) (http://www.aicc.org/),
- World Wide Web Consortium (http://www.w3.org),
- Dublin Core Metadata Initiative (DCMI) (http://dublincore.org/).

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the development of ICT-mediated learning materials in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the development of ICT-mediated learning materials in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the development of ICT-mediated learning materials in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience develop an institutional toolkit for the development of ICT-mediated learning materials in TVET.
- Ask a group of key stakeholders in TVET to review the toolkit.

EVALUATION OF ICT–MEDIATED MATERIALS

A Framework to examine the effectiveness of ICTs in TVET

Two key elements must be taken into account when considering the effectiveness of learning technologies, namely instructional effectiveness and instructional efficiency. Instructional effectiveness and efficiency are two elusive terms for which no accurate definitions can readily be found in the literature. The difficulty in defining these terms is probably due to the number of factors extraneous to the material itself, which confounds measurement related to the quality of instruction.

In previous studies the efficiency and effectiveness of an instructional product have been used as dependent variables. Nathenson and Henderson (1980) note that research has had a very narrow focus with regards to the effectiveness of instructional materials. In many studies effectiveness has been viewed only in terms of learning gains on post-tests. The authors argued that although improved student performance is an important element, it should not be the only indicator of instructional material effectiveness. Chinien (1990) suggests that instructional material effectiveness should be viewed within a framework, which encapsulates three major elements, achievement, study time, and the students' attitude toward the material. After reviewing the research on distance education, Institute for Higher Education Policy (1999) identified three broad measures of effectiveness that were most commonly used, namely student achievement, student attitude, and student satisfaction.

Achievement

Several studies (see Chinien and Boutin, 1994) have demonstrated that the quality of instructional material can help significantly improve students' achievement on post-tests. Two indicators of instructional material effectiveness are used with respect to achievement. The first relates to the ability of the material to help a predetermined percentage of students reach a designated level of mastery on post-tests. The criterial level of effectiveness could specify that 90% of the test subjects should score at least 90% on post-tests (Romiszowski, 1986). Setting the criterial level for number of students and for level of mastery is arbitrary, and the decision can be made on the basis on the consequences of inadequate performance or mastery of content. The gain in learning is a second indicator of effectiveness related to achievement. Learning gain is usually expressed as the difference between post-test and pre-test scores (learning gain equals post-test score minus pre-test score, Romiszowski, 1986).

Study time

The amount of time that students spend interacting with an instructional product is another critical element of instructional material effectiveness. Nathenson and Henderson (1980) cite many research studies that have reported achievement at the expense of increased study time. These authors quote Faw and Waller (1976) to emphasize the critical relationship between study time and the achievement component of instructional material effectiveness:

> (Since) the single most important determinant of how much is learned is probably total study time... it is hardly surprising that the manipulations which tend to extend the period of time spent in study... are in general accompanied by superior levels of learning (p. 169).

There are also some studies demonstrating improved student performances on post-tests while keeping study time constant. Study time is also commonly referred to as a measure of efficiency (Davis, Alexander, and Yelon, 1974; Futrell and Geisert, 1984).

Attitude

A third dimension of instructional material effectiveness is the student's attitude toward the material (see Chinien and Boutin, 1994). Studies conducted by Aberdor (1972), Stolovitch (1975), and Wager (1980) indicate that effective in-

structional materials generate more positive student attitudes. On the other hand, Berthelot (1978) and Chinien (1990) found no significant differences in students' attitude related to the quality of instructional material. Romiszowski (1986) cautions that the novelty effects may confound measures of student attitudes. He argues that the novelty may not only inspire negative attitudes that diminish over time, but may also generate excessive praise and enthusiasm that may also disappear.

Although research on time-on-task indicates that a positive correlation between achievement and time engaged in learning tasks, time is not generally used as an independent variable in research on distance education. The effectiveness of an instructional material can be conceptualised within a framework of three major elements: student achievement, study time, and student attitudes. All three elements are important and need to be considered collectively when assessing instructional material. Any investment in ICTs is a waste if not accompanied with investment in high quality, relevant curriculum material, since ICTs will not compensate for poor content (Bates, 1995).

While a general consensus is emerging regarding the need to integrate ICTs in teaching and learning, there is little empirical evidence to support the decision-making process. In fact, over 350 research projects conducted during the past 70 years have failed to establish a significant difference in effectiveness between ICTs and traditional methods (Baalen and Moratis, 2001). While these findings tend to suggest that ICTs do not considerably improve teaching and learning, the fundamental question that remains unanswered is: were the researchers assessing the effectiveness of ICTs or were they simply assessing the effectiveness of instructional products that were less than perfect?

In spite of considerable progress made in the development of instructional materials through the adoption of systematic instructional design, practitioners still have difficulty in producing efficient and effective instructional materials because our knowledge of human learning is still limited. Many of the critical assumptions that are made during the design and development of instructional product are based on learning theories that are weak. The final product is therefore less than perfect (Dick and Carey, 1996, Gagne and Briggs, 1979). Conscious of this inherent difficulty, and recognizing that the design process is not foolproof, instructional developers have included a formative evaluation component in their models (Geis, Weston, and Burt, 1984). The purpose of formative evaluation is to provide instructional developers with an opportunity to identify and correct errors and problems within a set of instructional materials while they are still in a developmental stage (Baker and Alkin, 1984; Dick and Carey, 1996; Gagne and Briggs, 1979; Geis et al., 1984; Sanders and Cunningham, 1973).

Formative evaluation is defined as the "evaluation of educational programmes while they are still in some stage of development" (Baker and Alkin, 1984, p. 230). Formative evaluation is the empirical validation of many of the theoretical constructs, which are included in earlier components of the instructional design model. If the theory is weak, the product is less than properly effective. Since our present theories and practices are imperfect, we need empirical data as a basis for improving the product (Dick, 1977, p. 312).

Formative evaluation of instructional material is an essential activity in the design and development of instruction, because there is a lack of comprehensive theory of learning to guide practice (Nathenson and Henderson, 1980).

Formative evaluation attempts to appraise such programmes in order to inform the programme developers how to ameliorate deficiencies in their instructions. The heart of the formative evaluator's strategy is to gather empirical evidence regarding the efficacy of various components of the instructional sequence and then consider the evidence in order to isolate deficits and suggest modifications (Popham, 1975, p. 14).

Earlier attempts for trying out and revising instructional materials date back to the 1920s, with educational films and radio (Cambre, 1981). There are two broad questions addressed by formative evaluation activities. The first relates to the content and the technical quality of the material, and the second pertains to its learnability. The evaluation of content and technical quality is addressed through expert verification and revision. It is generally believed that the students are most qualified for providing feedback data to assess the learnability (Nathenson and Henderson, 1980). Figure 6 shows various components of the developmental testing and model.

Expert evaluation and revision

The use of experts' opinion in assessing the worth of an instructional product is probably the oldest evaluation strategy used in education. Experts' opinion is an important evaluation tool because it is quick, cost-effective, and it tends to enhance the credibility of an instructional product. Additionally, experts' opinion can be used to modify a product

before it is used by students. Types of experts are commonly used for the evaluation process, namely content, language, target, media, format, and delivery system experts (Table 11):

- The content expert will ensure that the content is relevant, accurate, and up-to-date.
- The language expert will ensure that the language is appropriate for the target population.
- The target population expert will ensure that the material is appropriate for the designated group that will use it. If the target population is adult learners, then the expert will ascertain that the material being evaluated is in agreement with the basic principles, philosophies, assumptions, and established theories in adult education. The five philosophies in common use in adult education (behavioural, liberal, progressive, humanistic, and radical) consist of beliefs about human learning, the roles of learners, and values attributed to learning. These philosophies can strongly influence the orientation given to the learning process, such as active learning, transformative learning, or self-directed learning, to name a few.
- The media expert will focus on the cost-effectiveness of the proposed materials. Typical cost considerations include: capital costs, installation/renovation costs, time cost, support personnel, training, maintenance, cost of alternatives, as well as shared costs. The expert can also assess the societal costs of not implementing a technology-based product. The media expert will assess the particular characteristics of the learning technology in order to determine its appropriateness for addressing the learning needs of the target population.
- The format expert will determine if the material has been packaged to maximize its effectiveness and efficiency.
- The delivery expert will ascertain that the material meets standards established by best practices. The effectiveness of instructional material depends to a large extent on how well instructional developers have been able to support internal learning processes with external events. Research has identified nine critical events of learning (Gagne, 1997). Delivery expert evaluation must determine if all the events of learning are present.

Events of Learning

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

Learner Verification and Revision

Learner Verification and Revision consists of a three-stage approach (Dick and Carey, 1996). These stages are one-to-one evaluation, small group evaluation, and field test (refer to Table 11).

One–to–one evaluation

The one-to-one evaluation occurs in the earlier phase of development (Dick and Carey, 1996). It serves to "identify and remove the most obvious errors in the instruction, as well as to obtain the initial student's reaction to the content." (p. 199) At least three students representative of the target population should be selected for this process: one with above average ability, another with average ability, and a third with below average ability. In a one-to-one evaluation the student is exposed to the instructional materials as well as to all pre-tests, post-tests, and embedded tests within the material. The one-to-one evaluation is an interactive process between student and evaluator. Data are collected through observation, interview, embedded tests, post-tests, and an attitude questionnaire. The data

can either be for making on the spot revisions for minor problems or delayed revisions for more complex ones (Thiagarajan, 1978, see Table 11).

The one-to-one evaluation can enable the developer to uncover gross misconceptions in information processing. Once these misconceptions are uncovered, the material can be easily modified to address the problems.

Small group evaluation

The second stage of formative evaluation is conducted with a group of eight to twenty students representative of the target population (Dick and Carey, 1996). The small group evaluation has two main purposes: to validate modifications made to the material following the one-to-one evaluation, and to ascertain if the student can use the material without the help of the evaluator.

The term "small group" refers only to the number of students involved in the evaluation process. Small group evaluation does not imply that all students should be assembled in one location, and be evaluated all at once. In a small group evaluation, the students are provided with all instructional materials and tests. They are instructed to study the material at their own pace. The evaluator intercedes only if a major problem occurs prohibiting the student from proceeding without help. After interacting with the materials and tests, the students are given an attitude questionnaire in order to obtain their reactions. Data gathered during the small group evaluation are used to further refine the instructional material (Table 11).

Field test

The field test or summative developmental evaluation is designed to verify the effectiveness of previous verifications and revisions performed during earlier phases of evaluation. The field testing also helps ascertain if the instructional material will function smoothly, and whether it will be accepted by students, teachers, and administrators in the intended setting (Dick and Carey, 1996). The focus of the evaluation is on the merit of the instructional product in terms of achievement, attitude, or study time.

Risk assessment

In spite of the importance of formative evaluation, research indicates that less than 1% of instructional products used in the US have been systematically evaluated. The costs and time required are two main deterrents to including formative evaluation in the instructional development process. A risk assessment can help weigh the time and the costs constraints against the consequences of making an inappropriate decision when adopting a technology-based learning product.

Although most experts recommend a three-stage formative evaluation process (Geis et al., 1984), there is some empirical evidence in the literature (Wager, 1980 and Kandasawmy, 1976) suggesting that small group evaluation can be eliminated without significantly affecting the overall effectiveness of the revised product.

Although the importance of formative evaluation is well evidenced in the literature, the state-of-the-art is still an underdeveloped, underconceptualized field of inquiry. There is a paucity of empirical foundations or rationales to support the guidelines and recommendations for the process. Research efforts are needed to improve and validate formative evaluation methodologies in current use, so as to give more credibility to the formative evaluation process.

In spite of these shortcomings formative evaluation works. Research indicates that instructional materials evaluated by even one learner are significantly more effective that the original unrevised version. Let us hope the educators will make more extensive use of formative evaluation so that the use of ICTs in TVET will not compromise previous commitments and progress made regarding education for all. Formative evaluation can assist us to identify and remove dispositional, institutional, situational, and informational barriers that could prevent some groups of people form participating in training designed for highly demanded, highly skilled, and highly paid occupations.

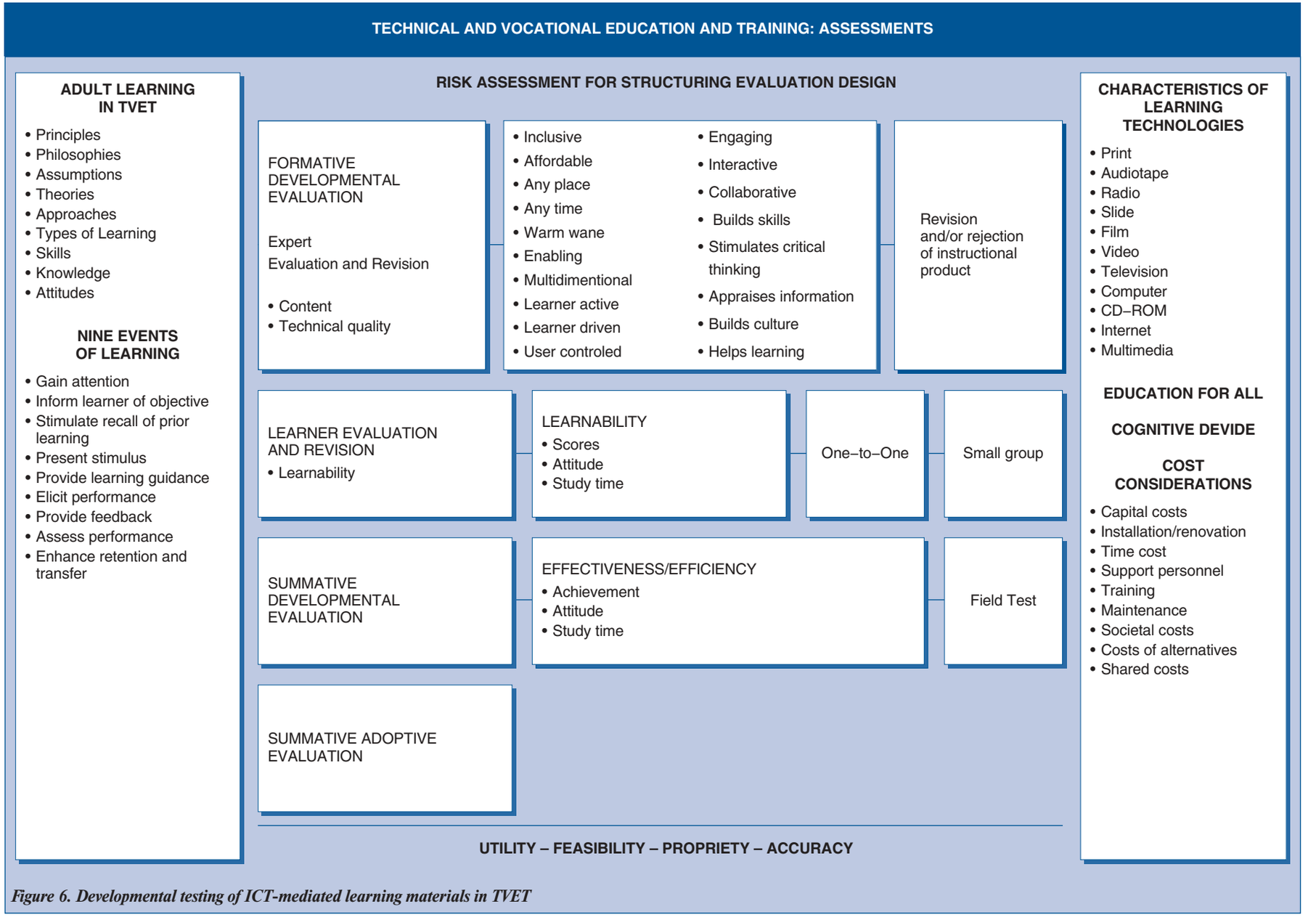


Figure 6. Developmental testing of ICT-mediated learning materials in TVET

Table 11. Experts and students' evaluation of prototypical products

Data source	Questions asked	Methods of collecting data	Types of data collected	Data utilization
Expert Subject Matter Expert Language Expert Delivery Expert Pedagogical Expert Instructional Design Expert	Is content adequate, accurate, up–to–date, and relevant? Is reading level appropriate? Is delivery medium appropriate and cost–effective and does it meet quality standard? Are objectives, content appropriate? Is the material appropriate for the target population? Were instructions designed according to systematic process and on the basis of sound theories of learning?	Check list Panel discussions Interviews	Feedback information in form of • Narrative reports • Completed checklist • Records of panel discussions • Records Recommendations • Records Interview transcripts	Feasibility analysis for implementing recommendations Modify material Discontinue, if revision is too involved and costly
One–to–One Evaluation Select learners representative of population. Include: • Learners of high, medium, and low ability • Males and females • Young and inexperienced, mature and experienced learners	Is the material learnable? What are the most obvious errors, problems, and weaknesses within the material? What are the learners' reactions to the material? Are pre–, embedded, and post–tests appropriate?	One–to–one leaner/evaluator interaction Think–aloud procedure Learners' verbal feedback, body language Observation, interviews Unobtrusive measures Reaction questionnaire Pre–, embedded, and post–tests Debriefing interview	Think–aloud protocols Comprehension Appeal Errors Problems Weaknesses Pre–, embedded, and post–tests data	Analyze learners' feedback and make inferences for changes During each try–out implement minor revision on the spot and present modified version to learners for confirmation After each try–out revise material on the basis of earners' feedback
Small Group Evaluation Select 10 to 20 learners representative of target population Material is handed to test subjects. Evaluation intervenes only when test subjects need assistance	How effective are changes made during one–to–one evaluation? Are there additional problems and errors in the material? Can learners achieve objectives? Were exercises, tests, and feedback appropriate and adequate?	Pre–, embedded, and post–tests Observation Unobtrusive measures Attitude questionnaire Debriefing interview	Pre–, embedded, and post–tests scores Observation records Interview data Learners' reactions Non–verbal data	Analyze learners' feedback data and make inferences for revisions Modify material on the basis of inferences made from learners' feedback data
Field Test Select one or more groups of learners (30 each) representative of the target population from urban and rural areas	Can learners achieve objectives when using material alone? Are previous revisions effective? Will material be accepted by learners, teachers, and administrators?	Evaluation of material in natural setting and context Pre–, embedded, and post–tests Attitude questionnaire	Pre–, embedded, and post–tests scores Reactions of learners, teachers, and administrators to material	Analyze feedback data and implement any additional revisions necessary to address new problems

In order to evaluate the effectiveness of ICT-learning strategies, Bennett (1979) puts forward a system of criteria for measuring the impact of learning. According to Bennett's systems of criteria, each hierarchy of impacts corresponds to a hierarchy of evidence. That hierarchy of evidence includes certain aspects, those relevant to this discussion are documented below:

- Participation;
- Reactions;
- Change of knowledge, attitudes, abilities, skills and aspirations;
- Change of practice;
- Final results.

Participation is conceptualized as a set of interventions in each phase, aspect, and activity of the ICT-mediated learning programme. Reactions are taken as the target individuals responses to each phase, aspect and activity of the ICT-mediated learning programme. This is then applied to assess the effectiveness of ICT strategies to learning and knowledge aquisition.This conceptual matrix serves to evaluate existing processes and will enable instructors, managers and organisations to adapt these processes and to formulate new methods of learning.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the formative evaluation of ICT-mediated learning materials in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the formative evaluation of ICT-mediated learning materials in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the formative evaluation of ICT-mediated learning materials in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

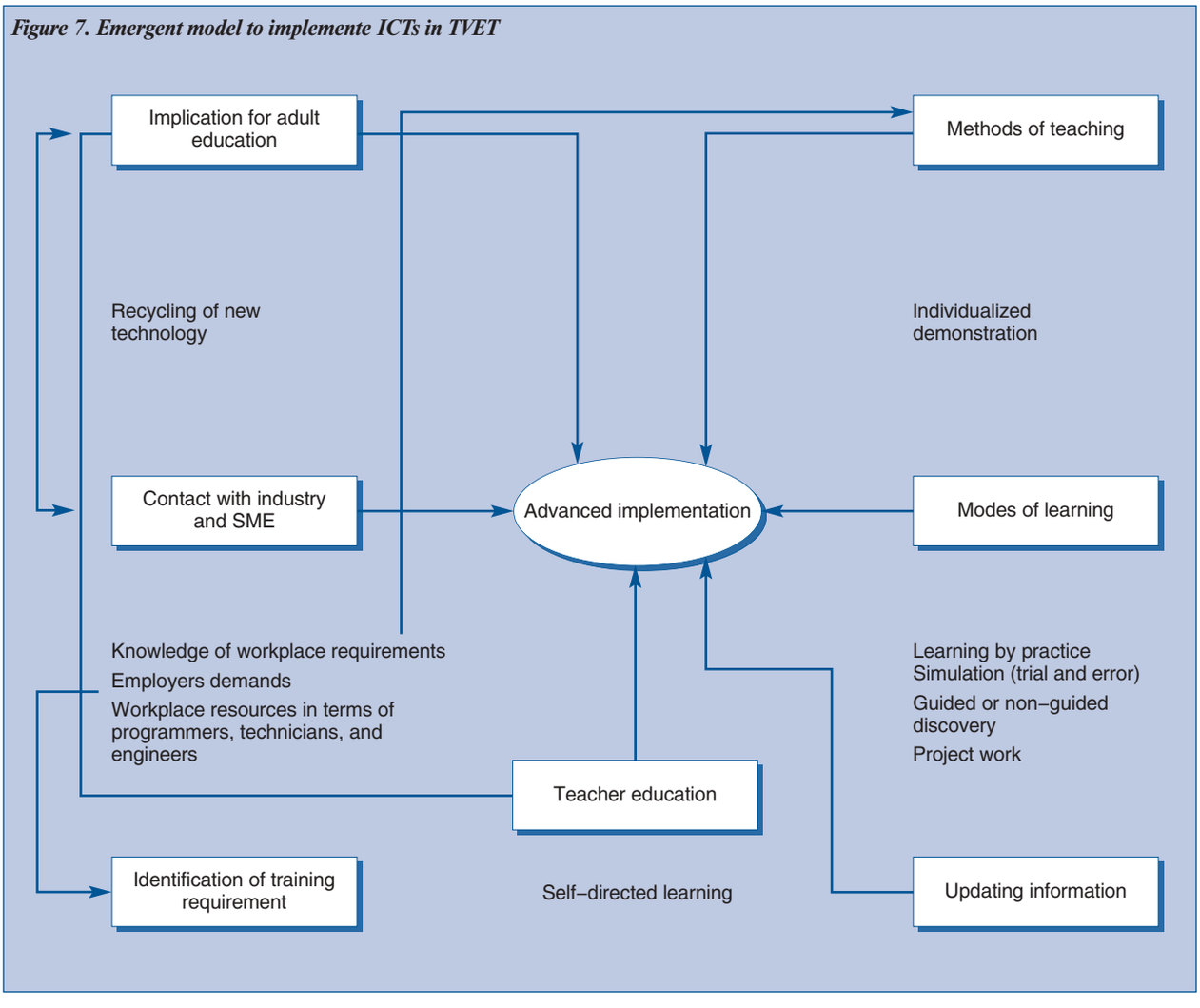
- Using your transformative reflection experience develop an institutional toolkit for the formative evaluation of ICT-mediated learning materials in TVET.
- Ask a group of key stakeholders in TVET to review the toolkit.

EMERGENT MODEL TO INTEGRATE ICTs IN TVET

Chomienne (1990) conducted a study to investigate the factors that facilitate the integration of ICTs in TVET. Results of her study pointed toward four pedagogical applications of computer technology: computer as a technical tool for teaching, computer as a teaching tool (teaching aid), computer as a working tool for the students (professional tool), and computer as a control system tool or laboratory and workshop tool.

To find out more, Chomienne collected additional data from teachers who have reached an advanced implementation level of ICTs in their teaching. Her objective was to better understand the ICT implementation process followed by these "exemplary" teachers. The result is summarized in Emergent Model of ICT Implementation shown in Figure 7. ICT implementation in TVET emerged from an intricate process. Contacts with industry kept teachers current with workplace requirements, and employers' human resource needs. This information helped teachers identify the training requirements and directly influenced the teaching methods used. The preparation received by teachers regarding methods of teaching and learning modes, along with their self-directedness in learning that kept them up to date are factors that affect the level of ICT implementation in TVET.

Figure 7. Emergent model to implemente ICTs in TVET



After reviewing the literature on the usage of ICT-mediated learning Farrell (2001) concluded that most of the literature on the use of ICT-mediated learning is focused on the sectors of K-12, university education, and adult basic literacy. The literature dealing with the usage of ICT-mediated learning in TVET is scarce, fragmented, and difficult to access.

Although ICTs are by far the most significant element undergirding the foundation of TVET, there is a paucity of literature and research regarding its implementation and use in this field of education and training. Attwell (1999) noted: "there has been only limited work on the potential impact for vocational education and training." This lack of research-based information on the use of ICTs in TVET is also echoed by Zircle (2002 b). Brennan, McFadden, and Law (2001) noted: "The degree to which diligent and high-quality research percolate beyond their place of origin is questionable. It is almost as though we have groups of people working in this area who do not have the structures in place to exchange information and insights in a productive way. Dissemination of these results seems to be a serendipitous process." (p. 64) However, based on the limited amount of information available, this section attempts to provide a global perspective of the usage of ICTs in TVET in both developed and developing countries.

USAGE OF ICTs IN TVET IN UNESCO MEMBER STATES AND OTHER SELECTED COUNTRIES

Lewis (2001), Director of the National Training Framework of the Australian National Training Authority, recently noted that traditional training approaches to TVET "are under threat and new ways of thinking about, organizing, and ensuring adequate skills formation that is useable in enterprises, are required". (p. 1) All UNESCO Member States are attempting to reform their TVET systems to make them more responsive to this new reality. Many countries are trying to harness the power of ICT-mediated learning as part of a comprehensive strategy to reform the TVET systems. However, there is a lack of a systematic approach to evaluate ICT usage in education. IITE (2001c) held an expert meeting to discuss indicators of ICT usage in education. The final report of that meeting is available on the IITE web site: www.iite-unesco.org

This section provides a brief overview of the usage of ICTs in TVET in some UNESCO Member States and other selected countries.

Africa

African Virtual University (AVU) uses satellite technology, the Internet, phone lines, and e-mail to link AVU centres across Africa to a studio classroom to provide learners with real-time interaction with the instructor. Tutors at the AVU centres provide support to students and facilitate two-way communication with the studio classroom instructor. AVU centres have successfully trained thousands of students as technicians, engineers, managers, and scientists ... in more than 15 African countries (African Virtual University 2001 Web site. http://www.worldbank.org/ knowledgebank/ facts/avu.html) (Stevens, 2001, pp. 70–74).

Distance education programmes developed by the Commonwealth of Learning have been used to train untrained/ unqualified TVET teachers in Botswana, Kenya, Swaziland, Tanzania, Uganda, Zimbabwe, Nigeria, Sierra Leone, Guyana, Bangladesh, St. Lucia, and Papua New Guinea (John, 2002).

In Botswana, distance and open learning is the responsibility of Distance Education Programme, an arm of the Botswana Department of Non-Formal Education. Government of Botswana is planning to introduce several new TVET programmes as well as construct several new TVET institutions. Bostwana has more than 20,000 Internet subscribers. This relatively high level of access to ICT facilitates the government's plan to implement high quality TVET programmes for various groups, using flexible learning methodologies (Australian National Training Authority, ANTA, 2001a).

The Educational Media Agency (EMA) in Ethiopia has partnered with WorldSpace. WorldSpace is providing one broadcast channel and 50 digital receivers to broadcast over 400 programmes from AfriSat. This satellite can broadcast audio programmes and transmit multimedia information, and it can download text, video, audio, and graphics to a radio. Files can then be sent to an attached computer. EMA intend to use the system to transmit data via the satellite to resource centres throughout the country (Stevens, 2001, p. 58).

Open and Distance Learning (ODL) in Namibia is offered through a number of providers, some of the most important ones are Namibia College of Open Learning (NAMCOL), National Institute for Educational Development,

Polytechnic of Namibia, and University of Namibia. Providers have established a fair number of learning centres across the country to reach population in rural areas. Schools become learning centres after regular hours. Enrolment in ODL has tripled in three years and accounts for 52% of all tertiary enrolments. The scarce programme offerings and the availability of learning resources limit greater increase in enrolment. Namibia Open Learning Network is a joint venture between the public providers and the government in an effort to provide better learning resources at centres across the country. ODL programmes depend on local tutorial support by teachers and experts in the field (Polytechnic Taskforce v2030, 2003).

Owerri Digital Village in Nigeria offers four main programmes: TechKids, TechTeens, TechEnhancement, and TechCommunities. TechKids caters children between the ages of 8 and 12 whereas TechTeens focuses on students between 13 and 18. TechEnhancement is geared toward civil servants who want to acquire skills that will help them in their daily activities (Ugwuegbu & Gipe, 2002, para. 12). TechCommunities trains poor, rural, semi-literate women to gain critical skills that will help improve their small businesses and communities. Owerri Digital Village offers academic learning and vocational and technology training, and provides adult education in business management skills. It exposes women to the new ICTs and how these can benefit them in their everyday life. For example, "trader women will use the e-post facilities at the digital village to deliver messages to their customers in the villages when a new shipment or stock has been received" (Ugwuegbu & Gipe, 2002, para. 18).

Arab States

UNESCO Regional Office for Education in the Arab States (1995) identified the types of ICTs commonly used in TVET in the Arab States in workshops and laboratories and for learning:

Workshops and laboratories:

- Operating systems
- Networking systems
- Communication Protocols
- Computers and associated software
- Computer Aided Design (CAD) systems
- Computer Aided Engineering (CAE) systems
- Computer Aided Manufacturing (CAM) systems
- Material Requirement Planning (MRP) systems
- Computer Integrated Manufacturing (CIM) systems
- Group Engineering
- Management Information Systems (MIS)
- Document Management Systems (DMS)

ICT-mediated learning:

- Multimedia Authoring systems
- Computer-Based Learning
- Computer-Based Training
- Open Learning/Teaching courseware
- Application Courseware
- Training Courseware
- Electronic Mail
- Electronic Bulletin Board
- Videotext
- Automated Libraries
- Databases and Databanks
- Multimedia
- Word processing
- Spreadsheet
- Desktop Publishing

Australia

Australia is recognized as a trendsetter in the area of TVET. The country has also established itself as a world leader for its initiatives in research, innovation, and reform in TVET. In keeping with this tradition: "Australia's pre-eminence in the area of distance education has been widely acknowledged" (Tapsall and Ryan, 1999, 147). At the national level, all states and territories have agreed to Australian Flexible Framework for National Vocational Education and Training System 2000-2004. The purpose of the agreement is to:

- build a critical mass of Vocational Education and Training (VET) staff that is able to use flexible learning approaches;
- achieve a national VET system, which facilitates affordable access by all communities, learners, and employers to online services;
- develop world class online content, applications, and services;
- remove unnecessary regulatory barriers to online learning (Keating & Thompson, 2001).

Australia has already made some significant accomplishments in flexible learning. Following are a few examples (EdNA VET Advisory Group, 2001, p. 5):

- Most states have TAFE online or are in the process of implementation.
- Adoption of National Technology Standards Policy (1997).
- Adoption of Preferred Standards to Support National Cooperation in Applying Technology to VET.
- Development of Multimedia Toolboxes for Training Packages.
- Hosting Conferences on flexible delivery in TVET.
- Providing professional development for flexible delivery.
- Communicating and marketing flexible delivery initiatives.
- Conducting research on online network in VET.
- Conducting research designed to provide practical guidelines to practitioners.

Australia has developed a strategic plan to achieve its flexible learning vision in VET. This plan is outlined in Australian Flexible Learning Framework for National Vocational Education and Training System 2000-2004. This plan addresses five areas of strategic importance:

1. Creative, capable people: to build a critical mass of VET staff that can apply flexible learning.

2. Supportive technological infrastructure: to ensure the availability of ICTs and necessary connectivity to achieve a national VET which is accessible to all.

3. World-class online content development, application, and services: to assist the Australian VET system to maintain and expand its share of the training market within Australia and internationally.

4. Enabling policies: to ensure that policies and protocols facilitate uptake and usage of flexible learning in VET.

5. Problem-solving regulations: to advocate for a regulatory framework to protect learners, remove legal and regulatory barriers, and foster the export of Australian VET products and services (EdNA VET Advisory Group, 2001, p. 14).

Under the leadership of ANTA, many training packages with strong emphasis on ICT-mediated (computer-based training, online learning, video-conferencing) learning have been developed for the TVET sector. The college network in Adelaide makes extensive use of video-conferencing to eliminate unnecessary travel across campuses. Video-conferencing is also used in Queensland to train personnel for the hospitality industry. Australia is experimenting with the use of AsiaSpace, a point-to-point satellite service for online learning. This system has the capacity to deliver data to fixed and mobile locations without phone (Tapsall and Ryan, 1999). State of Victoria is planning to launch TAFE Online, which will be a web-based campus representing 30 TAFE colleges. All states are implementing coordinated and centralized networked online system for information and student administration. Several states have also implemented learning centres to encourage the use of multimedia and video-conferencing.

Onkaparinga Institute of TAFE (Technical and Further Education) in South Australia uses CD-ROMs in many of their courses, in fields ranging from community services and health, horticulture and agriculture, to transport engineering. One of their transport engineering courses offers training in Heavy Vehicle Mechanics. In 1997, the institute began to use interactive CD-ROMs as a learning tool for their students in this course. Both the practical and theoretical components of the course material were provided on the CD-ROMs. The materials are presented using text, audio, graphics, and video and are geared to students who prefer less text, and more user-friendly and interactive presentations, including diagrams, photographs, and video. Some of the modules developed on the CD-ROMs are being used in the actual workplace where the computers are located at the end of the workbench and provide step-by-step instruction for specific tasks.

Australia has also some exemplary online training initiatives in the private sector. For example, Quantas College Online was established to serve 30,000 employees who are unable to attend face-to-face training because of their shift work and travel. The rapid growth of ICT-mediated learning in Australia has been fuelled by the reluctance of employers to release trainees during working hours.

A recent study conducted by Misko (2000) showed that "online delivery of instruction is still in its formative stages in Australia TAFE colleges" (p. 12). Another research conducted by Mckavanagh et al. (1999a, 1999b) cited by Brennan, McFadden, and Law (2001) found that:

- A lot of the delivery was not yet online, although there were a lot of plans.
- Most online modules had a nominal duration of 40 hours.
- The number of enrolments reported for 73 valid cases from 12 different providers varied from six to 144, with a median value of 31, again indicating the small present scale implementation of online learning in VET.

Lewis (2001) indicated that Australia is also working on the next generation of online learning based on the concept of toolboxes.

Canada

Canada has four national programmes that affect virtual education and training. First is Office of Learning Technologies (http://olt-bta.hrdc-drhc.gc.ca/indexx.html), which works with governments, institutions, and private sector organizations to promote research, assessment, and use of technologies in education; raise awareness of the opportunities, challenges and benefits of technology-based learning; and act as a catalyst for innovation in the area of technology-enabled learning and skills development. The second is School/Net, an initiative of governments, the business sector, and the educational community. It provides a wealth of information and promotes the use of the Internet in the school systems. Third is Telelearning Network of Centres of Excellence, located at Simon Fraser University, which researches, develops, and demonstrates effective tele-learning pedagogies to support the development of knowledge economy. Finally, Canadian Association for Distance Education promotes research and organizes conferences and workshops for professionals working in distance education. Several examples of virtual education can be found in the school system, from kindergarten to university level. Exemplary programmes implementing ICTs in TVET are: Mount Royal College in Calgary, which offers a programme in critical care nursing for Web delivery; and George Brown College in Ontario, which has developed a complete Electrician Technician Certificate for delivery via CD-ROM (Farrell, 1999).

Chile

Chile's Instituto Nacional de Capacitacion Profesional (INACAP) provides technical and vocational education through its distance education branch, Sistema Nacional de Capacitacion a Distancia (SINCAD). Twenty-five offices throughout the country offer three types of vocational courses: basic occupational training, technological training programmes, and specific training courses. Following an introductory session, students learn independently using self-study materials, audio and video cassettes, slides, or meetings with the teacher. A certificate is awarded to the candidate following the successful completion of the final exam (Stevens, 2001, p. 51).

China

Government policy in China aims to train 22 million secondary vocational graduates and 8 million higher vocational education graduates within five years. There is also a need to train 50 million city workers annually. Additionally, 2 million displaced workers need to be retrained and 150 million rural people need to be trained prior to transfer for city work. Given this magnitude of the country's training needs, the government is taking major initiatives promoting the use of ICT-mediated learning. The ChinaOnline (2001) (cited by ANTA, 2001a) reports that "Ministry of Education (MOE) hopes that by 2010, distance-learning networks will be available for everything from basic to graduate education, vocational programmes, teachers' training and specialized instruction for rural and rural labourers." MOE has established China Education and Research Computer Network (CERNET) to link all potential online service providers. An enormous rate of growth in Internet users is expected in China over the next few years.

Europe

Lisbon European Council (2000) (cited by ANTA, 2001a) stated that although Europe has one of the world's highest level of education and necessary investment capacity, it still lags far behind in the use of ICTs (p. 36). The European E-learning Action Plan was adopted in March 2001. The objective is to "make lifelong learning the driving force behind a cohesive and inclusive society within a competitive economy" (p. 40).

Massy and Ward (2002) conducted a survey through European Training Village to determine the extent of use of new technology in training and learning in Europe within organizations using e-learning in TVET. Results (Table 12) showed that about a quarter of respondents' training time in Europe was spent either in e-learning (11.6%) or in blended learning (15.4%).

Table 12. Time spent on e-learning, blended learning, and classroom tuition in selected EU Member States

	Classroom instruction	E–learning	Blended instruction
Finland	67.4	8.5	21.4
France	41.7	8.8	13.9
Germany	36.3	13.2	16.9
Greece	62.5	3.3	8.8
Ireland	23.9	7.8	17.4
Italy	50.4	14.0	11.0
Netherlands	42.6	15.9	24.4
Spain	32.3	13.7	20.3
Sweden	76.8	4.1	8.7
United Kingdom	43.5	12.0	10.9
European Union	43.4	11.6	15.4

Source: Massy, J.H. and Ward, T. "The European E-learning Market 2002". Published by Bizmedia Ltd 2002. www.elearningage.co.uk

European Centre for the Development of Vocational Training (CEDEFOP) is an initiative of the European Community. The Centre keeps vocational education and training stakeholders in Europe informed of the present and future trends in VET using an interactive web site, newsletter, journal, seminars, and workshops. CEDEFOP sustains links between policy makers, organizations, and practitioners across Europe and provides information and advice to help them make informed choices about vocational training policy (ANTA, 2001a).

European Training Village (ETV), a project of the European Union, is part of CEDEFOP. The objective is to provide state-of-the-art information about innovative training methods to key stakeholders.

In 1995, European Union established a task force to allow six European programmes (Socrates, Leonardo da Vinci, TSER, Esprit, Telematics Applications, and TEN-Telecom) to collaborate for boosting the development and implementation of ICTs in education.

Republic of Korea

Founded in 1997, Korea Polytechnic University's mission is to provide continuing education to technicians. The Polytechnic must also train technologists through distance education and provide tradespersons with field experience as well as face-to-face education. The university has established Centre for Distance Technology Education and Training to develop virtual courses and to design different models of ICT programme delivery (Robertshaw, 1999). The Human Resources Development Centre (HRDC) in Samsung Group has established a web server and developed virtual courses and web video lectures for their members. Samsung Cyber Campus (http://cyber.samsung.net) now offers a more integrated form of virtual training. South Korea hosts a UNESCO Centre of Excellence in TVET.

Mongolia

The government is committed to provide free access to the Internet to all Mongolians and to create the necessary environment for the development of ICT knowledge and skills. Ministry of Education has adopted a facilitating order for the integration of ICTs in education by year 2010. The following enabling initiatives have already been implemented:

- National Park was established in 2002 to provide ICT skill development for young people.
- The establishment of a computer network connecting all TVET schools.
- ICT training for teachers and trainers.
- Investment in the ICTs in education.

Mongolia has acquired the technology and the expertise to implement distance education. In 1994, UNESCO implemented a distance education programme in Gobi to assist women to prepare dairy products and run small business. Non-Formal Education Centre has been established with the assistance of Korean Government (NIER, 2002).

Namibia

Vocational education and training in Namibia is provided by seven government and government supported centres and seven community skills development centres. Open and Distance Learning (ODL) account for 52% of all tertiary enrolments and is offered through learning centres located in all regions of the country. ODL programmes extend face-to-face offerings and are mainly focused on easily accessible target groups. Course delivery is done using mainly printed material supported by inconsistent tutorial guidance. Only one centre has so far introduced video-conferencing and online delivery. The drop out rate among OLD students is extremely high (46.8%).

Support from the European Union has enabled the country to establish Namibia Open Learning Network (NOLNET). This network will provide the learning centres with better learning resources.

Presidential Commission on Education, Training, and Culture has recently made a series of recommendations to address issues of access, relevance, efficiency, equity, quality, integration, and flexibility of programmes and programme delivery (Polytechnic Task Force v2030, 2003).

New Zealand and the Pacific Islands

New Zealand has no coherent policy for the integration of ICTs in education. While the country has one of the highest per capita telecommunications access among developed countries as well as the highest rate of penetration of the Internet, educational institutions are not being adequately funded to purchase ICTs. Additionally, they lack a coherent vision and champion for courses as well as trained staff and support systems (Rajasingham, 1999).

Open Polytechnic is New Zealand's leading provider of open and distance learning and the largest tertiary-level institution with an enrolment of over 30,000 students annually. It uses mostly print-based learning material supplemented with audio and/or videotapes, audio graphics, and teleconferencing. The Polytechnic operates from a central base in Waiwhetu in Lower Hutt, with business centres in Wellington, Auckland, and Christchurch. Over three-quarters of current students are studying part-time to enhance their career opportunities. Seventy-three per cent are over the age of 25. The institution offers over 130 programmes and 1,300 courses and grants formal qualifications at the certificate, diploma, and degree levels. Most courses are approved by New Zealand Qualifications Authority and registered on National Qualifications Framework. Major programmes offered are: business and management, computing, information systems and technology, engineering and technology, financial services, and planning and construction. Open Polytechnic has recently established Open Mind Online, and is now offering business programmes and qualifications through this medium (Stevens, 2001, p. 17).

The research showed that University of South Pacific is using a satellite network that links five centres, namely Lautoka, Fiji, Cook Island, Tonga, Vanuatu and Samoa to provide distance education. ICTs are also used in these centres for career counseling (Rajasingham, 1999).

Singapore

Singapore Polytechnic has spearheaded several development projects, such as the CD-ROM-based Electronic Lab Book (ELB), Virtual Lab (Vlab), Electronic Performance Support Systems (EPSS) for the marine industry, and web-based EPSS. Current EPSS projects include EPSS for marine operations and EPSS for marine regulations. (Banerji, 1997 as cited in Banerji, 2000). The web-based EPSS initiative has led to the development of Virtual College, which operates and administers a large collection of interactive, online learning modules: Diploma in Accountancy, Diploma in Media and Communication, Diploma in Chemical Process Technology, Diploma in Plastics Technology, and Diploma in Architectural Technology, to name only a few. Two major goals of this college are "to provide continuing education and lifelong learning for graduates and professionals in industry" and "to supplement conventional lectures and improve teaching and learning through Information Technology for full-time students" (Cheong et al., 2000, p. 4).

United Kingdom

British Educational Communication and Technology Agency (BECTA) was established by United Kingdom government in 1998. The role of BECTA is to promote the use of ICTs to improve and transform learning, teaching, and leadership in schools, colleges and lifelong learning. BECTA provides advice and support educational users in the effective integration of ICTs into their work.

The UK has set up University for Industry (UfI) to provide workers from small- and medium-size enterprises with job-related education and training. The UfI will be instrumental in developing a national network of learning centres. It will take a leadership role in drawing all stakeholders together, provide guidance so that workers can achieve their potential, promote lifelong learning, and co-ordinate the infrastructure of information (Mason, 1999).

Most TVET institutions have ICT equipment and usage limitations.

LAO-PDR	The provision of ICTs in Lao TVET institutions requires urgent attention.
Nepal	ICTs are at an early stage of usage in TVET institutions, and will require significant resources to implement.
Bhutan	ICT are at an early stage of usage in TVET institutions, and will require significant resources to implement.
Sri Lanka	There is increasing use of ICTs for both administrative and teaching purposes. There is limited knowledge and skill of ICT application in teaching and learning.
Thailand	Better provision and effective usage of ICTs in TVET for both learning and management purposes is needed. There is increasing use of ICTs for both administrative and teaching purposes UNESCO (2004).
Viet Nam	Encouragement is given to innovate teaching and learning. The use of ICTs has been introduced. Distance education techniques are used to offer TVET, with the television being the main mode of delivery. Vocational teachers are reluctant to use ICTs in the classroom.

United States

Dirr (1999) observed that "there has been an explosion of interest in distance and virtual education in recent years in the US." He noted that 3,000 colleges and 1,400 universities were offering distance education courses and programmes and that 79% of all the institutions were offering one or more distance education courses. In the US, the community colleges are the largest providers of TVET. Because of their open-door mission and tradition to community service, the community colleges have been quick to embrace ICT-mediated learning. Recent statistics indicated that 87% of the colleges had the necessary infrastructure for satellite video-conferencing, 60% were equipped for two-way video-conferencing, and one-third were using T1 lines. Fifty per cent of the colleges were actually using two-way video-conferencing for teaching and another 4% expressed an interest in adopting distance education. In 1997, 80% of the public two-year colleges offered distance education courses, and 62% of their students were enrolled in these courses

in 1997–98. Distance education is reducing the degree completion time for college learners (Olson, Coyner and McCann, 2000).

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding how other countries are using ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship how other countries are using ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding how other countries are using ICT-mediated learning in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience generate a list of good practices integrating the use of ICT-mediated learning in TVET.
- Ask a group of key stakeholders in TVET to review this list.

USE OF ICTs FOR PROGRAMME SUPPORT IN TVET

Does your organization use ICTs for programme support in TVET?

TVET makes considerable use of ICTs to support its programmes. This section provides a description of this usage. More specifically, the discussion will focus on the use of ICTs for administrative purposes, career education and guidance, labour market information, placement of graduates, information search and retrieval, communication purposes and programme design and development.

USING ICTs FOR ADMINISTRATIVE PURPOSES

The use of ICTs in education for administrative purposes has met less resistance and has been more readily accepted and adopted. This is, perhaps, because educational administration embraces the management rather than the educational paradigm; and ICTs are perceived as empowering rather than threatening, as is sometimes the case in the teaching profession. ICTs have been very effective and used in TVET for the following administrative purposes (Table 13):

Table 13. Administrative uses of ICTs

Uses of ICTs	Specific functions
Accounting	Budgeting, purchasing, grants administration, cash flow, account receivable, account payable, audits.
Advertising	Promoting programmes and courses offered.
Staff administrative services	Human resources management – assessing staffing needs, recruiting staff, monitoring staff performance records, communicating with staff. Human resources development – conducting needs' assessments, needs' analyses and training needs' analyses, delivering and assessing employee training.
Student administrative services	Recruiting and selecting students, advising students, supporting prior learning assessment and recognition, registration, recording attendance, record, and fee payment.
Support services	Providing programme information – calendar featuring programme and course description; pre–requisites and other requirements; keeping records to comply with freedom of access to information; maintaining web site giving access to administrative units, faculties and departments; managing computer and e–mail accounts for faculties and students.
Research and evaluation	Conducting institutional research, programme evaluations, and student assessments of faculties; statistical analyses.
Physical plants	Keeping records and inventory of facilities and equipment; storing information on occupational health and safety, including workplace hazardous information system.
Fund raising	Establishing databases for fundraising; keeping records of donations.

Management Information System (MIS) is a type of software geared specifically for administrative purposes. MIS is essentially a computer programme that can store important pieces of information. Since all the data are stored electronically, MIS facilitates the collection and analysis of these data. The data can be easily accessible to instructors and administrators, which will save time for routine tasks. There are several types of student data that can be stored: attendance, assessment, report writing, timetable, finance, communication, allocation of classroom and laboratory facilities, budgeting, cash flow etc.

USING ICTs FOR CAREER EDUCATION AND GUIDANCE IN TVET

Does your organization use ICTs for administrative purposes in TVET?

There are currently too many school leavers that "spend several years floundering in the labour market before they find steady, long-time jobs" (Stern, 1997, p. 4). The average age of beginning apprentices in Canada is 28. TVET practitioners and career guidance counselors should work in close collaboration to monitor labour market conditions and requirements in order to provide optimal services to students. Since a large proportion of secondary school leavers will not attend universities, all stakeholders need to work together to improve the image of TVET so that parents and students can appreciate the relevance and importance of vocational training.

The European Community (*Livre blanc sur l'éducation et la formation*, 1995) recognized that the individual is the most important agent responsible for constructing her/his qualifications by upgrading, combining and using acquired knowledge, skills, and training to make herself/himself employable and adaptable in the changing world. However, in the present environment where choosing and preparing for a career is like attempting to shoot at a moving target, proper career guidance and counseling are of critical importance to ensure seamless learning throughout life. The purpose of vocational guidance and counseling is to assist students to "understand and appreciate their talents; relate effectively to others; explore career alternatives; develop appropriate educational and vocational training plans; implement and complete their plans; and integrate successfully in society and the labour market" (Conger, 1998, p. 1).

The US has developed National Career Development Guidelines to assist educators in implementing career development programmes in elementary, secondary, and post-secondary education and training. The model includes three main components: self-knowledge, educational and occupational exploration, and career planning.

Career Education and Guidance (CEG) consists of a set of approaches and strategies specifically designed to enable people to make informed choices related to their education and their work (BECTA, 2001a). According to the UK Department of Education and Skills, CEG has three goals:

Self-development: helping students to understand themselves and develop their capabilities.

Career exploration: helping students to investigate career opportunities, find out about post-16 choice, and investigate the knowledge and skills people need at work.

Career management: using the results of self-assessment to implement their career, and developing effective strategies to make and implement career decisions (BECTA, 2001a).

ICTs are revolutionizing CEG by providing new ways of exploring career options through video, graphics, and sound. Many CD-ROM titles and specific web sites dedicated to the following aspects of CEG are now available: information databases, self-evaluation aids, decision-making aids, work simulations and games, psychometric tests and checklists, self-presentation aids, and career resources (BECTA, 2001a).

ICT support to Career Education and Guidance includes:

- Storing large amounts of information in a range of formats;
- Searching for and retrieving information quickly and accurately;
- Matching information to individual preferences;
- Printing out information in a personalized form;
- Simulating work environment;
- Updating information quickly;
- Providing a mechanism for sharing and communicating information (BECTA, 2001a, p. 1).

Bridges, commonly used in Canada, is career explorer software designed by career counselors to enable students from Grade 6 to 12 to explore various career options. The programme is available both online and on CD-ROM. The online

version is more accurate as it is updated everyday. The online version also supplies more resources on the Internet to further students' research and to assist them in planning their career path.

The programme offers features such as awareness tools, exploration, planning, transition, and instructional support. The awareness tool is used to expand students' knowledge regarding various career opportunities. The exploration tool is used to assess students' interests, abilities, and traits and match them to possible careers or job opportunities. On the online version, the exploration tool can be accessed through the library and be searched by using key words or career clusters. The planning tool emphasizes goal development by assisting students create a career path. The transition tool uses the career path and creates a career portfolio that keeps them informed of career news and scholarships available for their career choice. Youth also have the opportunity to create an online portfolio, which gives them the ability to store information such as references, course information, and résumés. It also offers a connecting tool that allows youth to connect to post-secondary institutions, financial aid, and employment opportunities. Instructional support provides lesson plans, new developments in their field of choice, and links to other resources. (http://cxinfo.bridges.com/) The Daily News features of this tool allow career counselors to gain access to all new content and to have access to online experts.

USING ICTs TO PROVIDE LABOUR MARKET INFORMATION IN TVET

Does your organization use ICTs to provide labour market information in TVET?

In an economy where human capital has become a critical element in the production of goods and services, easily accessible and up-to-date labour market information (LMI) must be available to students as part of the CEG services. ICTs are increasingly used to disseminate LMI. Canadian Government (Human Resources Development Canada) is using the Internet to provide detailed LMI to Canadians. This information can help people search for work, and make general employment, training, and career decisions. The Labour Market Information is accessible from the Human Resources Development Canada web site. The information is broken down by specific regions of the country and by occupational titles. Following is the Human Resources Development Canada Web Site: http://lmi-imt.hrdc-drhc.gc.ca/scripts/profile.asp?lang=eandprov=MAandgeo=B3andplat=1andtitle=sandocc=7242andopt=8

USING ICTs FOR PLACEMENT OF TVET GRADUATES

Does your organization use ICTs for placement of TVET graduates?

To a large extent, the effectiveness of TVET programmes is measured by the success of graduates to obtain jobs related to their occupational preparation. Service providers and funding agencies usually conduct follow-up of TVET graduates to assess placement rate after graduation.

ICTs are revolutionizing employee recruitment and job search. Many countries, including Australia, Canada, and the United States have created online national job bank where employers can post vacancies, and job seekers can search for jobs by occupational categories, average earnings, and geographical location. These free services have considerably reduced the time needed for matching employers and employees.

USING ICTs FOR INFORMATION SEARCH AND RETRIEVAL

Does your organization use ICTs for information search and retrieval?

In workplaces where employees' performances depend heavily on information, computerized manuals are replacing printed information. Manuals are conveniently stored on various CD-ROMs so that they are readily accessible (Kirk, 2002). In this information age the ability to retrieve and use information in form of electronic text, sound, graphics, and video is becoming an essential skill fastly. BECTA (no date, b) identified these critical skills related to information retrieval:

- ability to conduct the Internet search;
- ability to restructure information;

- ability to assess the quality of information;
- ability to assess the validity and authenticity of material;
- ability to assess the quality of information;
- ability to select the most appropriate source of information;
- ability to download and save information.

All education institutions in developed countries host digital library catalogue systems where teachers and learners can perform a computer-based search. Searches can be done on a number of variables such as authors, subject, titles, and keywords and can use searching limits such as the date or year published, language, and material type (IITE, 2002b). Educational institutions can also purchase licenses to electronic databases that contain bibliographic information for books, articles, and journals. These databases span several different disciplines, such as engineering, science, social sciences, and humanities.

UNESCO Institute for Information Technologies in Education (2002b) hosted the expert meeting and workshop to address issues dealing with digital libraries.

The final report of that meeting can be obtained from the IITE web site: www.iite-unesco.org

The Internet revolution has spawned a new approach to information retrieval, allowing teachers and learners to access information from all over the world in fractions of a second. Some educational institutions are placing their digital library catalogue on the web. Some public library systems are also placing their catalogue online. The British Library Public Catalogues are one of such examples (http://blpc.bl.uk/). Online catalogues can sometimes be restricted by password to students, teaching staff, or subscribers.

Some magazines and/or journals (also known as e-journals) provide their articles online where users can search and browse through the current issue or archived issues. Examples of such journals/magazines include Techknowlogia (http://www.techknowlogia.org), Syllabus magazine (http://www.syllabus.com/) and International Review of Research in Open and Distance Learning (IRRODL) (http://www.irrodl.org/).

Individuals can use search engines to find information on the web. Examples of search engines include AllTheWeb, AltaVista, AOL, Excite, Google, Hotbot, Lycos, and Yahoo. There are also meta-search engines that submit the keywords to multiple search engines, and the results from the different search engines are returned. Examples of meta-search engines include Surfwax, Copernic, and Ixquick (IITE 2000b). Better search results can be obtained by using specialized information systems.

Following are examples of online research databases in vocational and technical education and training:

1. UNESCO International Centre for Technical and Vocational Education and Training (UNESCO-UNEVOC International Centre), Bonn, Germany hosts the online research database featuring full text documents dealing with TVET. (http://www.unevoc.de/publications/index.htm)

2. ETV (European Training Village) is an interactive platform; a meeting point for policy-makers, social-partners, practitioners, researchers, and all those with an interest in vocational education and training. Experts in the field can share and exchange knowledge and experience with associates within and outside the European Union. The ETV is administered by CEDEFOP, the European Centre for the Development of Vocational Training. (www.cedefop.eu.int)

3. National Research Centre for Career and Technical Education conducts research and development in Career and Technical Education in the US. (http://www.nccte.org)

4. National Dissemination Centre for Career and Technical Education: (www.nccte.org)

5. VOCED is an international database of research abstracts for technical and vocational education and training. It is hosted by Australia's National Centre for Vocational Education Research (NCVER) as part of its role of a UNESCO regional centre of excellence in technical and vocational education and training, and Adelaide Institute of TAFE (Technical and Futher Education). (http://www.voced.edu.au/) UNESCO-UNEVOC Centre of Excellence in TVET in Partnership with Adelaide TAFE.

Other databases of interest to TVET practitioners and learners include online job banks, labour market information, and directories of TVET institutions and programmes.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the specialized use of ICTs in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the specialized use of ICTs in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the specialized use of ICTs in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience generate a list of good practices regarding the specialized use of ICTs in TVET.
- Ask a group of key stakeholders in TVET to review this list.

SPECIALIZED USE OF ICT–MEDIATED TEACHING IN TVET

This section provides a discussion in depth on the specialized use of ICTs for teaching and learning. The discussion is focused on current practices as well as the issues and concerns regarding the use of ICTs for teaching attitudes and practical skills, for workplace training, study at home, assessing teaching and learning, prior learning assessment and recognition, virtual internship, and assistive technology to accommodate people with special needs.

USING ICTs FOR WORKPLACE TRAINING

Does your organization use ICTs in TVET for workplace training?

Conference Board of Canada (2001a) notes: "More than ever, employers depend on knowledgeable and skilful employees to create value-added products and services, efficiently and effectively, so that they can compete successfully." (p. 3) Economic prosperity in the global economy is becoming highly dependent on an ability to develop, attract, and maintain a well-educated workforce. As a result of these changes, the demand for skilled workers often exceeds the supply in many sectors of the economy. Seventy per cent of Fortune 1,000 companies perceive the lack of a pool of talented workers as the biggest barriers to sustaining growth. In order to ease this skill gap, employers are significantly investing in workplace education and training.

Trends indicate that workers acquire 70% of the skills they need for the workplace through informal training. Employers are increasingly embracing e-learning solutions to meet this growing requirement for workplace training. It appears, however, that information on employers' involvement in e-learning may not be readily available.

In its recent survey of 29 countries with advanced economies, Organization for Economic Co-operation and Development (OECD) found the two most important incentives to integrate e-learning in the corporate world were reduced costs and increased flexibility (OECD, 1999). Bates (2001) noted that the most dramatic impact of ICTs has been on campus learning and corporate training. Canadian employers intend to increase their use of e-learning from 17% to 24%. This is consistent with American counterparts who also foresee a growth in the use of ICTs for workplace learning – from 19.8% to 24%. It is estimated that 50%–70% of American firms use the web for instructional delivery, and that corporate spending for online learning in that country will reach $11.4 billion (Zirkle, 2002). The estimated growth of e-learning for 2003 in the corporate sector and higher education, combined, is in the area of $18 billion (Bates, 2001). A significant proportion of employers are using both the Internet and Intranet to meet their learning needs. Research conducted by Conference Board of Canada (2001a) indicates that the top reasons given by employers for using ICTs in training and development are improved just-in-time workplace learning (60%), cost-effectiveness (45%), greater control of employees over learning (35%), and best fit with organization's workplace learning needs (33%).

In recent years there has been a proliferation of "corporate universities" in the private sector. These training facilities make extensive use of ICTs such as video-conferencing and the Internet for teaching. The unprecedented demand for workplace training has also encouraged the development of an online learning industry led by contractors interested in servicing the training needs of small- and medium-sized companies (Bates, 2001). Fifty-one per cent of Canadian employers' e-learning solutions are developed in-house, while 49% are acquired off-the-shelf (Conference Board of Canada, 2000).

Although corporate e-learning is growing at an exponential rate and is perceived by many employers as an essential tool for keeping their employees' workplace ready, there are serious barriers that hinder e-learning implementation. The top three starting barriers are cost of learning technologies, time required for programme development, and lack of content in learning technology format. The top three implementing barriers include cost of learning technologies, lack of dedicated learning time, and time necessary for developing e-learning programmes (Conference Board of Canada, 2000).

USING ICTs FOR STUDY–AT–HOME TVET PROGRAMMES AND FOR INFORMAL SKILLS DEVELOPMENT

Does your organization use ICTs in TVET for Study–at–Home TVET Programmes and for Informal Skills Development?

The high demand for skilled workers coupled with the growing requirement for some form of technical training as a condition for initial employment, is challenging TVET institutions. Even in well-developed countries it is common for cash-strapped institutions to list a two- to three-year waiting list on some high-demand training programmes. A two-tiered TVET home-study system is flourishing as a result. Many of the TVET home-study programmes are run by private and for-profit organizations, although some public institutions are also involved. While a two-tiered system for health care meets considerable resistance in many countries, it appears to be more acceptable for training, thus giving the "haves" easier access to skills training than the "have-nots".

Home-study programmes are available in a wide range of trades and professions, from auto mechanic to accounting. Delivering these programmes has traditionally relied heavily on print-based materials; however, in recent years more ICTs have been used to deliver programmes. For example, Education Direct is a "Train at Home" Canadian correspondence school offering TVET programmes in over 55 occupations to Canadians. Education Direct (www.edudirect-canada.com) is fully accredited by Canadian Education and Training Accreditation Commission (CETAC).

Using ICTs for informal skills development

Does your organization use ICTs for informal skills development?

According to ILO World Employment Report (1998) the great majority of new jobs in developing countries are being created in an informal economy. This economy can be defined as "small and micro scale economic operations that are not institutionalised through business registration or registration with other regulatory authorities and undertaken with little investment" (National Institute for Policy Research, 2002, p. 22). ILO estimates that this informal economy involves approximately 500 million jobs. This job growth in the informal economy operates primarily in agricultural, industrial and service sector activities both in rural and urban areas and comprises mostly the poor. The rise of the informal economy can be attributed to inadequate job growth in the formal economy.

In addition to the technical skills, workers involved in the informal economy must also possess a set of generic competencies in the following domains: cognitive, social, and entrepreneurial skills (Singh, 2000). National Institute for Policy Research indicated that skill training could play an important role in improving the management capability and productivity in the informal economy. The Institute also provided a list of critical training needs:

- management/entrepreneurship;
- enterprise development;
- multi-technical skills;
- use of appropriate technology;
- access to and analysis of information on product design and development.

The Institute further noted that institutional training systems are not responding to the training needs of informal sector workers. It, therefore, recommended introducing open learning, mobile training, and distance learning to meet the training needs of these workers.

The increased demand for informal learning is not unique to developing countries. A study conducted by Livingstone (2000) suggested a trend toward the vocationalization of informal adult education. Two-thirds of adult Canadians surveyed were involved in informal learning related to their current or future employment for an average of six hours a week. Canadian Commission for UNESCO (2002) identified four main barriers preventing Canadians from participating in adult education. These are lack of time (60%), family obligations (women: 26% and men: 15%), education and training costs (40%), and timing and location at which education is offered (40%).

USING ICTs FOR ASSESSING LEARNING

Does your organization use ICTs for assessing learning?

Three broad strategies are used in assessing performance in TVET. Cognitive skills are assessed using written tests, practical skills are assessed for process and product, and attitude is assessed through ongoing observation. ICTs can provide considerable support to TVET instructors in the assessment process. A computer with the associated software can be used to design, develop, administer, score, and evaluate objective tests and examination. A hand-held computer can be used for the progressive assessment of practical work or to record observation data in the assessment of attitudes. Electronic records of performance allow instructors to monitor students' progress regularly and identify patterns and trends that would lead to improved teaching. ICTs can also be used to assist students in generating an electronic portfolio.

USING ICTs FOR PRIOR LEARNING ASSESSMENT AND RECOGNITION

Does your organization use ICTs for prior learning assessment and recognition?

As a result of changes in many sectors of the economy, there has been an increased interest in developing and implementing policies and practices for assessing and recognizing prior learning in order to ease skill gaps. The process is known as Prior Learning Assessment and Recognition (PLAR). The concept of Prior Learning Assessment and Recognition (PLAR) grew out of the need for lifelong learning. Conference Board of Canada (2001b) further highlights the benefits of PLAR for educational institutions and adult learners (Table 14).

Table 14. Benefits of PLAR for educational institutions and adult learners

Benefits of PLAR to educational institutions and adult learners	
Institutions	**Learners**
• Greater number of learners in learning programmes • Meet societal needs for holistic learning and personal development • Provide more lifelong learning opportunities • Enhanced recognition of learning environment • Make better use of resources • Provide access to a wider range of potential learners • Enable institutional growth • Increased access to employment opportunities and promotion	• Higher income • Enhanced personal development • Greater lifelong learning opportunities • Reduced duplication of education and training • Enhanced quality of life • Increased job mobility, access to employment, and enhancement of career development • Learners who are members of disadvantaged groups gain more equal access to learning

Source: The Conference Board of Canada (2001b)

ICTs can be used in TVET to provide new and innovative strategies to facilitate the assessment and recognition of prior learning. Alboim (2002) presented a very comprehensive model of PLAR involving the use of ICTs at Canadian National Summit on Innovation and Learning. Her model is primarily designed to facilitate the labour market entry of skilled immigrants in Canada. The main role of ICTs in this model is through an Internet portal. Some key components of this proposed portal include (1) information; (2) assessment services for academic achievement, technical skills, language and Canadian work practices; (3) labour market counselling and learning plans, and (4) mentorship by Canadian practitioners.

Canadian Council for Human Resources in the Environment (2002) also presented an electronic immigration-screening tool at the above-named summit. Canadian Information Centre for International Credentials (CICIC) is a Canadian initiative for using ICTs for the assessment and recognition of Canadian and international educational and occupational qualifications. CICIC collects, organizes, and distributes information, and acts as a national clearing house and referral service to support the recognition and portability of Canadian and international educational and

occupational qualifications. In partnership with the provinces and territories, CICIC also provide current information about post-secondary education systems in Canada for a variety of users, including Canadian missions and evaluation agencies abroad.

CICIC submits detailed information about Canadian post-secondary education for the World Higher Education Database (WHED) CD-ROM, a powerful research tool that facilitates comparison of credentials from every part of the world. Source: http://www.cicic.ca/indexe.stm

USING ICTs FOR VIRTUAL INTERNSHIP

Does your organization use ICTs for virtual internship?

The uncertainty regarding the efficient and effective transfer of knowledge and skills acquired in formal TVET to the workplace is a major concern to educators. To overcome this difficulty TVET educators have established cooperative education or internship programmes that give students the opportunity to practice their skills in the real work environment under the supervision of experienced workers. While these programmes have proved to be very successful, they are resource-rich. Therefore, they are reaching only a limited number of students. Additionally, students from rural areas may experience difficulties in locating a suitable internship site. It is also very costly to sponsor international internships that give students international work experience.

In order to address these shortcomings, a group of European educators and business leaders have used ICTs to support a system of Virtual Internships. The colleges taking part in this innovation were Tietgen Business College, Denmark; Arcada Polytechnic, Finland; Buserud University College, Norway; and Institut de Formation International, France. Four companies also participated: Tronrud Engineering; Kremlin, Inc; ICL Invia; and DFDS Transportation Group.

The project team defined a virtual internship as an activity that involves the use of the ICT supported environment where students interact with each other and with companies, independent of time and space and across traditional geographical boundaries. In this environment, effective communications are created between students, faculty, and company representatives, in order to carry out a specific and meaningful work-based activity that fits within the student's compulsory education environment.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the specialized use of ICTs in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship the specialized use of ICTs in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the specialized use of ICTs in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience generate a list of good practices regarding the specialized use of ICTs in TVET.
- Ask a group of key stakeholders in TVET to review this list.

ISSUES REGARDING THE USE OF ICTs IN TVET

Has your organization addressed the issues regarding the use of ICTs in TVET?

This section deals with various issues and concerns to consider when integrating ICTs in TVET. The discussion is focused on barriers to the integration of ICTs in TVET.

Haughey (2002) identified the following five policy issues and concerns:

1. Infrastructure: Appropriate infrastructure must be available to ensure equity of access and proper delivery of content.
2. Administration: The system must provide adequate resources and support for technology integration.
3. Learning: ICTs must be used to enhance learning.
4. Teaching: Teachers need to be adequately prepared for using ICTs to teach and facilitate student's learning.
5. Content Development: Content development can be costly and time-consuming, and the content itself can have a short shelf life. Developing and keeping high quality instructional products up-to-date is a major challenge for TVET.

While technology-enhanced education holds great promise, its widespread implementation also poses some immediate challenges with respect to capital outlays in hardware and software, equal access to eliminate technological "haves" and "have-nots", appropriate strategies for integrating technology across curricula, copyright issues, and availability of pedagogically sound materials. Teacher development is a major challenge for the implementation of technology-enhanced learning since for most teachers information technologies are both exhilarating in their possibilities and daunting in the uncertainty created by the speed of change (Council of Ministers of Education, 1997).

Conference Board of Canada (2000) has identified nine of the most common challenges faced by employers who have attempted to use ICTs for workplace learning. These are lack of time, money, and support; technological and systemic limitations; difficulty of using ICTs; no evaluation of outcomes; resistance to change; lack of planning; lack of communication; lack of leadership; and learner resistance.

Stevens (2001) also identified five barriers related to the implementation of ICT-mediated learning in TVET, namely content and curriculum, appropriateness and efficacy of technologies, quality and branding of programmes, stakeholders' resistance to innovations, and the digital divide.

BARRIERS TO THE INTEGRATION OF ICTs IN TVET

Further we will focus on the most critical barriers identified in the literature, namely content and curriculum; appropriateness and efficacy; quality and branding of distance and e-learning; stakeholders'resistance (teachers, institutions and students); lack of appropriate software; digital divide; cognitive divide; and copyright issues.

Content and curriculum

While much attention is being given to the development technologies that drive ICT-mediated learning, one of the most critical issues remains the curriculum content. Stevens noted: "A current impediment to the further growth and

diffusion of more advanced systems in all parts of the world is the unavailability of relevant, well-designed instructional content. This is particularly true in the technical/vocational training area." (Stevens, 2001, p. 52) Considerable up-front investment must be made in developing programme materials for electronic delivery. This is especially problematic in TVET because recovering investment costs could be difficult or even impossible due to the relatively small markets, particularly in developing countries.

Appropriateness and efficacy

There is a perception that distance education is not an appropriate method for delivering vocational and technical skills. However, "... for many occupations within the emerging 'knowledge economies' the cognitive and affective learning domains are becoming more substantial relative to psychomotor skills." (Stevens, 2001, p. 52) Providing distance education in these two domains is much less challenging than teaching manual skills at a distance.

The efficacy for distance learning in vocational education will keep improving with the upgrading and improvement of learning technology, instructional design, adaptive learning models, simulation of workplace environment, learners' support systems, access to e-learning, and the development of intelligent tutoring. Greater emphasis on a self-directed style of learning and an increase in computer literacy among stakeholders will further enhance the efficacy of distance learning in TVET. (Stevens, p. 52)

Quality and branding of distance and e-learning

The proliferation of e-learning courses in North America raises suspicion among learners as to the quality of course content and the credibility of the institution. These courses must be accredited by educational authorities for e-learning to become a legitimate method of course delivery and to gain learners' confidence. (Stevens, 2001, p. 54)

Stakeholders' resistance

Teachers' resistance. The shift to technology-based learning may represent a threat to job lost for some stakeholders, thus resulting in resistance to embrace the innovation. Adopting ICTs for teaching will not result in job loss, however there will be a change in the instructor's role, moving from teaching to facilitating and guiding the learning experience. (Stevens, p. 54) Brennan, McFadden and Law (2001, p. 7) noted that "there is a potential loss of work if the scenario of teacherless classrooms comes anywhere near reality. Secondly, technology by its very existence and its degree of present and predicted permeation of education and training, throws all existing methods up to scrutiny. Practitioners are forced to examine and justify their existences." The case studies of online learning conducted by Curtin also confirmed this problem: "Where the institutional constraints are not addressed, the case studies suggest that online delivery is likely to remain an island of innovation in a sea of resistance." (Curtin, 2002, p. 7)

Institutional Barriers. Institutional barriers associated with ICT-mediated learning have been well documented in the literature. Following are some of the barriers:

- Lack of equipment and support;
- Difficulties in scheduling;
- Lack of adequate resources;
- High cost of programme development;
- Instructional difficulties;
- Difficulties in recruiting qualified instructors;
- Difficulties in maintaining reliable technical assistance and support (Zircle, 2002).

Student Barriers. There are many barriers experienced by distance education learners. These include:

- Cost of equipment and access to technology;
- Motivation;
- Lack of immediate feedback form instructors;
- Lack of adequate support and services;
- Alienation and isolation;
- Lack of ICT literacy skills;
- Lack of skills in managing data and time (Zircle, 2002).

Online learning also requires a high level of self-discipline and motivation and can often be daunting for those who lack computer and/or typing skills. The students also seemed to be uncomfortable with ICT-mediated learning. A survey recently conducted by European Training Village (E-learning and training in Europe, 2001) indicated that 61% of all respondents rated the overall quality of e-learning negatively – as "fair" or "poor". It is noteworthy that 82% of the 433 respondents were from EU countries. Research conducted in Europe also suggests that more mature and motivated learners are more likely to benefit for ICT-mediated learning than those involved in initial TVET programmes.

Lack of appropriate software

The development of ICT-mediated learning materials for TVET has been slow as compared to rate for the general education sector. This trend can be explained by (1) comparatively low enrolment in TVET; and (2) the need for a wide variety of occupational specific software in TVET. "Specifically, technology applications used in various occupational fields are not available to educators." (Allen, Walker, & Morehead 1999, p. 6)

Vocational education does benefit from manufacturers' developed software and hardware dealing with specific products or services. On the other hand, many of the products are not comprehensive enough to cover all aspects of a programme's curriculum. Herschbach notes:

> "The market for vocational education is relatively small, compared to the potential market for general education subjects in the elementary and secondary levels. On the other hand, vocational education benefits from products of all kind developed for business and industrial applications in general, although there are few instructional areas where comprehensive coverage may be expected." (Herschbach, 1984, p. 8)

Digital divide

ICTs can be seen as driving the new network economy. Access to ICTs is essential to innovation, economic growth, and social development. Research attributed GDP growth, economic activity, productivity growth, research and innovation, and higher paying jobs to the use of ICTs. Therefore, differences in access to ICTs create a "digital divide" between those who can benefit from the opportunities offered by ICTs and those who cannot (Montagnier, Muller and Vickery, 2002). This digital divide is widening inequalities between the "haves" and the "have-nots" not only between countries but also within them. Speaking on this issue, the Right Honourable Jean Chrétien, Prime Minister of Canada noted: "Alleviating world poverty is our common cause. We must share the benefits of globalization. We must give it a human purpose and a human face... And we must bridge the digital divide. We must ensure that the benefits of the information revolution are shared by all." (Prime Minister Jean Chrétien, Plenary Session of the Millennium Summit of the United Nations, New York, September 7, 2000)

ILO identified three ways in which ICTs contribute to the widening of this digital gap. Firstly, higher-level skilled workers are moving freely in the global economy. Therefore, we are witnessing a global division of labour. Knowledge workers will cross borders freely, facilitating the circulation of technology, including the growth of technology-intense industries, and helping to create a truly global marketplace for skills (ILO, 2001). Secondly, although more than 200 countries are currently using the Internet, only 5% of the world's population are actually Internet users and 88% of those users are from industrialized countries. Furthermore, within each country, access to the Internet usually depends on income, education, age, racial or cultural background, urban or rural location, gender, geography, and firm size. Montagnier, Muller, and Vickery (2002) noted that language is another dividing factor since the majority of web sites are still in English. Finally, speed separates companies and countries to the benefit of those in better position to adapt and change rapidly. ILO (2001) indicates that "a distinct minority of the world – the wealthiest, the best educated – is best placed to gain greatest advantage from these technologies." (p. 2) The digital divide has accentuated the existing social and economic inequalities among nations. The world today is divided not only by ideology, but also by technology.

To illustrate the magnitude of the divide ILO reports that the number of phone lines per capita in developed countries is approximately one line for every two citizens as compared to 1.4 phones per 100 people in low-income countries. This gap is further evidenced by the fact that of all individuals in the world using the Internet today, only 1% live in Africa (Kadius, 2002).

ILO (2001) reported: "The poorer developing countries face the formidable task of overcoming the handicaps that have so far prevented them from seizing the new opportunities. The first priority is to raise the basic education and skills levels

of their populations, e.g. by establishing policies and systems for lifelong learning." (ILO, 2002) The involvement and active participation of developed countries is crucial to bridging the ever-widening ICT gap between developed and underdeveloped countries.

Farrell cautions: "Even within developed economies, the disparity of access (to ICTs) is so great that many policy-makers fear that adopting these technologies will result in widening the gap between the "haves" and "have-nots" (Farrell, 1999, p. 6). In commenting on this issue ANTA (2001a) noted: "Lack of access to learning can be experienced in technologically-advanced countries to as great an extent as in developing countries." (p. 42). Canada and Australia are cited as countries with lack of access for groups of their citizens.

Cognitive divide

Technology is said to be driving this new economy, and human capital is its fuel (Moe and Boldget, 2000). Increasingly, human capital investment is seen as an essential ingredient in the growth recipe of advanced economies (Baran, Bérubé, Roy and Salmon, 2000). In a recent report on human resources development ILO noted: "People with low skill levels, outdated skills or no employable skills are more likely to be excluded from the labour market. Disadvantaged groups are also excluded from opportunities that are central to participation in the social, political, and cultural life of society, as a result of their limited access to education, skills training, health care, and employment. Their exclusion incurs high costs on social security systems and society in general. Also, the opportunity cost to national economies of having so many inactive people is substantial." (ILO, 2002)

Access and equity in adult education and training is seen as an essential policy for combating exclusion and promoting inclusion, especially among disadvantaged groups. Considerable efforts and resources are being devoted to providing equal education and training opportunities to all. However, having equal educational opportunities now means more than having access to education and training. It also means that a person has the repertoire of cognitive skills needed to learn and succeed in the learning environment. Many adults lack the essential cognitive literacy skills to succeed even if they were given access to education.

Cognitive-based research over the past 15 years has demonstrated that one of the most important factors contributing to achievement differences is the cognitive skills that a student brings to academic tasks. In order to succeed, a student must possess a repertoire of thinking skills that meet the cognitive demands of learning and performance tasks (Letteri, 1985). Several cognitive skill dimensions have been identified. Seven of these cognitive skills appear to contribute more significantly to effective learning (Chinien, Boutin, and Letteri, 1997). These skills are analytical, focus, reflective, narrow, complex, sharpener, and tolerant. Using these seven cognitive styles, Chinien, Paul, and Bannatyne (2001) developed ICT self-directed instructional material (LEARN – Learning Enhancement for Adult Retraining Needs) for enhancing the learning skills of adult learners. The material is available on CD-ROM, and an electronic version is also available for download at the following URL: http://www.uman-itoba.ca/unevoc/conference/chinien/index.html (Project of National Centre for Workforce Development Canada – UNEVOC Centre)

Copyright ICT-mediated learning materials

ANTA (2002c) defines copyright as "a form of intellectual property that protects literary, dramatic, artistic and musical works, films, broadcasts, sounds recordings, and published editions. Protection is also given to computer software." (p. 3)

The main goals of copyright systems are to ensure that the creators of a work are credited and compensated for their effort and to encourage creation and innovation (Dusollier et al., 2000). Copyright covers the expression of an idea, not the idea itself, which is public domain (Australian Copyright Council, 2002). Copyright protection comes into effect as soon as the creator's work is in a reproducible form. The creator should place a copyright notice and symbol on the work.

ICTs are fast becoming an essential tool in education. Consequently, educators have a growing interest in copyright issues. Many believe that copyright laws are too restrictive to allow students to benefit fully from ICTs and from the Internet, especially. The debate rages as to what constitutes acceptable use of information and just how far copyright law should extend.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding various issues related to the use of ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship various issues related to the use of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions various issues related to the use of ICT-mediated learning in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience develop specific policies to address the issues related to the use of ICT-mediated learning in TVET.
- Ask a group of key stakeholders in TVET to review these policies.

INTERNATIONAL COOPERATION AND ICTs

Does your organization participate in international cooperation involving ICTs?

To achieve TVET for all, more developed countries will need to help developing countries. This assistance is discussed in the framework of capacity-building and the transfer of technology.

CAPACITY–BUILDING IN LEAST DEVELOPED COUNTRIES

The Director General of UNESCO promotes capacity-building as a key strategy to expand the use of ICTs for teaching and learning in its Member States (UNESCO, 2002c). UNESCO has established UNESCO Institute for Information Technologies in Education in Moscow to enable the organization to contribute more fully to the development of capacity-building in the use of ICTs in education and training.

UNESCO and ILO (2002) recommendation 98 has important implications with regards to the need for more developed countries to assist TVET practitioners from developing countries in using ICTs for teaching and learning.

Member States should encourage international cooperation with a view to capacity-building in developing countries, especially in the areas of acquisition, adaptation, and application of technology, through:

- offering fellowship and exchange programme for teachers/trainers, students, and administrators/managers;
- establishing sustained cooperation between similar institutions in different countries, such as through twinning arrangements;
- providing work experience abroad, particularly when opportunities at home are limited;
- encouraging countries to present and make known their educational programmes outside their national boundaries (pp. 50–51).

TECHNOLOGY TRANSFER TO LEAST DEVELOPED COUNTRIES

With the revolution in the use of ICTs for teaching and learning, many developed countries are looking at open and distance education as an export commodity. This means that countries are expecting a return on the investment made in their national education systems. While this appears to be good business practice, it is negating the ability of ICTs to reduce the knowledge gap and disparities between developed and developing countries. There is a need for more developed countries to assist developing countries in implementing the use of ICTs in TVET. UNESCO and ILO (2002) acknowledged that international cooperation in TVET is critical "as a means of narrowing disparities between North and South and as a bridge to a more prosperous and peaceful future." (p. 51) These UN organizations consider international cooperation a critical element for renovating and sustaining TVET systems. They recommend the use of ICTs to enhance the sharing of intellectual property. UNESCO and ILO recommendations numbers 95 and 97 have implications regarding the use of ICTs in TVET.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding international collaboration and ICTs in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship international collaboration and ICTs in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding international collaboration and ICTs in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience develop specific policies regarding international collaboration and ICTs in TVET.
- Ask a group of key stakeholders in TVET to review these policies.

Has your organization established indicators of programme quality for ICT–mediated learning?

EFFECTIVENESS OF ICT–MEDIATED LEARNING

The integration of ICTs in TVET requires considerable investment in time and resources. When planning to implement ICT-mediated learning, it is critical to consider the instructional efficiency and cost-effectiveness of the technologies. Further we will focus on specific indicators of instructional effectiveness of ICT-mediated learning.

Research assessing the effectiveness of ICT-mediated learning

An analysis of the extensive amount of research conducted by Russell (1999) to assess the effectiveness of ICT-mediated learning leads to the conclusion that there is no significant difference to be observed in performance measures between learning with and without technology. A meta-analysis of over 500 studies indicated that students receiving computer-based instruction tend to learn more in less time. Baalen and Moratis identified some interesting trends from these studies:

- The preference of students for face-to-face instruction reported in the 1950s and 1960s can perhaps be attributed to their unfamiliarity to the technology. Recent research tends to show a developing preference for distance learning among post-secondary learners.
- Earlier studies were designed to demonstrate that technology would not have a negative impact on learners' performance. The goal was to prove the non-significant difference. In contrast, more recent studies have attempted to determine if technology-based learning was more effective that face-to-face instruction. Although most of these studies report no significant difference in outcome measures, many other studies reported equal or superior achievement over traditional classroom instruction.
- Earlier attempts to use technology for learning were restricted to drill and tutorial programmes. With today's enabling technology ICT-mediated learning engages learners in authentic learning tasks that allow them to use the technologies to "simulate events, communicate, collaborate, analyze data, and access information sources". (Baalen and Moratis, 2001, p. 101)

Although research on these innovative applications of ICTs in education is not extensive, some studies have demonstrated positive learning outcomes in support of ICTs.

After reviewing the literature and research on distance education, the Institute for Higher Education Policy concluded: "It may not be prudent to accept these findings at face value. Several problems with the conclusions reached through these studies are apparent. The most significant problem is that the overall quality of original research is questionable and thereby renders many of the findings inconclusive." (Institute for Higher Education Policy, 1999, p. 3) Following are some of the shortcomings identified: much of the research failed to control for extraneous variables, most studies failed to use randomly selected subjects, instrument of questionable validity and reliability were used, and many studies failed to control for reactive effects. Brennan, McFadden, and Law (2001) also concluded that "the gaps between the often rhetorical claims of 'effectiveness' and the reality of well-researched studies are not often bridged". (p. 64)

Many studies comparing ICT-meditated learning to traditional face-to-face instruction are also of limited relevance and values for two main reasons. First, it is impossible to establish a benchmark for making meaningful comparison. Second, several years of educational research spent comparing methods of instruction have failed to inform practice. The Attitude by Treatment Interaction research indicates that an instructional treatment interacts with the learner's characteristics to produce differential learning gains. Snow (1976) argued: "No matter how you try to

make an instructional treatment better for someone you will make (it) worse for someone else." (p. 292) Additionally, according to Messick (1976), "no matter how you try to make an instructional treatment better in regard to one outcome, you will make (it) worse to some other outcomes." (p. 266) Clearly, there is a need for developing a conceptual framework to guide research in ICT-mediated learning and there is also an urgent need to impose more rigor on research in this area.

After Conducting a thorough review of research on online delivery of education and training Brennan, McFadden, and Law (ibid, p. 65) concluded that there are many tensions in the literature regarding the effectiveness of online teaching and learning in TVET, notably:

- Online delivery of VET creates learner isolation versus online delivery of VET creates a community of learners.
- Online delivery promotes a transformational view of learning versus the medium perpetuates a transmission view of learning.
- Online delivery is socially and politically liberating versus online delivery is an expression of cultural domination.
- The medium encourages choice of information and learner autonomy versus the medium strictly controls information and learning.
- Online delivery facilitates new and exciting modes of communication between learners and facilitators versus online delivery further isolates those already isolated by distance, ethnicity, or socio-economic circumstances.
- Online delivery facilitates the growth of the learner versus online delivery encourages learner dependence.
- Online delivery regards the learner as a static vessel to be filled versus online delivery demands and encourages the learner to become an evolving and multidimensional individual with new skills and aptitudes.
- The site of online delivery establishes and builds a valuable learning culture versus online delivery is objective and disembodied.
- Online delivery focuses on the quality of the learning versus online delivery achieves quantifiable and sometimes narrow outcomes.
- Online delivery requires completely new ways of teaching versus online delivery requires small modifications to previous pedagogies.
- Online delivery can solve most education and training problems versus online delivery is restricted in its capacity to solve the major problems confronting education and training.
- Online delivery of education and training is engaging, intrinsically motivating, and inclusive versus online delivery of education and training discriminates against certain kinds of learners and their backgrounds and leads to disaffection with learning.
- Online delivery of education and training is predominantly a mass distributive versus online delivery of education and training is focused on communication, collaboration, and interactivity.
- Online delivery of education and training is a liberating opportunity for learning versus online delivery of education and training is characterized by low take-up rates.

Baalen and Moratis (2001) believed that assessing the effectiveness and efficiency of ICT-mediated learning using empirical research results provides only a very narrow perspective on the true value of learning technologies. He suggested that the effectiveness and efficiency of ICT-mediated learning is "emergent". By this he meant that it is only through experimentation and experience that the true value of learning technologies can be realized. Moratis (ibid) argues that the emergent concept should also be applied the resistance of stakeholders to ICT-mediated learning as the level of resistance may change with experimentation and experience.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the effectiveness of ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to use of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the effectiveness of ICT-mediated learning in TVET.

- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop a set of key indicators to assess the effectiveness of ICT-mediated learning in TVET.
- If your organization has already established indicators of programme quality for ICT-mediated learning in TVET, review and revise these indicators as may be necessary.
- Ask a group of key stakeholders in TVET to review these indicators.

Has your organization identified the potential contribution of ICT–mediated learning in TVET?

TECHNOLOGY AS AN INSTRUCTIONAL TOOL

Educators attempt to apply the small amount of knowledge they have about human learning to the process of teaching. The learning process can be divided into two broad categories: (1) learning conditions that are internal to the learners and (2) learning conditions that are external to the learners. People learn through the five senses, and the contribution of each to the amount that we learn varies. Following is estimated amount of learning from the five senses (Kupsh and Mason, 1985):

- Taste: 1%
- Touch: 1.5%
- Smell: 3.5%
- Hearing: 11%
- Seeing: 83%

The amount of information that people retain is also an important aspect of learning. Kupsh and Mason detiled the amount of information retained through the various senses over time:

- When students had heard the material they retained 70% of the information after three hours, however, after three days they retained 10% of the material.
- When students had visualized the material they retained 72% of the information after three hours, however, after three days they retained 20% of the information.
- When students both had heard and visualized the material they retained 85% of the information after three hours, however, after three days they retained 65% of the information.

Analysis of the retention rate through the various senses indicates that ICTs can be used to create a variety of external conditions that are conducive to learning and retention.

The different types of audiovisual aids that can be used to maximize learning outcomes in TVET include:

Overhead projector	Telephone
World Wide Web	Radio
Projector Simulators	Tape recorder
Digital Cameras	Computer
Online publishing	CD player
Television	Printed materials
Film strip projector	Chalk board
Scanners	Electronic board
Slide projector	One or two way video
Graphical interfaces	Satellites

Source: Chris Chinien, 2003

Specific technologies can enable people with sensory or mobility difficulties to overcome barriers which confront them in traditional learning provision. They can also enable them to participate on equal terms, since visible disabilities cease to affect interaction with able-bodied learners. This use of technology is a way of increasing equality of provision in terms of access to on-site programmes for students with special needs.

The focus of ICT-mediated instruction is self-directed learning rather than traditional teaching. Adults bring to the learning situation a wealth of knowledge and past experience with which to filter and interpret new information. According to Knowles (1975) adults feel they need to know only what is useful to them and will learn it when they feel it is important. Therefore, instructors may need to reflect on their methods of delivery and devise new approaches to learning in order to meet adult learner's needs. There is no single instructional methodology, ideology or philosophy of education that will be effective in every situation, adult education being no exception. For the instructor it is knowing when and in what situation to apply them. The reality is, "when a pedagogical methodology is inappropriately utilized, adult students may leave the class with a feeling of alienation, lack of self-esteem, intimidation and with something less intellectual than they should have received from what should have been an enlightening educational experience." (Billington, 1990; Galbraith, 1994)

This is what Jones says of the role of ICTs to facilitate learner autonomy:

> "It is important to accept that computer-aided learning can genuinely lead to autonomy, to a state in which learners exercise as much control as possible over the learning process and are as little dependent on the teacher as possible." (Jones, 2001)

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the potential contributions of ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the potential contributions of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the potential contributions of ICT-mediated learning in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop a toolkit outlining the potential contributions of ICT-mediated learning in TVET.
- If your organization has already developed a toolkit outlining the potential contributions of ICT-mediated learning in TVET, review and revise that toolkit as may be necessary.
- Ask a group of key stakeholders in TVET to review that toolkit.

Objective 3.1.3 *Identify essential ICT literacy skills for learners*

Has your organization identified the essential ICT literacy skills needed by TVET learners?

ICT LITERACY FOR LEARNERS

Jones (2001) identified the low level of learner ICT skills as a key factor that inhibits learners in an ICT-mediated environment. In 2001, Educational Testing Service (2001) convened International Literacy Panel to look at the need to measure cognitive literacy and to develop a working framework. The panel said of technology skills, that "without corresponding cognitive skills and general literacy" they "will not decrease the gaps defined by a digital divide." To the panel, ICT Literacy is "using digital technology, communication tools, and networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society."

The five components considered essential for ITC literacy represent a set of skills and knowledge presented in a sequence that suggests increasing cognitive complexity.

They are as follows:

- Access: knowing about and how to retrieve information.
- Manage: applying an existing organizational scheme.
- Integrate: interpreting and representing information, summarizing, comparing and contrasting information.
- Evaluate: judging the quality, relevance, usefulness, or efficiency of information.
- Create: adapting, applying, designing, inventing, or authorizing information.

According to Letteri (1992), a student "must possess a repertoire of thinking skills that meet the cognitive demands of learning and performance tasks. Without appropriate cognitive skills information may be rejected, lost, translated incorrectly or stored incorrectly." The students may not be able to perform a particular task because they do not possess the information processing skills demanded of them by that task. How is this solved? Many researchers postulate that the environment must be adapted to meet the learner's needs, however, a more appropriate approach would be to alter the cognitive style of the learners so that it can become more adaptable to the needs of the learning environment. (Ausburn and Ausburn, 1978)

On the basis of Feuerstein's Theory of Structural Cognitive Modifiability that demonstrates the transformative nature of the individual's cognitive structures and mental level, Letteri (1985) developed Cognitive Profile Assessment Instrument, which contains seven basic cognitive skills. These are required in order to learn and succeed in this learning environment and are bipolar measures of basic cognitive skills.

They are as follows:

- Analytical: recognizing the various components/parts of a given problem as distinct and unique pieces of the whole.
- Focus: maintaining attention to the specific and important part in the problem and disregarding all irrelevant data.
- Reflective: taking sufficient amount of time to make a complete and accurate comparison between the given problem and prior problems for correct identification.
- Narrow: selecting from alternative solution strategies the one which most accurately satisfies the problem task.
- Complex: defining the problem accurately by specific category for the purpose of selecting appropriate solutions.
- Sharpener: comparing a problem with all other problems in a similar category and applying solution procedures, which have been successful in the past.
- Tolerant: having the ability and willingness to deal with information that may not be consistent with what they know and explore novel areas of learning.

Adapted from: Chinien & Boutin, Bridging the Cognitive Divide in ICT-Mediated Learning.

These skills are essential in order to succeed in an ICT-mediated learning environment.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the essential ICT literacy skills for TVET learners.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to regarding the essential ICT literacy skills for TVET learners.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the essential ICT literacy skills for TVET learners.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop a competency profile outlining regarding the essential ICT literacy skills for TVET learners.
- If your organization has already developed a competency profile outlining regarding the essential ICT literacy skills for TVET learners, review and revise that profile as may be necessary.
- Ask a group of key stakeholders in TVET to review this competency profile.

Has your organization developed an ICT strategy to address the differing needs of learners?

USING ASSISTIVE TECHNOLOGIES IN TVET

Traditionally, people with special needs have been excluded from TVET. However, for their own well-being and inclusion in society, action must be taken to ensure that they have every opportunity to participate in vocational education. The analytical survey *Information and Communication Technology in Special Education* prepared for UNESCO states: "by definition, people with disabilities are often restricted in the extent to which they can take a full part in the society in which they live, but many of those restrictions can be reduced by their receiving good education." When the number of suitably trained teachers is limited, it is often easier to procure and provide technological solutions, and it is most fortunate that in special education, technology can play a highly beneficial role. The case study, which follows, describes an initiative of IITE (2002a) to use ICTs for people with special needs.

Most of existing technology was not initially designed to provide accessibility to people with special needs. Assistive technology attempts to bridge this gap. Assistive technology aids people with disabilities, impairments, and/or handicaps to overcome their limitations. Assistive technology can range from a simple aid, such as a crutch, to a computer-based Braille system. In order not to deprive people with special needs of any life opportunities, it is essential that assistive technology be incorporated into TVET. This section will outline some of the assistive technologies and strategies for aiding people with special needs in TVET.

In its report on *Assistive Technologies for Online Training Delivery* (which is part of the initiative within Australian Flexible Learning Framework for the National Vocational Education and Training System 2000–2004), Australian National Training Authority (ANTA, 2002a) outlines the following assistive technologies that facilitate online learning in TVET (and in general) for people with disabilities. Most of these technologies are not simply exclusive to TVET but common to SNE in general.

Braille systems for the blind

There are three main Braille systems: note-takers/writers, printers (embossers), translation software and hardware. Braille note-takers/writers support speech synthesisers "enabling the user a choice to review documents". (ANTA, 2002a, p. 7) Braille printers emboss Braille dots on special paper, and most printers connect to a PC through a serial port. Translation software and hardware converts printed documents into Braille, where software programmes convert ASCII text files into Grade 2 Braille.

Screen readers and voice synthesisers

A screen reader is a software programme that "reads the contents of the screen aloud to a user" (W3C, 1999, Screen reader). The components of a computer-based voice synthesiser also include computer software and a sound card. These systems are geared toward the blind and they read and dictate to the user what is being typed or what is on the screen. There is also specific software geared for accessing information on Internet sites, where the text on the sites is spoken to the user.

Optical character recognition (OCR) systems

OCR involves converting printed material to speech or digitized format, thus giving the blind access to printed materials. These systems include a scanner, the recognition component, and OCR software. They can accompany other assistive technologies or act as a stand-alone reading device.

Closed circuit TV (CCTV) systems

CCTV enables visually-impaired users to view enlarged text from printed material on a computer or TV screen. One configuration uses either a fixed camera situated over a movable table where the document lays, or a mobile camera that moves over a document. These systems can be connected to a computer where the CCTV image can be seen on the same screen as a computer programme, such as a word processor. An alternate configuration features a mobile, stand-alone unit that can be used in libraries, labs, shops, or the workplace.

Text enlargement software

This computer software supports visually impaired individuals by enlarging text and images on a computer screen.

Voice recognition software

Voice recognition systems allow the user to "type" and control programmes using speech. Some programmes have the ability to interpret words spoken at normal speed and have them appear in the document. Users can also edit and format text using voice commands.

Computer software

There is other software that "assists students who experience difficulties either accessing, processing, or delivering information" (ANTA, 2002a, p. 9). This type of software offers various features:

- speech feedback letter-by-letter, word-by-word, sentence-by-sentence, marked block, and proof-reading;
- word-by-word spell checking to catch errors as they occur;
- word completion and suggestion (predictive typing), which saves very slow typists from having to type the whole word;
- page modification to suit individual needs and also to select, space, highlight, and mask specific text (ANTA, 2002a, p. 10).

Keyboard alternatives

There are software programmes that assist users who have difficulty in using a normal keyboard. In the Microsoft Windows™ environment, there are various features to aid users. StickyKeys allows for commands that typically involve the simultaneous pushing of more than one key (i.e. commands that use the SHIFT or ALT keys) to be executed by pushing one key at a time. Users instruct the operating system to interpret the keys pressed as if they were pressed simultaneously. This is ideal for learners that type with one finger or a mouth stick. FilterKeys allows Windows to ignore keys that are not held down for a minimum amount of time, which aid users who unintentionally press certain keys. MouseKeys allow the mouse pointer and mouse commands (clicking, double-clicking, dragging, and dropping) to be controlled using the keyboard.

Mouse alternatives

There are several alternatives for learners who cannot use a standard mouse: trackball, mouse pen, foot mouse, mouse pad, head mouse, joystick, mouth joystick, and membrane keyboard.

On-screen keyboards

On-screen keyboards allow users to point to keys displayed on the screen using switches, a mouse, or mouse emulators instead of pushing them on a keyboard.

Teletypewriter (TTY)

TTY (also known as a text-telephone) enables people who are deaf or speech-impaired to communicate over the telephone network. Individuals type into the TTY where the text is transmitted to the other person and printed out the receiving TTY. For people who are both deaf and blind, TTY must also interface with a Braille system.

Given that web-based training is gaining widespread acceptance, it is essential to make this type of training accessible to all, including people with disabilities and/or impairments. "Authors creating web pages for online courses and information need to make them accessible to students with cognitive, motor, and sensory disabilities." (Robertson and Harris, 2003). The World Wide Web Consortium (W3C) has created Web Accessibility Initiative (WAI) that "pursues accessibility of the Web through five primary areas of work: technology, guidelines, tools, education, outreach, and research and development" (W3C, 2000, 6. *Techniques for Web Content Accessibility*). As part of the initiative, it has developed a set of guidelines, namely Web Content Accessibility Guidelines 1.0, to make web sites accessible for people with disabilities. These guidelines should be applied to TVET programmes, delivered via the Internet. A brief otherview of these guidelines is presented in Table 15.

Table 15. Web content Accessibility Guidelines 1.0 as developed by the WAI through the W3C

Guideline	Overview
Provide equivalent alternatives to auditory and visual content	Provide content that, when presented to the user, conveys essentially the same function or purpose as auditory or visual content.
Don't rely on colour alone	Ensure that text and graphics are understandable when viewed without colour.
Use markup and style sheets and do so properly	Mark up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.
Clarify natural language usage	Use markup that facilitates pronunciation or interpretation of abbreviated or foreign text.
Create tables that transform gracefully	Ensure that tables have necessary markup to be transformed by accessible browsers and other user agents.
Ensure that pages featuring new technologies transform gracefully	Ensure that pages are accessible even when newer technologies are not supported or are turned off.
Ensure user control of time–sensitive content changes	Ensure that moving, blinking, scrolling, or auto–updating objects or pages may be paused or stopped.
Ensure direct accessibility of embedded user interfaces	Ensure that the user interface follows principles of accessible design: device–independent access to functionality, keyboard operability, self–voicing etc.
Design for device–independence	Use features that enable activation of page elements via a variety of input devices.
Use interim solutions	Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.
Use W3C technologies and guidelines	Use W3C technologies (according to specification) and follow accessibility guidelines. Where it is not possible to use a W3C technology, or where doing so results in material that does not transform gracefully, provide an alternative version of the content that is accessible.
Provide context and orientation information	Provide context and orientation information to help users understand complex pages or elements.
Provide clear navigation mechanisms	Provide clear and consistent navigation mechanisms – orientation information, navigation bars, a site map etc. – to increase the likelihood that a person will find what they are looking for at a site.
Ensure that documents are clear and simple	Ensure that documents are clear and simple so they may be more easily understood.

While ICT-mediated learning offers advantages for students with learning disabilities, it also poses special problems. More information than ever is available to students through online learning, but it is not always barrier-free. A lack of awareness on the part of instructors and institutions of how ICT-mediated resources are used by students with disabilities has lead to increased resources without increased access. The technologies that should give students with disabilities greater access to learning have yet to fulfill their promise (Rowland, 2000). Web pages divided into segments or frames can confuse software programmes that translate text to voice. Graphics that have not been labeled with text will be read only as "image" by the software reading the text on the screen and will deprive students of valuable content. Web pages with a long list of hyperlinks crowded together can confuse a student with visual, cognitive, or motor disabilities.

In spite of the common misperception that ICT-mediated learning is not text-based, the opposite is true. Lectures are converted into handouts and online discussions, group activities are almost entirely text-based, and class discussion takes the form of discussion groups and real-time chats that entail exchange of on-screen text messages. Students may,

in fact, be exposed to an entire semester's worth of material (i.e. text) at once. In addition, much of this interactivity occurs without the assistance of the teacher or teacher's aid. Students learn in the solitude of their own computers. This dependency on print requires new strategies to help students bridge the gap between the online content and the student.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the use of ICTs to accommodate the differing needs of TVET learners.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to the use of ICTs to accommodate the differing needs of TVET learners.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding the use of ICTs to accommodate the differing needs of TVET learners.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your Transformative Reflection experience, develop an ICT strategy for accommodating the differing needs of TVET learners.
- If your organization has already developed an ICT strategy to accommodate the differing needs of TVET learners, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

Has you organization developed an ICT policy regarding health and safety issues?

HEALTH AND SAFETY ISSUES: USING ICTs IN TVET

TVET educators are in general very safety conscious, and they strive to eliminate all hazards associated with potentially hazardous equipment and materials in the training environments. The same safety consideration should be applied in the integration of ICTs in the learning environment. Although the safety issues regarding the use of ICTs may not appear as hazardous as working with high-speed woodworking machinery or high voltage current, there are still some critical health and safety concerns that must be addressed. Following is a brief review of the Health and Safety guidelines developed by the BECTA (2002) regarding the installation of ICTs in schools.

- All electrical systems and equipment must be constructed and maintained in safe condition.
- Power cables must be carried out in trunking that separates them from voice and data cables. Power cable should be secured and covered, and should never trail.
- Provide a minimum of four power sockets for each workstation.
- Provide power cutout switch and earth leakage circuit breaker at appropriate locations.
- Use a cable management system when necessary.
- The level of lighting recommended in ICT area is 300–500 lux to provide good contrast between screen and background environment. There should be adequate provisions for controlling glare and reflections.
- Temperature should be maintained between 18–24 degrees Celcius.
- Humidity level should be maintained between 40%–60%.
- Provide good ventilation and heat extraction when necessary.
- Flooring or carpet should be non-slip and anti-static.
- Provide a minimum of 1,000 mm between workstations for one learner.
- Provide adequate desk space for peripherals and paperwork at each workstation.
- Allow at least 850 mm of clear space in front of computer table.
- Allow at least 1,200 mm of aisle to allow wheelchair access.
- Design workstation to meet needs of persons with disabilities.
- In determining the height of the workstation the eye line should be level with the top of the monitor. The recommended height of workstations is 610–680 mm for secondary school learners and 730 mm for adult learners.
- Use a variable height workstation if possible.
- Work surface should be at least 800 mm deep. Allow between 450–750 mm form the monitor to the edge of the desk to enable learners to rest their arms and wrist on the desk when keyboarding.
- Use height and tilt-adjustable chairs. Recommended chair heights are between 370–420 mm for secondary school learners, and 450 mm for adult learners.
- Use ceiling-mounted projectors whenever possible.
- Teachers and learners must be made aware of the potential danger of staring directly into the projector's beam.
- When using mobile equipment, trailing cables must be covered and secured.
- Select lighter weight portable computers, 3 kg or less.
- Wireless networks involve health risks associated with radiation. Some equipment are supplied with signs warning users to keep clear for at least two inches from a wireless LAN PC card and eight inches from a base station. These distances should be increased when using external antennas.
- Training in using ICT learning equipment should include health and safety issues.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding health and safety issues related to the use of ICT-mediated learning in TVET.
- Examine and assess the consequences of these assumptions on your beliefs, feelings and actions in relationship to health and safety issues related to the use of ICT-mediated learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection regarding the extent to which this instruction has helped you identify and explore alternative sets of assumptions or reinforced your initial assumptions regarding health and safety issues related to the use of ICT-mediated learning in TVET.
- If this instruction has helped you consider alternative sets of assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop an ICT policy dealing with health and safety issues related to the use of ICT-mediated learning in TVET.
- If your organization has already developed an ICT policy dealing with health and safety issues related to the use of ICT-mediated learning in TVET, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

MODULE 3 ICT–MEDIATED LEARNING IN TVET

UNIT 3.2 ASSIST LEARNERS TO USE ICTs FOR LEARNING

Objective 3.2.1 Understand the need for assisting learners to transfer their learning strategies to ICT–mediated learning environment

How does your organization assist TVET learners in transfering their learning strategies to ICT–mediated learning environment?

TRANSFER OF LEARNING STRATEGIES

The way in which individuals live and work has undergone significant change due to innovation through the use of ICTs. The use of ICTs increasingly underpins many facets of modern society and is "helping" society to move rapidly toward "Society of Knowledge". In this context, learning in an ICT-mediated environment will play an important role in providing individuals the choice of learning in a way they prefer. However, in this "knowledge-age" it is not enough to have skills of accessing information in order to achieve a relative advantage. The knowledge-age indicates that there is a need to possess a unique set of cognitive skills in order to benefit from available information. Those who master the skills of collecting information, as well as the ability to analyze, classify, and organize it, will achieve a social, cultural and economical advantage. Learning plays a central role in knowledge creation which in turn is essential for the transition from a society of information to a society of knowledge. Given the role that ICTs play in that transition, it is important to understand the difference between ICT-mediated learning and more traditional forms of learning.

What defines ICT-mediated learning as a mode of learning is the learning contents being delivered by technology. It is important here to ask: are the means of delivery important enough to define a mode of learning? Can teaching contents delivered by electronic means be considered an ICT strategy? One might argue that ICT- mediated learning differs from traditional learning merely in the presentation of content. Yet, ICT-mediated learning may introduce a new strategy for approaching learning, since it integrates various components for learning, such as contents, strategies, and tutoring. In addition, people learn using different methods, and develop their own learning styles which may vary with context, task and age. ICT-mediated learning allows individuals to adopt new learning styles and this may help researchers enhance their understanding of the learning process. ICT-mediated learning strategies may lead to changes in the way people learn due to the increasing effectiveness of interoperability and security, appropriateness of time and pace, opportunity and speed. (Reeves, 2003)

Traditionally, learners in formal education environments were taught using a number of delivery methodologies that, subconsciously, shaped the way they learn and assimilate new information. These learning techniques may not always fit with the demands of an ICT-mediated environment, and many learners may be reluctant to change or adapt their existing skills. It is therefore, important for instructors to help learners develop systems that will enhance their learning process whilst recognising their exisiting skills and experiences.

According to Laurillard (1993), if instructors fail to do this:

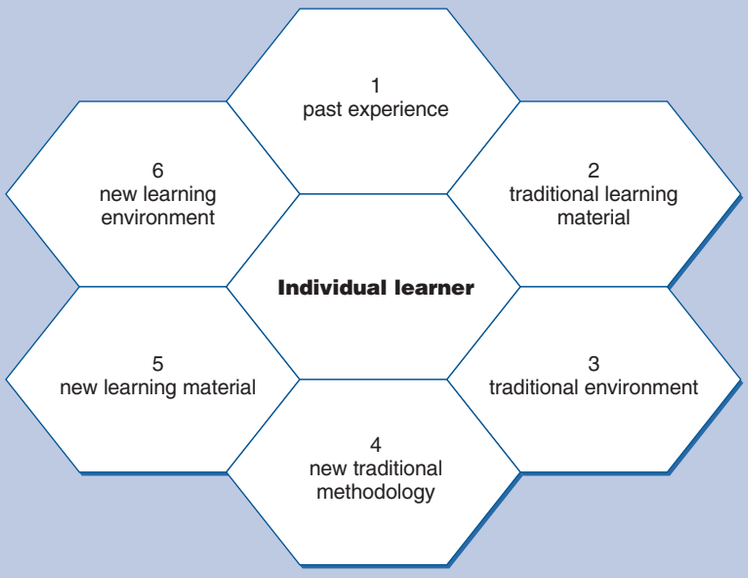
> "The knowledge that students bring to a course will necessarily affect how they deal with the new knowledge being taught ... each new course builds on an assumption about what the student has already mastered. This is a dangerous assumption ... The teacher will often be building on sand (p. 30)."

This quotation serves to illustrate the need for a complete needs analysis, help and guidance systems implemented to support students at the start of their learning programme in an ICT-mediated learning environment.

Adult learners will have encountered a myriad of learning experiences in a variety of environments yet this process often occurs without analysis of its quality or effectiveness. Adults often assume that knowledge comes with age and that the older you are, the more you know. Therefore, it can become difficult to challenge these beliefs and to assimilate new ideas and skills. Instructors can help them to overcome this and achieve more from their learning by ensuring they are aware of successful learning techniques at the beginning of the learning process.

Elements 1 to 3 of Figure 8 illustrate the traditional approach to learning often taken in further and adult education and training. The learners will have past experience of the learning process as part of their compulsory education an informal learning experiences. This method of instruction will have included traditional learning material, books, paper-based handouts, overhead projectors and television and would have taken place within traditional learning environments, such as classrooms and lecture theatres.

Figure 8. Factors that may influence learners and learning process



The individual as a learner, adapted from "Unlocking the Potential of ILT". Lockitt (1997)

Elements 4 to 6 of Figure 8 relate to the new learning methods and methodologies now implemented in further and adult education. A large number of learners accessing further and adult education in the last ten years were not familiar with new learning methodologies. These new methodologies would be presented in the form of student-centered learning, workshops, drop-in centres and distance learning. Here the learner is presented with elements of learning that place a great deal of responsibility for the learning process on the learners themselves. In this new environment, learners would also be faced with the use of new technologies where interactive learning materials are used: CD-ROM, the Internet, computer aided simulations and PowerPoint presentations. Adult learners with their traditional methods of learning have to adapt and assimilate the process of learning in a more flexible and open environment using new technology and having greater responsibility and choice for their learner pathway.

This may represent an enormous challenge to learners as well as to instructors, who may also be learning to adapt to this new environment. Instructors working in further and adult education need to be aware of this challenge and training needs to be in place to ensure that instructors are competent in learner-centred education and training methodologies, be skilled in ICT delivery and be capable of training learners to use modern learning environments, and technology. The new learning processes need to be related to and integrated with the past experiences of the learner and should be a process of building on what has already been achieved by the individual, not a process of taking them back to basics and starting again. Tutors should help learners assimilate new learning models and integrate them into their own perceptions of learning. If this process is not integrated and applied efficiently, then the learner may feel alienated or incompetent and this will result in the learners failing to achieve their learner outcomes.

Fundamental to this discussion is to consider that the design of the learning experience and the content of the course are mutually interdependent, "how" students will learn(form) and "what" they will learn (content) are interconnecting decisions.

Dearing in 1997 stated that "planning for learning means that designing the forms of instruction which support learning becomes as important as preparing the content of programmes." (Dearing, 1997, 8.13)

There is a need for institutions to address within their curriculum the developmental needs of "non-traditional learners". Provision for this can be "separate", where provision is specifically targeted at non-traditional learners or "integrated" where provision is aimed at developing requisite capabilities in all learners (Purcell et al., 2002). Warren strongly supports the integrated approach as the best means of meeting both the widening participation and "skills" agendas that are currently in place within the educational system. This approach could lead to the development of meaning-making, or semiotic tools which are specific to given disciplines or professions and the reapplication of the tools and practices of the given culture, coupled with recognition of the relatedness of tacit and codified knowledge in the context of tasks or problems, is fundamental to the development of expertise (Stiles, 2000). This supports a view that skills are more likely to be "transferable" when developed in an authentic context, rather than treated in a separate, "generic" way.

The need to encompass the diversity of all learners and different experiences they bring to the learning context requires a greater understanding of appropriate pedagogic practices by instructors. Practices that are effective for the non-traditional student are likely to be effective for all learners. This implies an increasing move to develop a wider understanding of constructivist approaches encompassing theories on the social nature of learning. Learning activities and assessment need to be "authentic" – normal to the culture in question and involve its tools and artifacts, and address the needs of the skills and lifelong learning agendas (Elton and Johnston, 2002). Entwistle (2003) advocates that both learning activity and assessment need to be clearly related to the syllabus and applied to reward understanding. Entwistle also believes that the learner's current level of development must be matched in terms of assessment, content and resources. For widening participation of students this has implications for the size of curricula.

DEVELOPING THE KOLB "LEARNING BY DOING" MODEL

The Kolb model provides a framework, based on constructivist theory to understand the type of activities learners need for "true learning" to take place. It identifies some of the activities an instructor can implement into the learning process which the learner can enter at any stage. For example, the learner may reflect upon an experience he/she had some time ago which, at the time, seemed unimportant but now has some significance. If this was the case they would enter the model at the "reflective observation" stage and work through to another "concrete experience" and then reflect upon that experience and compare it with the previous one. If they achieve the desired result they would stop at this stage and move onto something else, if not, they would proceed round the model until a successful outcome is obtained.

Kolb's *Experiential Learning* (Kolb, 1984) states that the learning experience is unique for everyone and that the identification of preferred learning styles should not be used to typecast learners. Instead, individual learning styles should be used to develop potential learning strategies. This theoretical approach should be used to focus on learning within an ICT learning environment to develop assessment and objective strategies that incorporate the demands of ICTs.

In this new learning environment it is imperative to recognize that ICTs relate to the process of teaching as much as it relates to ICTs as a tool for learning. It is merely a shift in the strategies used where the focus is now on individual learning and that the responsibility for learning must gradually be transferred from a tutor or facilitator (a third party) to the learner in recognition of his or her level of self directedness. Learning is about building on an adult's experience and prior knowledge, not simply erasing what has been assimilated in the past and starting again.

According to Reeves (2003), ICT-mediated learning cannot reach its full potential without further changes being made. Reeves advocates a mental model for ICT-learning which needs to be developed and expanded in the mind of the individual, to enable him to react to change and to solve problems. As with learning styles, these are constructed in relation to the individual experiences of the object about which the model is constructed. This is often reflected in how it relates to subject delivery, e.g. trainers may see training activities as presentations and group discussions where as subject matter specialists see ICT-mediated learning as an alternative strategy to delivering content. According to Reeves, assessments need to be improved by integrating a system for individual assessment based on the process of assessing learning outcomes. This assessment of outcomes is a far more effective tool to indicate individual learning than the traditional methods of assessment previously used by instructors. Using computers for performance assessment is an interactive experience, and it depends upon the mode of user interface that links the person and the computer. User interface devices such as keyboards, mice, light pens, and induction pens have different effects on the performance of the individual at the computer. Due to progress in computer technology, using virtual reality to simulate hands-on assessment tasks may be useful for designing more effective computer-based performance assessment applications in

terms of an increased sense of realism. Research efforts in computer-based assessment need to take into account the effects of user interfaces on student performance in order to develop more valid assessment tools using computers.

The increased use of ICTs provides greater flexibility in terms of access but it also provides a student-centred approach to learning and motivates students by providing relevant and sometimes individualized learning programmes with the teacher now as a facilitator and negotiator of the pathways for student learning. Pedagogically, ICTs can support a variety of learning styles provided by course designers who have an understanding of the potential of the technologies and provide engaging content relevant to the context in which learning takes place.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the transferability of learning methodologies in an ICT-mediated environment.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to how these methodologies should be supported to assist learners to use ICTs effectively.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives for assisting learners to adapt to this new way of teaching and learning.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the transferability of learning methodologies in an ICT-mediated environment.

If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop an ICT strategy for assisting TVET learners to transfer their learning strategies to ICT-mediated learning environment.
- If your organization has already developed a strategy for assisting TVET learners to transfer their learning strategies to ICT-mediated learning environment, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

Has your organization developed a strategy to accommodate differences due to learning styles in an ICT–mediated environment?

IMPLICATIONS OF LEARNING STYLES IN AN ICT–MEDIATED ENVIRONMENT

Each individual responds differently to a learning situation. This response will be influenced by the way the individual thinks, his past experience, the demands of the environment and the demands of the task. This approach is recognized as an individual learning style. A successful learner will be able to adapt his approach to meet the needs of the activity, but not all learners will have developed this skill.

Despite considerable effort and resources devoted to ensure equal opportunity of access to ICT-mediated education and training, this equal opportunity of access refers not just to the use of resources but also to the cognitive skills to learn effectively in this learning environment. Cognitive-based research has shown that the most important reason as to why achievement levels differ is the differing levels of cognitive skills amongst learners. This is especially the case for the field-dependent and field-independent predispositions to learning that students bring to academic tasks. These cognitive skills, the information processing method of perceiving, thinking, problem solving and remembering are more important in the demands of an ICT-mediated environment where the mediating role of the instructor is somewhat absent.

The expansion of ICTs has removed distance from education and increased access to knowledge for all, it has provided the opportunity for people to learn with choice and autonomy and has evolved to encompass the specific needs of the learner. However, less focus has been placed on the process than the technology itself. It is only recently that the implications of cognitive style have sparked interest amongst researchers (Chinien & Boutin, 2003).

Kirkby (1979) offers a comprehensive summary of nineteen cognitive styles. Amongst them are the aforementioned field-dependent and field-independent constructs. These are the psychological constructs related to global versus and analytical ways of perceiving. They entail the ability to perceive items without being influenced by the background. (Kirkby, 1979) Rearch has shown that field-dependent and field-independent students differ in important ways with respect to personality factors, perceptual patterns and social interaction. (Ausburn and Ausburn, 1978) Field-dependent students tend to have a global perception, and the problems will take longer to solve (Witkin & Moore, 1974). In contrast, the relatively field-independent learners are more abstract-analytical and tend to solve problems more rapidly.

HOW DOES THIS RELATE TO ICT–MEDIATED LEARNING?

These different cognitive styles of learning are present in all environments, and therefore, the non-linear nature of ICTs makes it appealing to educators. Research has shown that field-dependent and field-independent learners prefer to follow different pathways through hypermedia systems, e.g. a linear or a non-linear approach. Studies have shown that individuals with different cognitive styles choose different learning strategies during the learning process illustrating that learners with different cognitive styles will use ICT learning materials in different ways. These learning materials may have been designed in a way that will advantage a particular style of learner, and therefore, disadvantage another.

In recent years there has been an increased interest in research focusing on the effect of cognitive style to instructional design in an attempt to link theory to practice. Greco & McClung (1979) studied the effect of attention grabbing techniques on learning for more field-dependent and field-independent learners to attempt to link cognitive style with instructional design. Elliot (1976) investigated the effect of manipulating design elements to make instruction concordant to individual cognitive style. Chinien (1990) conducted an experiment to determine the effectiveness of using cognitive style construct as a student selection criterion in formative evaluation of prototypical materials. In review of this research Atkinson (2001) concludes:

> "As the literature has established that one's cognitive style is consistent and influences how one codes, stores and performs, it is possible that the cognitive style of the designers of Computer Aided Learning materials could influence the form of learning materials they present. That being so it follows that, whether one is a learner using Computer Aided Learning materials or the person designing those materials there could be an interaction between the cognitive styles of the two people involved."

A common approach to viewing learning styles is linked to a learning cycle of experience, observation and reflection, formation and then testing of concepts. Although commonly referred to as the "Kolb Learning Cycle" it was based on the work of Kurt Lewin. According to Kolb, "learning is the process whereby knowledge is created through transformation of experience" (1984).

The cycle represents a continuous process with the current "concrete experience" being the basis for observations and reflections, which leads to the creation of a "theory". The "theory" is then tested in new situations to lead to more concrete experience.

The four stages of Experimental Learning Styles are:

Stage one: CONRCETE EXPERIENCE, the student has actively experience a something at first hand.

Stage two: REFLECTIVE EXPERIENCE, the student reflects on that experience.

Stage three: ABSTRACT CONCEPTUALIZATION, the student focuses on how the experience is applied to known theory and how it can then be modified for experimentation.

Stage four: EXPERIMENTATION, the testing of new concepts.

Kolb developed from the Lewin model the idea that students have a dominant phase of the cycle during which they prefer to learn, and therefore, will have preferred modes of learning. In order to identify the preferred study and learning styles, Kolb developed Learning Style Inventory (1976) that identified student's preference for the four modes corresponding to the stages in the learning cycle:

- Converger: linked to stage one, strong at practical application of tasks;
- Diverger: linked to stage two, imaginative ability and ability to generate ideas;
- Assimilator: linked to stage three, excels in inductive reasoning and theoretical processes;
- Accommodator: linked to stage four, good at doing things and solving problems intuitively.

Honey and Mumford (1986) developed Learning Style Questionnaire built upon Kolb's work. They identified four learning styles:

- Activist.
- Reflector.
- Theorist.
- Pragmatist.

Activists

Activists like to be involved in new experiences and are enthusiastic about new ideas. They enjoy doing things and tend to act first and consider the implications afterwards. They are unlikely to prepare for the learning experience or review their learning afterwards.

Activists learn best when:

- Working with others in team tasks or role-playing;
- Involved in new experiences, problems and opportunities;
- Being thrown in the deep end with a difficult task;
- Chairing meetings, leading discussions.

Reflectors

Reflectors like to view the situation from different perspectives. They like to collect data, review and think carefully before coming to any conclusions. They enjoy observing others and will listen to their views before offering their own.

Reflectors learn best when:

- Observing individuals or groups at work;
- Reviewing what has happened and thinking about what they have learned;
- Producing analyses and reports doing tasks without tight deadlines.

Theorists

Theorists like to adapt and integrate observations into complex and logically sound theories. They think problems through step-by-step. They tend to be perfectionists who like to fit things into a rational scheme.

Theorists learn best when:

- Put in complex situations where they have to use their skills and knowledge;
- They are in structured situations with clear purpose;
- They are offered interesting ideas or concepts even though they are not immediately relevant;
- They have the chance to question and probe ideas.

Pragmatists

Pragmatists are eager to try things out. They like concepts that can be applied to their job.

They tend to be impatient with lengthy discussions and are practical and down to earth.

Pragmatists learn best when:

- There is a link between the topic and job;
- They have the chance to try out techniques;
- They are shown techniques with obvious advantages such as saving time;
- They are shown a model they can copy.

Source: Mumford, A. (1997) *How to manage your learning environment. Peter Honey Publications.*

The plethora of research into identifying learning styles has illustrated the need to design instructional material that meets the individual needs of the students based on their preferred style of learning. It is not enough to expect every student to adopt the same method of learning at the same time and for the same activity, which poses many challenges for the instructor and the learner alike. However, opportunities exist for students to learn using their preferred pathway within an ICT-mediated environment. The challenge here is ensuring that this opportunity is embraced by the organization and reflected in its policy.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the need for accommodating differences due to learning styles in an ICT-mediated environment.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to specific strategies to accommodate differences due to learning styles in an ICT-mediated environment.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives to accommodate differences due to learning styles in an ICT-mediated environment.

- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the importance of accommodating differences due to learning styles in an ICT-mediated environment.

If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop an ICT accommodating differences due to learning styles in an ICT-mediated environment.
- If your organization has already developed a strategy accommodating differences due to learning styles in an ICT-mediated environment, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

Has your organization developed a strategy of using ICTs to facilitate self–directed and transformative learning in TVET?

SELF–DIRECTED LEARNING

Self-directed learning gives responsibility back to the students and enables them to have direct input into the learning process. However, not all students find moving away from the traditional methods of pedagogy easy to grasp. Grow (2003) proposes the Staged Self-Directed Learning Model (Table 16) as a guide for instructors to assist learners. This model, inspired by Situational Leadership Styles of Hersey and Blanchard, illustrates the instructor's role of matching the student to a particular stage of learning to assist him in becoming self-directed.

Table 16. The Staged Self-Directed Learning Model

	Student	Teacher	Examples
Stage 1	Dependent	Authority, coach	Coaching with immediate feedback. Informational lecture. Overcoming resistance
Stage 2	Interested	Motivator, guide	Inspired lecture plus guided discussion. Goal setting and learning strategies
Stage 3	Involved	Facilitator	Discussion facilitated by teacher who participates as equal. Seminars, Group projects
Stage 4	Self–directed	Consultant, delegator	Self–directed study group, individual work

Adapted from: "Teaching Learners to be Self-directed" by G. Crow (2003)

By identifying the stage of the learner and then by providing the appropriate methods of instruction and support, a student can develop the skills required to move onto the next stage of learning. According to Crow, it is only at the third stage that the students see themselves as participants in their own education. It is at this stage that the learner develops critical thinking, individual initiative and a sense of himself as described in Mezirow's theory of "perspective transformation." (1981)

At stage four learners strive in an atmosphere of autonomy where the teacher's role is not to teach subject matter but to cultivate the student's ability to learn. Here the teacher actively monitors progress but steps in only to assist students in acquiring the skills to be self-directing and self-monitoring. Interestingly, the student at this stage still requires the presence of an instructor.

This process of learning can be greatly affected by the style of the instructor. If a student operating at stage four was taught by an authoritarian instructor, then this would create a mismatch where the two styles conflict. This concept illustrates the importance of recognizing an individual's needs and adapting the learning process according to those needs. In the same vein, an instructor should be aware of his/her style of instruction and tailor his/her methods of learning accordingly.

Self-directed learning should take place in an environment with some structure provided by the instructor and at times by the institution. It is important that the student should retain the freedom and flexibility to explore and progress as a

person within some boundaries. Also it is important to consider and incorporate into educational practice alternative methods of instruction, preparing alternative means of delivery such as reading, video, classroom, one-on-one mentoring, resource centres, study guides, modified on-the-job training, and then provide learners with choices and options. In light of research into learning styles and individual preferences in the process for learning, this ensures that each student can employ a range of skills and methods of enquiry in order to satisfy his needs. To optimize self-directed learning, students need to have materials available when they want them. Training and resource centres need to encourage self-directed learning by allowing materials to leave the facility and providing learning materials that are so readily accessible that a learner might look something up simply because it is there.

How can this be achieved?

Lowry (1989) provides an extensive list of suggestions for instructors to facilitate self-directed learning, some of them are listed below:

1. Be a manager of the learning experience rather than an information provider.
2. Teach inquiry skills, decision making, personal development and self-evaluation of work.
3. Help learners develop positive attitudes and feelings of independence in relation to learning.
4. Encourage critical thinking by incorporating appropriate activities, i.e. seminars.
5. Provide opportunities for self-directed learners to reflect on what they are learning.
6. Promote learning networks, study circles and learning exchanges.

It is interesting to note that the verbs used: “create” “promote” and “help”, reveal mutuality between student and instructor. Many adults attend class voluntarily and usually have an inherent interest in their education. As a result, they have a need to be made a part of the process and not simply a passive recipient of information. This can be achieved by considering strategies that include students from the beginning by involving them in curriculum committees, making them participate in the review of regulations and requirements design and delivery of learning modules.

TRANSFORMATIVE LEARNING

Transformative learning is located within the realm of non-formal adult learning and can be triggered by an unexpected event as much as it can be foreseen. A central tenet to transformative learning is critical reflection, a process of questioning one’s own beliefs as well as the social and cultural context within which learning is occurring. Transformative learning has been associated with a few primary researchers, namely Jack Mezirow, who was influenced significantly by Habermas and Paulo Freire. The principles of transformative learning, as will be described, can assist an ICT programme in laying the groundwork for dialogue and critical reflection among students as well as assist with the development of programmes that take into account learner social contexts.

THEORY OF COMMUNICATIVE ACTION

Jurgen Habermas is regarded as one of the most prominent contemporary thinkers in critical social theory, emerging from a tradition of critical theory born in the Frankfurt School in Germany in the late 1920’s (Morrow and Torres, 2002). Critical social theory seeks to “understand how ideological systems and societal structures hinder and impede the fullest development of humankind’s collective potential to be self-reflective and self-determining historical actors”. (Welton, 1995)

In his theory of communicative action, Habermas (1984) suggests a polarization in society between technological systems and democratic dialogue. While both technology (and associated concepts of success and control), and democratic dialogue are inherent to any society, Habermas claims that technological progress has undermined the reflective, democratic and communicative nature of society. In response, Habermas theorizes about how the dialogic and reflective nature of society can be strengthened. First, all participants must have equal opportunity and freedom to speak. This is further elaborated as the “ideal conditions for speech”. Second, meaningful democratic dialogue

occurs when communication is competently delivered. Four tests for competent communication, also called "validity claims", are (Webler and Tuler, 2000, p. 569):

1. Does the statement make sense?
2. Is the statement factually true?
3. Is the statement morally right?
4. Is the speaker being sincere?

Since technology is inherent to society, Habermas also describes instrumental competence, which corresponds to how to control or manipulate the environment and cope with the external world. In the context of ICTs, instrumental competence is the ability to use these technologies, while communicative competence is the ability to reflect upon and meaningfully discuss the message delivered vis-à-vis the technologies.

Habermas's theory of communicative action has had an important influence on transformative learning theory developed by Jack Mezirow. Further, while there is little indication that Habermas influenced Paolo Friere's critical pedagogy, scholars have drawn a number of compatibilities such as the importance of interaction for higher leaning, moral reasoning and human autonomy (Morrow and Torres, 2002). Though emerging from different roots, all three theorists present an impetus for social change and view critical reflection as key to creating social change.

TRANSFORMATIVE LEARNING THEORY

Jack Mezirow is an American adult education theorist who developed transformation theory in the early 1980's based on research of adults returning to university (Mezirow, 1981). Mezirow theorized about the cognitive processes of learning for individuals based on instrumental and communicative competence and functional frames of reference. Instrumental learning refers to learning how to be in the world, where communicative learning refers to understanding meanings and their underlying purposes, beliefs and values. Frames of reference are the "structures of assumptions through which we understand our experiences" (Mezirow, 1995) and include our concepts, feelings, values, and conditioned responses. A critical learner "assesses assumptions, how they were acquired and their consequences to our actions and feelings" (Mezirow, 1995) and through this reflection a transformation in the learner's frame of reference can occur. Transformation is beyond simply establishing a new point of view, it is the critical self-reflection of an existing point of view that can lead to a transformed point of view and further, to a new habit of mind. Such transformations can can make a learner more inclusive, discriminating, self-reflective and integrative of experience. Because a transformational shift can be significant, it is often precipitated by an event that is chaotic- a "disorienting dilemma", requiring the learners to reflect on their underlying assumptions before choosing their response. Reflection followed by action is known as praxis.

The process of transformative learning is enabled by the following ideal conditions for learning, adapted by Mezirow from Habermas's ideal speech conditions (Mezirow, 1981):

1. Access to accurate and complete information;
2. Freedom from coercion and distorting self deception;
3. Ability to weigh evidence and assess arguments objectively;
4. Be open to alternative points of view;
5. Become critically reflective upon assumption and presuppositions and their consequences;
6. Have equal opportunity to participate in various roles of discourse;
7. Be willing to accept an informed, objective, rational consensus as a legitimate test of validity until new perspectives, evidence or arguments are encountered.

Activity: Following are examples of reflective and critically reflective statements (Table 17), taken from a survey designed to measure critical thought using Mezirow's definition (Kember et al, 2000, p. 15). Based on these statements, what are some of the differences between reflection and critical reflection? Continue the example with statements of your own.

Table 17. Reflection and critical reflection

Reflection	Critical reflection
• I sometimes question the way others do something and try to think of a better way. • I like to think over what I have been doing and consider alternative ways of doing it. • I often reflect on my actions to see whether I could have improved on what I did. • I often re–appraise my experience so I can learn from it and improve for my next performance.	• As a result of this course I have changed the way I look at myself. • This course has challenged some of my firmly held beliefs. • As a result of this course I have changed my normal way of doing things. • During this course I discovered faults in what I had previously believed to be right.

CRITICAL PEDAGOGY

Paulo Freire (1972) was an adult educator in Brazil who pioneered a type of adult literacy based on dismantling hierarchical barriers in the student-teacher relationship, thus enabling adults to better understand the power relationships in their social context (Morrow and Torres, 2002). One of Freire's main contributions was the methodology "based on a distinction between banking education, through which knowledge is mechanically accumulated, and critical education in which the learner becomes an active participant in the appropriation of knowledge in relation to lived experience" (Morrow and Torres, 2002). Through the process of conscientization, learners gain a new perspective on the world around them and are empowered to create social change (Baumgartner, 2001, p. 2). Emerging from Freire's pedagogy are 10 values, as elicited by Shor (1993). In Table 18, below, these values have been contextualized for ICTs in the operational definition column.

Activity: Use the third column of Table 18 to consider how each of these conditions can be met.

Table 18. Values from Freire's Pedagogy, after Short (1993)

Criteria and conceptual definition	Operational definition	How can this condition be met?
Research process		
Participatory *Learners have a voice in education*	Students have a role in developing the content of the ICTs.	How can students be included in curriculum development?
Desocialization *Education encourages active participation in education*	All students are encouraged to participate in providing input for the ICT.	How can students be encouraged to participate?
Multicultural *Curriculum acknowledges cultural diversity*	ICT shows respect for and include elements of cultural diversity.	How can cultural diversity be included in the ICT?
Research–oriented *The teacher studies the identity of student; and students research problems posed in class*	ICT reflects the learning needs of participants. ICT promotes further research and learning among students.	How can the ICT reflect the learning needs of participants? How can the ICT promote further research and learning?
Activist *The classroom is both active and interactive*	ICT includes interactive components.	What features make ICT interactive?
Situated *Material reflects learners' thoughts and language*	The language used in the ICT reflects the language of the learners.	How can the language of ICT reflect the language of learners?

Criteria and conceptual definition	Operational definition	How can this condition be met?
Research process		
Democratic *Educators and learners work together to develop the learning agenda*	Participants have a voice in ICT development. Students have the opportunity to provide feedback.	What opportunities are there for students to give feedback?
Dialogic *Learning methods emphasize discussion*	ICT encourages dialogue among participants.	How can dialogue be encouraged among students?
Critical *The dialogue promotes self–reflection and social analysis*	ICT promotes critical reflection by providing opportunities for dialogue.	How can critical reflection be encouraged among students?
Affective *Discussion interested in broad feelings*	ICT promotes online relationships.	How can online relationships be promoted?

Common to each of the three contributors to democratic social action is the value of social change and critical reflection. For Habermas, social change is needed to breathe life into the world of meaning and democracy, which has been compromised by technological growth; this is brought about through democratic communication. For Mezirow, democratic communication is brought about through becoming critically aware of one's beliefs and assumptions and allowing them to be transformed into more functional ones. For Freire, the process of learning must address power imbalances that the students learn to transform the social world around them into one that is more democratic and participatory.

Transformative learning occurs for teachers as much as for students. In one study, teachers undergoing professional development where they learned, discussed and developed technology applications for the classroom, experienced transformations related to the use of computer technology. Specifically, teachers experienced the following transformations (King, 2002, p. 12):

- A shift from teacher-centered teaching to student-centered facilitating;
- An expansion of the worldview of teaching to include worldwide resources;
- Exploration of new research and material preparation methods;
- Self-confidence and renewed trust in technology as a teaching tool.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the importance of using ICTs to facilitate self-directed and transformative learning in TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to specific strategies to use ICTs to facilitate self-directed and transformative learning in TVET.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives to use ICTs to facilitate self-directed and transformative learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the importance of using ICTs to facilitate self-directed and transformative learning in TVET.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITY

- Using your transformative reflection experience, develop an ICT strategy to use ICTs to facilitate self-directed and transformative learning in TVET.
- If your organization has already developed a strategy to use ICTs to facilitate self-directed and transformative learning in TVET, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

MODULE 3 ICT–MEDIATED LEARNING IN TVET

UNIT 3.3 FACILITATE ON–SITE LEARNING IN TVET USING ICTs

Objective 3.3.1 Develop awareness of the use of ICTs to enhance on–site teaching and learning

Has your organization developed a strategy to use ICTs to enhance on–site teaching and learning in TVET?

ICT–MEDIATED LEARNING ENVIRONMENTS

ICT-mediated learning provides two educationally rich learning environments to the learners: (1) explorative environment; and (2) interaction environment (Dillemans et al., 1998). In the explorative learning environment learners can practice their skills in safe settings, but they can also investigate (simulate) aspects of the world. Modelling tools go even further, enabling students to shape simulated world themselves (Van Baalen and Moratis, 2001). In the interaction environment ICTs facilitate human interactions. Dillemans et al. (ibid) proposed six critical dimensions that must be examined in order to bring out the best of educational technology in the explorative and interaction environments. Following is a brief description of each:

1. Information modality: ability of the technology to transmit verbal, para-verbal and non-verbal information.
2. Linearity: the technology can transmit the information in a linear or non-linear way.
3. Type of interaction: distinction between human-human and human-machine interaction.
4. Number of participants: the interaction with ICT-mediated learning can be one-alone, one-to-many, and many-to-many.
5. Time/place (in) dependency: ability of the technology to transmit information of time and place.
6. Immediacy: amount of time for sending a message and getting a response to this message.

The juxtaposition of these six dimensions with two learning environments in Table 19 gives a powerful decision-making tool for ICT-mediated designers and developers.

On-site learning can combine traditional methods of pedagogy with ICTs to enhance the learning process. Students are able to work independently and still have the presence of an instructor close at hand. ICTs can help improve the delivery of existing services, make them more accessible and present them in new and exciting ways. There are many examples of projects, which have used ICTs to create new and innovative learning centres. An initiative currently running in the United Kingdom offers a mobile on-site learning centre for students. “Computer Gym” is a mobile classroom, workshop and library. It uses the latest ICTs to offer on-site training in an informal, supportive and “fun” environment. There is much demand for the service because it is generally cheaper and more accessible than computer training in fixed locations. Adult learners who wish to improve their skills in ICTs may still prefer to do so in an environment where they feel supported. Working online requires competent communication skills predominantly written, and benefits those who prefer visual learning.

A number of studies have been carried out regarding the use of technology in classroom teaching. Cassady (1998) found that students preferred the use of presentation software (PowerPoint) to enhanced lectures and presentations. According to students the presentation was more legible, helped students pay attention in class and clarified teaching materials. The study also found that students felt that the use of e-mail and telephone conferencing made the lecturer more accessible and responsive to students. It also led to greater class cohesion, as these methods opened up lines of communication among students. According to Schull and Farber, (2001) the benefits of using technology in teaching very much depend on the characteristics of the students, type of technology and manner in which it is employed. It is important for the educator to be aware that ICTs must be curriculum-led rather than technologically driven.

Table 19. Classification of tools

		Information modality	Linearity	Number of participants	Time (in)dependency	Immediacy
Explorative environment	Interactive video	Dynamic visual	Linear or alinear	Not applicable	Not applicable	Immediate or non–immediate
	CD–ROM	Text, dynamic visual display	Linear	Not applicable	Not applicable	Immediate or non–immediate
	Hypermedia	Text, dynamic visual display	Alinear	Not applicable	Not applicable	Immediate or non–immediate
Interactive environment	Audio–conferencing	Audio	Linear or alinear	One–one one–many many–many	Synchronous	Immediate
	Audiographic conferencing	Audio, still graphics	Linear or alinear	One–one one–few few–one	Synchronous	Immediate
	Computer conferencing	Dynamic visual display, mainly written words	Linear or alinear	Many–many	Asynchronous	Non–immediate
	Video–conferencing	Audio, still graphics, nonverbal information	Linear or alinear	One–one one–many many–many	Synchronous	Immediate
	Internet	Dynamic visual display, mainly written words	Alinear	Many–many	Asynchronous	Non–immediate

Source: Van Baalen and Moratis, 2001, p. 106

Many teachers are aware that traditional methods of instruction are inadequate for today's active learner and have begun to adapt their teaching methods. ICT-assisted learning engages the student in manipulating data, experimentation, testing and analysis through multimedia applications. Lectures can be made more interesting by integrating video and audio facilities to aid the delivery of course content and to make learning more interactive. Electronic screens linked to a teacher's computer can engage students to pay more attention and to see the relevance of learning where ICTs are used as a key feature. Technologies used as teaching aids, such as personal computers, allow students to take more responsibility for their own learning and, thus, become more independent learners. It also enables collaborative learning between the teacher and learner.

The use of interactive computer simulations offers students exposure to real-life situations, permitting them to practise various response patterns or skills with feedback being received as to their effect. The immediacy of interactive simulations allowed for instantaneous feedback and the possibility of an ongoing review of the two way communication process. Simulators are often used in TVET to address safety concerns during the initial phase of training and to offset cost in renting equipment for training crane operators and truck drivers. Learning materials can incorporate much more active participation, from simple multiple-choice checklists to virtual reality tours and simulations.

The use of the World Wide Web and the Internet has opened up a wealth of knowledge to students and instructors. Textbook publishers have also embraced technology by providing PowerPoint slides of each chapter, Internet exercises, course Web page services, and additional exercises all of which can be incorporated into lessons to enhance teaching.

HOW AND WHERE ICTs FIT IN THE LEARNING ENVIRONMENT

Haddad and Drexler (2002) state that there are five different hierarchical levels of education where ICTs can be used: presentation, demonstration, drill and practice, interaction, and collaboration. These levels and example technologies are outlined in Table 20 (Haddad and Draxler, 2002, p. 9):

Table 20. Appropriate technology for different teaching levels

Technology					
Use	**Text**	**Audio**	**Video**	**Computer**	**Internet**
Presentation	X	X	X	X	X
Demonstration	X	X	X	X	X
Drill and Practice	X	(e.g., language lab)		X	X
Interactive	hyperlink			X	X
Collaborative				networked	X

Each of different technologies provides instruments that communicate their "content in one or more modes" (Nunes and Gaible, 2002, p. 97). For example, a book readily accommodates text, images, and graphics (Nunes and Gaible, 2002, p. 97). Each of different modes and instruments offer their own benefits and limitations (Table 21).

Selecting a technology or a combination of technologies for teaching and learning depends on many factors, such as available infrastructure, pedagogical constraints, learners' characteristics, subject matter, content, and time available to teach and learn. The guidelines presented in the following flow chart (Figure 9) can give a systematic approach to the decision-making process in selecting ICTs for TVET programmes. It is not an absolute "recipe", but it can be used as a starting point when deciding which technologies are better suited for specific needs and certain situations. The flow chart has been adopted from *Training Aids Selection Scale* to design technical and skills training programmes developed by Sage and Rose (1985, p. 15).

Table 21. Affordances and limitations of modalities

Mode	Instrument	Affordances	Limitations
Text	Books/magazines	• Portable • Durable • Can present complex information • Sequential structure guides learner • Little eyestrain • Moderate cost of development	• Difficult to modify (as in localization, updating etc.) • Requires literacy plus higher–order thinking skills • Content is difficult to extract for use in other resources • High per–unit cost of publication
	Web page	• Dynamic and easily modified • Hyperlinks enable non–sequential navigation • Low development cost and very low publishing cost • Supports interactivity (e.g., navigation, user–centred information etc.) • Can support assessment	• Non–sequential structure may obscure critical information or cause confusion • Reading may cause fatigue • Requires PC, electricity, connection • Potential additional system requirements (e.g., Java, plug–ins)
Images	Printed photos, maps, and schematic drawing	• Concrete, specific, detailed information • Appropriate for learners with "visual intelligence" • Engaging and motivating for many learners	• Low information value relative to text • Resistant to reuse by learners • "Visual literacy" skills required for best use • High reproduction cost

Mode	Instrument	Affordances	Limitations
Images	Digital photos, maps, and schematic drawings	• Benefits similar to printed photos • Easily copied, shared, and used • Low reproduction and publishing costs • Can be data–based or Web–served for delivery to handheld computers and other "anytime, anywhere" devices	• Limitations similar to printed photos • Require PC and electricity, and possibly an Internet connection
Audio	Radio	• Can present contemporary and topical information easily • Highly accessible and potentially engaging format (no literacy skills required) • Widely adopted in developing countries • Moderate production costs • Highly scalable • Low–cost hardware	• Information is not durable; learners can't "review" a broadcast • Poor presentation of complex concepts • No visual component (e.g., schematics, maps, photos) • Synchronous form requires system–wide coordination (e.g., announcements, class schedules etc.)
	Audio tape	• Widely adopted • Low hardware cost • Information persists (tape may be reviewed many times) • Moderate production and reproduction costs • Highly accessible • Supports asynchronous presentation • Sequential structure guides learner	• Poor presentation of complex concepts • Medium is not durable, especially in extreme circumstances • Studio recordings not easily modified or well–suited for current events
	Digital audio (Web– and CD–based)	• Can present contemporary and topical information easily (Web) • Information is durable (that is, it can be reviewed many times) • Medium is durable • Moderate production costs • Low reproduction costs; easily scaled • Easily catalogued and reused (by developers and users) • Can be indexed or catalogued to enable non–sequential access	• Requires robust PC and/or high–speed Internet connection • High storage "overhead" (in terms of hard drive capacity) • May not support presentation of complex concepts
Video	Analog	• Highly accessible and potentially engaging format (no literacy skills required) • Sequential structure guides learner • Concrete, specific, detailed information • Appropriate for learners with "visual intelligence" • Engaging and motivating for many learners • Moderate hardware costs	• High production costs • Moderate reproduction costs • Complex information may be difficult to present effectively • Information may prove difficult for some learners to analyze/synthesize
	Broadcast	• Same as analog video • Can present contemporary or topical information easily	• Same as analog video; however, costs may be higher

Mode	Instrument	Affordances	Limitations
Video	Digital (Web– and CD–based)	• Same as analog video (NOTE: "moderate hardware costs" is not applicable) • Can present contemporary or topical information easily • Easily catalogued and reused (by developers and users) • Can be indexed or catalogued to enable non–sequential access	• Same as analog video • Requires robust PC and/or high–speed Internet connection • High storage "overhead" (in terms of hard drive capacity)
Simulations	Interactive (Web– and CD–based)	• Same as non–interactive simulations • Active–learning characteristics engage learners via several paths to reinforce concepts • Quantitative elements are supported and reinforce conceptual learning • Engaging and motivating for many learners • Can support assessment	• Requires robust PC and/or high–speed Internet connection • Potential for additional system requirements (e.g., Java, plug–ins)

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the importance of using ICTs to enhance on-site teaching and learning in TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to specific strategies using ICTs to enhance on-site teaching and learning in TVET.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives using ICTs to enhance on-site teaching and learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the importance of using ICTs to enhance on-site teaching and learning in TVET.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your transformative reflection experience, develop a strategy to use ICTs to enhance on-site teaching and learning in TVET.
- If your organization has already developed a strategy to use ICTs to enhance on-site teaching and learning in TVET, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

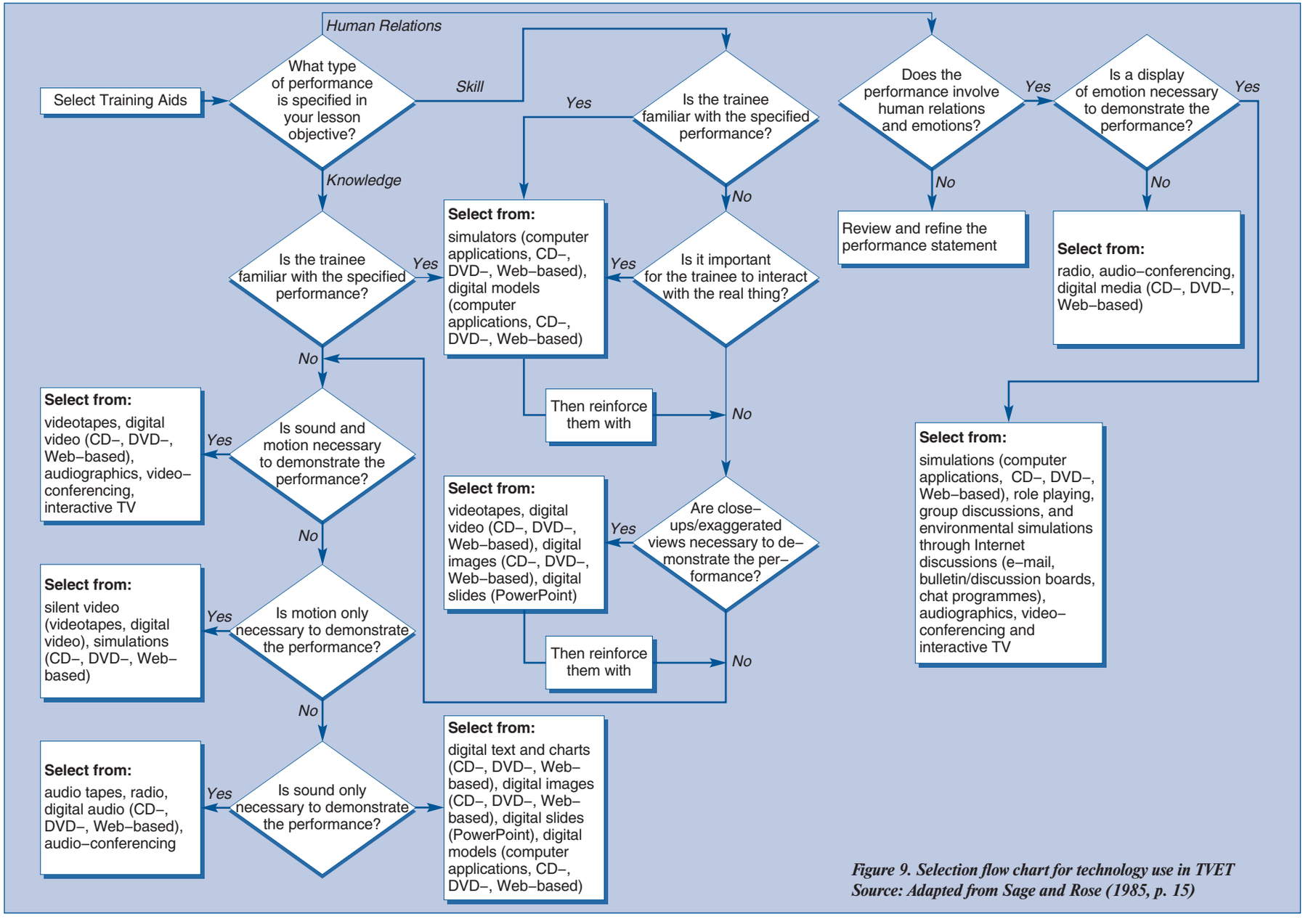


Figure 9. Selection flow chart for technology use in TVET
Source: Adapted from Sage and Rose (1985, p. 15)

MODULE 3 ICT–MEDIATED LEARNING IN TVET

UNIT 3.4 FACILITATE ONLINE LEARNING IN TVET USING ICTs

Objective 3.4.1 Develop awareness of the use of ICTs to enhance online teaching and learning

Has your organization developed a strategy using ICTs to enhance online teaching and learning in TVET?

OPEN AND DISTANCE LEARNING IN TVET

UNESCO (2002a) defines Open and Distance Learning (ODL) as an "educational process in which all or most of the teaching is conducted by someone removed in space and/or time from the learner, with the effect that all or most of the communication between teachers and learners is through an artificial medium, either electronic or print." (p. 22) IITE (2000a) identified three types of ODL: (1) learner-content; (2) learner-learner; and (3) learner-tutor. The infrastructure and level of technology available in the region determine the choice of the medium. This may include printed study guides, educational television, radio systems, multimedia systems, and Internet-based systems. The open nature of ODL helps learners take responsibility for "what they learn, where they learn, how quickly they learn" (UNESCO, 2002a, p. 22).

Mishra (2002) noted that "advances in education technology have led us to accept that the benefits from TVET through ODL are far greater than from other types of courses." (p. xi) Hampton and Bartram (2002) argued:

> "If access to technical and vocational education and training (TVET) is to increase, new ways of developing and delivering courses must be explored. TVET must be taken outside of the classroom and into the communities, the workplaces, and the homes of the students. Traditional ways of thinking about TVET must be put aside and different ways of packaging and delivering knowledge and skills must be developed. This is particularly critical in meeting the demands of countries with depressed economies and countries where people are separated by water (as in island states), by terrain or by distance..." (p. 63).

ODL can be used in TVET to empower the most disadvantaged people , such as the disabled, unemployed and ethnic minorities. ODL can also allow greater participation in technical and vocational education and training after work hours for those who can't afford to take time off from their jobs and who are interested in improving their vertical mobility professionally (Mishra, 2002). ODL in the field of vocational training may have to be supplemented by hands-on work though, which could be done through residential schools, home experiment kits or collaboration with the workplace (UNESCO, 2002a).

John (2002) noted that in developing countries ODL has been successfully used to change the social lives of people, raising them from economic vulnerability to economic empowerment. ODL has been used to successfully impart carpentry skills, building construction etc. Dhanarajan (2002) also noted that ODL has been successfully used for training workers in many fields ranging from farming to electronics, health to engineering, and animal husbandry to automobile engineering.

There are many obstacles that hinder the full implementation of distance learning. Some of these barriers include: lack of infrastructure, underfunded programmes, high costs of installation and maintenance, lack of organizational support, and lack of training of those involved.

Some factors affecting costs of ODL include: number of course materials that need to be developed, the frequency with which course material must be revised and changed, and the choice of technology. Advocates of ODL often cite economies of scale in their support of this mode of delivery. However, this concept does not necessarily apply to distance learning. There are many cases where it would be more cost-efficient to attend classes on campus instead of studying through distance education. Many North American universities that invested heavily in distance education are now phasing out their programmes due to low enrolment and high dropout rate. It appears that the role of distance education is not to minimize the costs of teaching and learning, but to find various media able to reach as many people as possible (UNESCO, 2002a).

Based on a comprehensive review of literature Brennan, McFadden and Law (2001, p. 8) identified the following pre-conditions necessary to meet student/user needs through online learning:

- Acknowledge and take into account differences in student/user backgrounds in every phase of the design and delivery of online learning materials and support.
- Strenuously apply the lessons we have already learnt about good teaching and learning.
- Cater to the differences in learning styles and preferences of student/user.
- Accept that student technological skill and comfort is located along a continuum of proficiency and plan to accept these and design materials and environments accordingly.
- Recognize that there is a huge difference in access to new technologies and work toward reducing these.
- Evaluate the effectiveness of online programmes using a variety of methodologies and time frames.
- Prepare teachers/trainers to use new technologies flexibly and beyond minimum levels of competence.
- Seek to explicitly enhance information literacy skills.
- Focus on the communicative and interactive dimensions of the new environments.
- Don't expect technology to solve all hard problems.

TEACHING ATTITUDINAL AND PRACTICAL SKILLS IN TVET USING ICTs

Effective human performance in TVET consists of the successful interactive effects of skills, knowledge, and attitude. All TVET programmes aim to develop three of these domains of learning. While there is a considerable amount of literature dealing with the development of cognitive skills using ICTs, there is a paucity of publications dealing with the development of psychomotor skills, and this review failed to identify any publications dealing with the affective domain in TVET. There is a perception that distance education is not an appropriate method for TVET. However, in high performance work environments, the cognitive and affective learning domains constitute greater segments of skill sets than do psychomotor skills. Providing distance education in these two domains is much less challenging than teaching manual skills at a distance. (Stevens, 2001)

TEACHING ATTITUDES USING ICTs

As mentioned previously, research offers little guidance for teaching attitudinal skills in TVET. According to the limited studies available, five approaches show some potential for attitude development in TVET. These are democratic approach, indoctrination approach, group discussion, dramatic involvement, and role modelling. The key issue here is: can ICTs be used for developing attitudes in TVET? This question will remain unanswered for lack of empirical evidence. However, one could speculate about the appropriateness of using ICTs to help students develop desired attitudes.

The indoctrination approach is often used for teaching safety attitudes in TVET. It is possible to indoctrinate learners in an ICT learning environment by creating a very rigid environment, one which does not encourage thinking and where the only choice to students is to learn a set of strict rules. The ICT learning environment can lend itself well to group discussions using bulletin boards and Internet telephony. These group discussions must be carefully moderated to prevent a negative and undesirable attitude from developing. Dramatic involvement can be achieved using games and simulations within an ICT environment. Finally, electronic mentoring could be used to provide role models to learners.

Using a strictly technology-based learning environment eliminates face-to-face contact, hampering the development of people's skills that are just as valuable in the workforce as technical skills. Audio- or video-conferences, online discussion groups, e-mail etc. do allow interaction with other people; however, these tools are not considered as effective in improving people skills as dealing with someone face-to-face. According to management consultant David Anderson of Anderson and Associates, nothing can replace direct people interaction. "When you're interacting with a web page you can be as uninterested, sarcastic, or rude as you like. The web page won't call you on it. People skills need to be taught by people." (Delio, 2000, p. 2)

The teaching of attitudes remains a challenge for even face-to-face instruction. Attempting to teach attitudes using ICTs is a significantly more challenging task, one plagued with uncertainty. The decision to use or not to use ICTs to teach attitudes in TVET must be guided by a risk assessment focused on the consequences of inadequate performance. Is the risk negligible, serious, or life threatening?

TEACHING PRACTICAL SKILLS USING ICTs

The literature and research dealing with developing practical skills in a face-to-face environment is limited. Romiszowski (1981) argued that: "Training of physical skills ...seems to have had a history quite divorced from the main stream of educational research and development. This is probably because for a long time educators tended to look down on the physical skills domain as unworthy of their attention." (p. 227)

In commenting on the use of ODL for teaching practical skills Hampton (2002) noted: "The learning of practical skills is most often associated with workshops and laboratories, specialist materials and equipment, smaller class sizes and, frequently, longer blocks of time for practice and rehearsal. For the open and distance learning (ODL) environment, the teaching of practical skills poses more difficulties that the teaching of knowledge and theory." (p. 83) She added that the teaching of practical skills would always require the support of skilled people and a range of tools or equipment. Haddad and Draxler (2002) noted, however, that the inability to meet the challenge is self-inflicted because of a tendency to use Industrial Age models to solve Information Age problems.

Oliveira and Rumble (1992) noted that for many years educators believed that ODL was only suitable for teaching cognitive skills. Sparkes (1982) argued that it might be more effective to teach a practical skill using a video rather than face-to-face instructions. He does concede, however, that practical skill will continue to need face-to-face supervision at least until two-way television is available. The author identified three organizations using ODL for teaching performance skills: National Extension College, UK; University of Victoria, Canada; and Indonesia Banking Development.

It could be useful to look at the taxonomy of the psychomotor domain before examining the appropriateness of ICTs for learning practical skills. The psychomotor domain can be divided into 5 main categories:

Imitation: the learner goes through a period of trial and error to imitate an act that has been explained and demonstrated.

Manipulation: the learner continues to practise the skill until some level of proficiency is attained.

Precision: the learner continues to practise until he/she attains the competency requirement.

Articulation: the learner attains a higher level of competency that allows him/her to solve problems.

Naturalization: the learner reaches a stage where responses can be automatic, without thinking.

Analyzing these categories sheds light on how practical skills develop and provides some insights regarding the implications of using ODL for teaching such skills. It is interesting to note that only during the imitation stage does the learner need explanation and demonstration. During the manipulation, precision, articulation, and naturalization stages the learner can practice independently to perfect his/her skill. Consequently, the imitation stage is the most critical stage of practical skills development and it is this phase that requires most guidance and support in an ODL environment.

Hampton suggested that it is critical to take into consideration the learner's learning style in choosing or developing materials for teaching practical skills by distance. She noted that print-based illustration and step-by-step procedures are most often used for learning a practical skill at a distance and that video, interactive multimedia on CD-ROM and online learning are increasingly used. She also assesses these three approaches. Advantages and problems with these three approaches were discussed previously in section 2.

Other approaches in current use to develop practical skills using ICTs are online learning, simulators, and virtual reality. Pilots, truck drivers, and crane operators may spend more training time in a virtual reality environment and in simulators than with the actual equipment to reduce hazards and equipment rental costs.

Majumdar and Ray (no date) state that the military has always been using state-of-the-art technology through simulation packages for teaching dangerous tasks like flight training, astronaut training, surgical operations, and handing nuclear energy. The author noted that the use of ICTs allows these skills to develop without using expensive equipment or subjecting trainees to extreme danger.

In addition to technological support, appropriate learning environments must be provided to enable learners to practise and perfect their skills. The types of support that have been proved to be effective include: mobile workshops, learning centres or learning commons, workplace training, on-the-job training, work-based learning, and work experience (Hampton, 2002).

Assessing skills acquired by distance learning is as challenging as developing them. The assessment of practical skills involves two elements: process – formative evaluation, and product – summative evaluation. Process assessment involves evaluating the procedures used for executing a practical task. Product assessment, as the name suggests, consists of evaluating the quality, accuracy, and finish of a final product. Hampton (2002) suggests that process evaluation can be accomplished through self-assessment and that product evaluation can be achieved using demonstration of skills, video recording of performance, validators, and workplace trainers and assessors.

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the importance of using ICTs to enhance online teaching and learning in TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to specific strategies using ICTs to enhance online teaching and learning in TVET.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives using ICTs to enhance online teaching and learning in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the importance of using ICTs to enhance online teaching and learning in TVET.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your transformative reflection experience, develop an ICT strategy for the importance of using ICTs to enhance online teaching and learning in TVET.
- If your organization has already developed a strategy to use ICTs to enhance online teaching and learning in TVET, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

Has your organization developed a strategy using ICTs to facilitate development of Online Learning Communities?

THE DEVELOPMENT OF ONLINE LEARNING COMMUNITIES

Online communities create a platform for individuals to share ideas, knowledge and experience quickly and efficiently. In terms of technology, online community environments can range from straightforward e-mail groups or instant messaging to more complex platforms that combine web content, discussion areas, video-conferencing and document exchanges.

> "Community refers among other things to one's sense of place, its people, their interrelations, their shared caring for one another and their sense of belonging." (Lorion and Newbrough, 1996)

However, a community needs to be nurtured in order to thrive, and a technologically based one is no exception. It is vital that online design supports a form of engagement and provides activities that will encourage the individual to become involved. Simply using the software and hoping that the community will develop is unlikely to occur. Essential to the development and management of the technology is that it should always support (and not hinder) dialogue between members of a community. This can be a difficult balance to achieve, as different levels of ICT confidence, different expectations of technology and different levels of interaction should all be catered for. It also appears that the decision to be apart of an online community rests with the will of the student. Tönnies (1995) categorizes this will as being either rational or natural. Natural refers to more personal characteristics, intellect and attitude, whilst rational refers to a rational decision making process based on perceived benefits and purpose of membership to the community.

According to Hiltz (1997), "the development of a collaborative learning environment is not simply a matter of employing the software to facilitate a communication place and informing students of its availability and telling them to use it at will. This will result in students not using the communication opportunity at all or dropping out of communication after a very short time".

The responsibility of the student is to be active in both the learning and community experience (Palloff and Pratt, 1999), in addition Palloff and Pratt propose that purpose and context can be stimulated through promoting social activities. (Table 22)

Table 22. Factors influencing community development in online settings

System	Course	Instructor	Group	Student
Accessibility policy	Orientation discipline	Experience teaching online	Collective characteristics	Education level
Online policy and suppor	Academic level	Educational philosophy	Cohort size	Experience learning online
Grading policy	Elective or core	Educational philosophy		Learning style
Technical support	Subject material	Cultural patterns of socialization		Patterns of socialization
Cohort selection	Cohort size	Perceptions of self–identity		Access to technology
Teaching focus		Management style		Goals and motivation
Funding				Personality traits and perceptions of self

Adapted from:Brook and Oliver online learning communities – a design framework (2003)

Often the use of online communities' technology to support student learning focuses mainly on the use of learning platforms (virtual and managed learning environments) to supplement and extend traditional teaching methodologies. Apart from specific distance education applications such as those provided by universities, learning platforms are more commonly focused on the delivery and exchange of educational content (for example, online learning activities or the uploading of completed assignments). If this is the case, then well-developed and supported online communities can provide good examples of the use of technology in an appropriate context. Online communication has many advantages. For example:

- Geographical boundaries and limitations do not prevent communication – the only requirements are access to e-mail or the Internet.
- Group sizes can vary greatly and still remain coherent and technically efficient.
- Responses from group members can be instant, regardless of their relative physical locations.
- Text communication can be supplemented quickly by distribution of documents and media files for information and discussion.
- It allows for Transformative Learning, whereby a student can critically discuss issues and present conflicting ideas and beliefs to others.
- The online group can enable questions to be sent immediately to potentially far more teachers than might be consulted face-to-face.
- Responses to questions can take account of particular contexts and circumstances.
- Discussion does not have to take place at a certain time and for a fixed duration. Online communities can support synchronous and asynchronous communication.
- It is possible to remain anonymous in an online community (only an e-mail address is visible), and some people feel less inhibited about asking questions or raising issues, which they may feel reluctant to pose face-to-face with an instructor or fellow peer.

Well-developed online communication technology is valuable only when it appropriately supports and extends the social elements of the community: the people, purpose and policies. Of great importance is supporting the learner to communicate effectively and to become proficient with the technology. This consideration must be part of the initial design and ongoing process of learning to meet the needs of the learner. The role of the instructor is vital in the development of online involvement and should not be understated (Colins and Berge, 1996). Even in the more independent nature of the online environment, students still need to be supported in managing their own learning experience including setting goals, roles, responsibilities and prioritising tasks (Hill & Raven, 2000).

In order to provide an environment, which will encourage and support discussion and a sense of community, technical and management issues must be addressed in a way that does not proscribe or alienate group members. Issues for consideration include the following:

- What is the purpose of the group? For example, is it to discuss specific professional and practical issues, or does it have a wider scope as a social network within which specific issues may be addressed?
- What is the most appropriate technology to use? The technology should not hinder or distract from discussions, but there may be a need for members to be able to share documents and media files, or refer to specific content on a web site.
- What technical and management roles are needed? How will members' enquiries, registrations or subscriptions be handled? Is it more appropriate to moderate discussions closely, or simply to facilitate dialogue without dictating what is discussed?
- How will policies and guidelines be developed and communicated? How will issues such as copyright, offensive language, inappropriate messages and off-topic discussions be addressed? How will members be made aware of guidelines and policies?

Adapted from: Brook and Oliver (2003) Online Learning Communities – a design framework.

When considering these issues, the best place to start is the group members themselves. This will ensure that any decisions taken are inclusive and relevant to their needs. The process and procedures for developing online communities are still largely unknown, with much of the current thinking based on the research of professionals working in the field. Research into instructional emphasis and how to learn design settings that promote community development are still required. However, the advantages of online learning communities cannot be ignored. In an increasingly ICT-mediated learning environment, the use of online collaboration serves as a social forum upon which interaction, discussion and reflection can facilitate learning.

For additional reading regarding online learning communities, consult the following reports prepared for the Office of Learning Technologies in Canada:

Best Practices Workshop on Learning Communities available from:http://www.hrsdc.gc.ca/en/hip/lld/olt/Skills_Development/OLTResearch/bpwlc_e.

Models of community learning networks in Canada available from http://www.hrsdc.gc.ca/en/hip/lld/olt/Skills_Development/OLTResearch/CLNmod_e.pdf

Transformative Reflection

Now that you have completed this segment of instruction, please engage in the following transformative reflection activities:

- Focus on your assumptions that underlie your beliefs, feelings and actions regarding the importance of using ICTs to facilitate development of Online Learning Communities in TVET.
- Examine and assess the consequences of these assumptions on your belief, feelings and actions in relation to specific strategies using ICTs to facilitate development of Online Learning Communities in TVET.
- Examine and assess the implications of these assumptions on your beliefs, feeling and actions with regards to desirable initiatives using ICTs to facilitate development of Online Learning Communities in TVET.
- Consider your learning experiences while completing this segment of instruction. Make a critical reflection of how this instruction has enabled you to identify and explore alternative assumptions or reinforced your existing assumptions regarding the importance of using ICTs to facilitate development of Online Learning Communities in TVET.
- If this reflection has enabled you to consider alternative assumptions, test the validity of these assumptions by participating in a reflective dialogue with a critical friend or by engaging in self-reflection.

ACTIVITIES

- Using your Transformative Reflection experience, develop an ICT strategy to use ICTs to facilitate development of Online Learning Communities in TVET.
- If your organization has already developed a strategy to use ICTs to facilitate development of Online Learning Communities, review and revise that startegy as may be necessary.
- Ask a group of key stakeholders in TVET to review this ICT strategy.

ASSESSING E–LEARNING READINESS

Now that you have completed your journey through this educational material, we invite you to use the knowledge and skills acquired to assess the e-learning readiness of your organization, using the following Quick Scan: SPOT! questionnaire.

E–LEARNING READINESS QUICK SCAN: SPOT!

(Developed by Baalen and Moratis, revised by Chinien, Kotsik, 2004)

The E-Learning Readiness Quick Scan: SPOT! is designed to be used during the planning and implementation stages of e-learning initiatives. The questionary was used for IITE Workshop ICTs in TVET Sofia, Bulgaria, 3 April 2004 held within IITE subregional project *ICTs for Development of Edication and Construction of a Knowledge Society* for the countries of South-East European Region.

ICT–MEDIATED VOCATIONAL EDUCATION NEEDS SURVEY: SPOT!

PURPOSE

The ICT-Mediated Vocational Education Needs Survey is designed to be used during the planning and implementation stages of ICT-Mediated Education initiative.

DIMENSIONS

Strategic Dimension

Strategic dimension is concerned with creating a strategic plan for the ICT-Mediated Vocational Education initiative. This involves establishing and communicating a vision, a strategy, and objectives. This is recognized by assessing the strengths and weaknesses of ICT-Mediated Education initiative in a particular country.

Pedagogical Dimension

Pedagogical dimension is concerned with the fit between the ICT-Mediated Vocational Education initiative and the learning approach currently employed.

Organizational Dimension

Organizational dimension focuses on the culture and impact of the initiative on human capital, and the resulting management implications.

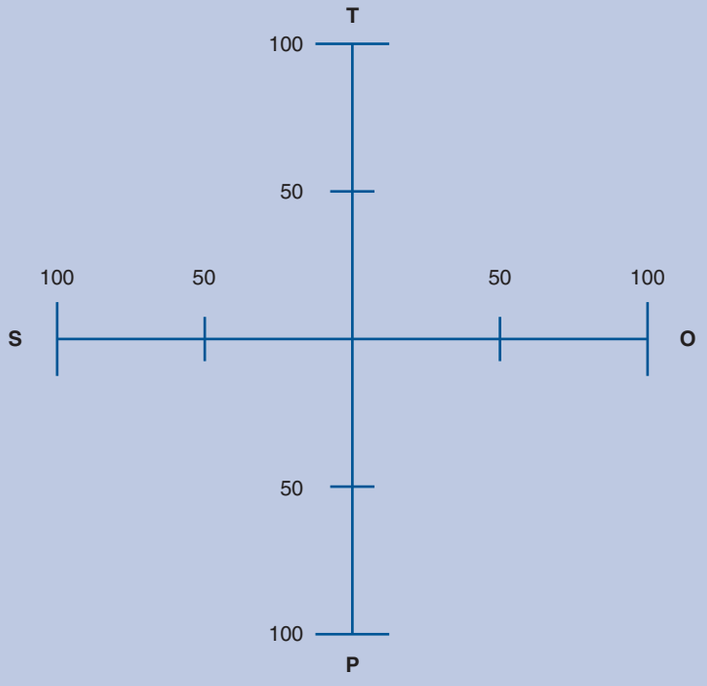
Technical Dimension

Technical dimension is concerned with the awareness surrounding internal technical capabilities and learning technologies available in the market.

OUTCOMES

Each individual dimension score is transformed into a percentage and represented on the following status graph. This is done for ease of comparison between the dimensions and to visualize the country's overall implementation stages for ICT-Mediated Education in TVET. The graph facilitates the identification of areas in need of attention or improvement.

SCORING CHART



SURVEY QUESTIONNAIRIE

Strategic dimension				
	Question	**Answer yes/no**		**Point value**
1	Has your country established the following for your ICT–Mediated Education initiative?		Strategy	yes = 0 no = 4
			Vision	
			Objectives	
			Financial viability of the project	
2	Has your country communicated the following to all stakeholders?		ICT–Mediated Education strategy	yes = 0 no = 4
			ICT–Mediated Education vision	
			ICT–Mediated Education objectives	
3	Has your country created or reviewed and appropriately modified legislation to facilitate the use of ICTs in TVET?		Yes, our country has created, reviewed and appropriately modified legislation to facilitate the use of ICTs in TVET.	0
			No, our country has not created, reviewed and appropriately modified legislation to facilitate the use of ICTs in TVET.	
4	Has benchmarking been conducted against other countries?		No, we have not benchmarked against other countries.	4
			We have informally benchmarked against other countries.	2
			Yes, we have benchmarked against other countries.	0
5	What is the purpose of the ICT–Mediated Education initiative with respect to your current learning approach?		The purpose of the ICT–Mediated Education initiative is to virtualize as much of the programme as possible.	4
			The purpose of the ICT–Mediated Education initiative is to complement the current programme components with ICT–Mediated Education technologies.	0
			We haven't defined a relationship between ICT–Mediated Education and our current learning approach.	4
			TOTAL:	

Pedagogical dimension				
	Question	**Answer yes/no**		**Point value**
1	Has your country assessed the compatibility of educational technology with your institutions' learning approach?		We have performed an assessment and found them to be compatible.	0
			In our assessment we found them to be incompatible.	4
			We have not performed an assessment.	4
2	Has your country surveyed the opportunities to include ICT–Mediated Education technologies in your curriculum?		We have surveyed the prospects and found several opportunities.	0
			We have surveyed the prospects but have found minimal opportunities to include the technology.	4
			We have not surveyed the opportunities.	4
3	Have you assessed the technological proficiency of (prospective) students?		Yes and their capabilities are sufficient for ICT–Mediated Education.	0
			Yes, and we have identified a need to develop their technological proficiency before implementing ICT–Mediated Education.	2
			No, we have not assessed their technological proficiency.	2
4	Have you ensured that your ICT–mediated Education initiative fulfils (prospective) student's educational needs and meets their expectations of modern learning environments?		Yes, we have ensured that our initiative fulfils student's educational needs and meets their expectations of modern learning environments.	0
			No, we have not ensured that our initiative fulfils student's educational needs and meets their expectations of modern learning environments.	2
5	Are the knowledge, skills, and abilities of your educators sufficient enough to ensure effective student instruction by means of ICT–Mediated Education?		Our educators will need development/training to ensure the success of this initiative.	4
			We will need to hire additional educators or consult experts to ensure the success of this initiative.	4
			Our human capital is sufficient for the success of this initiative.	0
			Our human capital exceeds the requirements of this initiative.	0
		TOTAL:		

Organizational dimension				
	Question	**Answer yes/no**		**Point value**
1	How well do culture of your educational institutions deals with change?		Well. Our educational institutions are very familiar with change.	0
			Somewhat well. Our educational institutions do not incur a lot of change.	2
			Not well. We have met with problems implementing changes.	4
			Our educational institutions prefer the status quo. They do not look for reasons to change.	4
2	Does your country's teaching staff support the ICT–Mediated Education initiative?		No. They have expressed resistance to the initiative.	4
			I do not believe they have a clear understanding of the initiative.	4
			Part of our teaching staff support this initiative.	2
			Yes the majority support this initiative.	0
3	Has your country identified (a) leader(s) capable of championing and rallying support for this initiative?		Yes, we have identified a champion for this initiative.	0
			No, we have not identified a champion for this initiative.	2
4	Has your country established and communicated the existence of training/learning support systems?		We have established support systems and their existence has been communicated throughout the organization.	0
			We have established support systems and their existence has been communicated to key organizational players.	1
			We have established support systems but only persons who enquire know of their existence.	2
			We have established support systems but their existence has not been communicated.	3
			We have not established support systems.	4
5	Have you completed or established the following for your teaching staff?		Needs Assessment	yes=0 no=2
			IT Comfort Levels	
			Training Plan	
			Minimum Training Standard	
			Mechanism to monitor training results.	
			TOTAL:	

Technical dimension				
	Question	**Answer yes/no**		**Point value**
1	Do you have an overview of available learning technologies?		Yes, we have researched available technologies.	0
			No, we do not have an overview of available learning technologies.	4
2	Has benchmarking been conducted against learning technologies available in the marketplace?		No, we have not compared our current capabilities to market norms.	4
			We have informally benchmarked against available learning technologies.	2
			Yes, we have formally benchmarked against learning technologies available in the marketplace.	0
3	What is the current state of the country's technological infrastructure when compared to ICT–Mediated Education initiative requirements?		The country has more than adequate infrastructure for this initiative.	0
			The country has adequate infrastructure to meet this initiative's requirements.	0
			The country's infrastructure is not currently advanced enough to support this initiative.	2
			The organization has no technology infrastructure.	4
4	Has your country created a technology application/infrastructure implementation plan?		Yes, we have created a technology implementation plan.	0
			We have implementation ideas, but nothing concrete.	2
			No, we do not have a technology implementation plan.	4
			No, because we currently have (more than) adequate technology for this initiative.	0
5	Has your country established and communicated the existence of technological support systems?		We have established support systems and their existence has been communicated throughout the country.	0
			We have established support systems and their existence has been communicated to key players.	1
			We have established support systems but only persons who enquire know of their existence.	2
			We have established support systems but their existence has not been communicated.	3
			We have not established support systems.	4
		TOTAL:		

SCORING GUIDE

STRATEGIC DIMENSION

0 – 12 Your country is strategically ready to implement ICT-Mediated Education. You have taken the time to assess the country's strengths. You have established key strategic guidelines for your project, taking important elements into consideration. Congratulations!

13 – 26 While you have made valiant steps toward strategic dimension, there are a few things that you may have overlooked in your strategic planning stage. Whether it be communicating the initiative's objectives or establishing policy, strategy is a key element to the success of any initiative. Review the identified problem areas to ensure that you are strategically ready for this initiative.

27 – 42 Your country is not strategically ready to implement ICT-Mediated Education. The success of a project is contingent on its strategy. Your country needs to complete an assessment. This will provide the appropriate foundation to establish strategy. Another key component of strategic dimension is achieving stakeholder buy-in, this can be achieved by communicating the initiative's strategy to the key stakeholders.

PEDAGOGICAL DIMENSION

0 – 5 Your country is pedagogically ready to implement ICT-Mediated Education. You have taken the time to ensure your ICT-Mediated Education initiative's compatibility with your country's orientation and identified opportunities to include ICT-Mediated Education in your curriculum. You have a comprehensive understanding of your student's technological capacities and educational requirements, and are prepared to fulfil their expectations.

6 – 10 While you have considered several pedagogical facets integral to implementing your ICT-Mediated Education initiative, there are a few areas that require a little more attention. Have you ensured that you have an accurate profile of your prospective students, including technological proficiencies and requirements and expectations of an ICT-Mediated Education programme? Have you examined your current orientation and curriculum to ensure that ICT-Mediated Education is concurrent with their pedagogy? Have you assessed the skills, knowledge, and abilities of your teaching staff and ensured that they are sufficient for this initiative?

11 – 16 You do not have sufficient pedagogically dimension to support the implementation of ICT-Mediated Education. Ensuring a fit between your organization's orientation and your initiative is critical to its success in the long-term, and is not to be overlooked. Understanding your target audiences' strengths and limitations regarding technology will help you tailor your product to maximize learning, as will understanding their educational needs and learning environment expectations.

ORGANIZATIONAL DIMENSION

0 – 8 Congratulations! The appropriate elements of organizational dimension have been met. In preparation for your initiative, your organization has appropriately reviewed the capabilities of your staff and the organizational culture. An initiative champion has been identified, and the appropriate support systems have been established and communicated.

9 – 16 Your country has a few things to undertake to ensure organizational dimension. Having a clear understanding of the knowledge, skills, and abilities of your teaching staff is key to successfully implementing ICT-Mediated Education. Evaluating the organizational culture can minimize potential resistance problems. Your employees are stakeholders in this initiative. Understanding their needs and developing the appropriate support systems will ensure this initiative's success.

17 – 24 Your country dimension is not sufficient to support ICT-Mediated Education. Having a complete understanding of your staff's present and required knowledge, skills, and abilities will facilitate the successful implementation of ICT-Mediated Education. Establishing and communicating support systems will ease the

implementation process for your teaching staff. An ICT-Mediated Education champion can increase stakeholder buy-in, something that is imperative in initiatives such as this.

TECHNOLOGICAL DIMENSION

0 – 6 Your country is technologically ready to implement ICT-Mediated Education. You have a solid understanding of your own capabilities as well as the learning technologies available in the marketplace. You have established an implementation plan and have established and communicated the appropriate technological support systems. It is obvious that you understand how key technological dimension is to ICT-Mediated Education implementation. You should incur only minor problems.

7 – 14 Your country is not quite ready to implement ICT-Mediated Education. Perhaps you have not explored all options of ICT-Mediated Education, or perhaps your learning technology is not quite advanced to support this initiative. Whatever it may be, take the time to explore your technology options and create the appropriate implementation plans and support systems. Dealing with these issues now will minimize future problems. Remember, the choices that you make now will affect your organization's future technological capabilities.

15 – 20 Your country is not technologically ready to implement ICT-Mediated Education. The success of an ICT-Mediated Education initiative is dependant on organization's present and future technological capabilities. Understanding your organization's technological infrastructure, benchmarking against available learning technologies, and being able to create an implementation plan are all key components of technological dimension. Additionally, setting up support systems will ensure efficiency and facilitate adoption. Consider these factors when reviewing your organization's technological state.

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