Université de Montréal

"A Systematic Approach for Implementing Interactive Videodisc Courseware in Training"

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Cette thèse intitulée :

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ABSTRACT

This study is in the area of educational technology investigating the implementation of a new training approach: **interactive videodisc instruction**, (IVI). Our investigation will lead us to develop a new guideline on how interactive video instruction should be implemented in a school system, and in the industrial environment. In so doing we will gather empirical data to built a theoretical background based upon the analysis of the Ministry of Education of Quebec (MEQ) study that we carried out in 1993. Therefore, this study is within the framework of development research defined by De Landsheere (1972).

The Introduction will highlight a few elements of recent studies, including the importance of IVI in school system and corporate environment. The efficient of IVI technology in training is demonstrated along with a more recent one conducted for the MEQ in 1993, using interactive videodisc instruction in a school system for electromechanical programs,- aimed at high school students. The MEQ study will lead us to different conclusions, consistent with past studies, but will also focus attention on new issues like the implementation of this technology. All of the studies we analyzed have convinced us of the need for in depth research into the problems inherent in IVI which is implementation.

The first chapter will present a review of literature based on an inductive process aimed at the issues expressed in our introduction. We will review what different authors understand about **implementation**. We will investigate two approaches: a ***"prescriptive approach"*** which is more theoretical about implementation, and a ***"pragmatic approach"***, based on real IVI implementation, and problems encountered.

The second chapter will present the creation of five grids regrouping different factors in order to analyze indepth the MEQ study. Those grids are divided into two period: the **preparation period** and the **implementation period**. Every steps of MEQ study implementation will be analyzed including the results and the recommendations. In light of this analysis, we will present our definition of **implementation** and discuss the characteristics of implementation.

The third chapter presents an inventory of all factors found from the review of literature, including those additional factors used in the MEQ study and finally considerations which come from problems raised in the MEQ study. Those considerations will become additional factors as well.

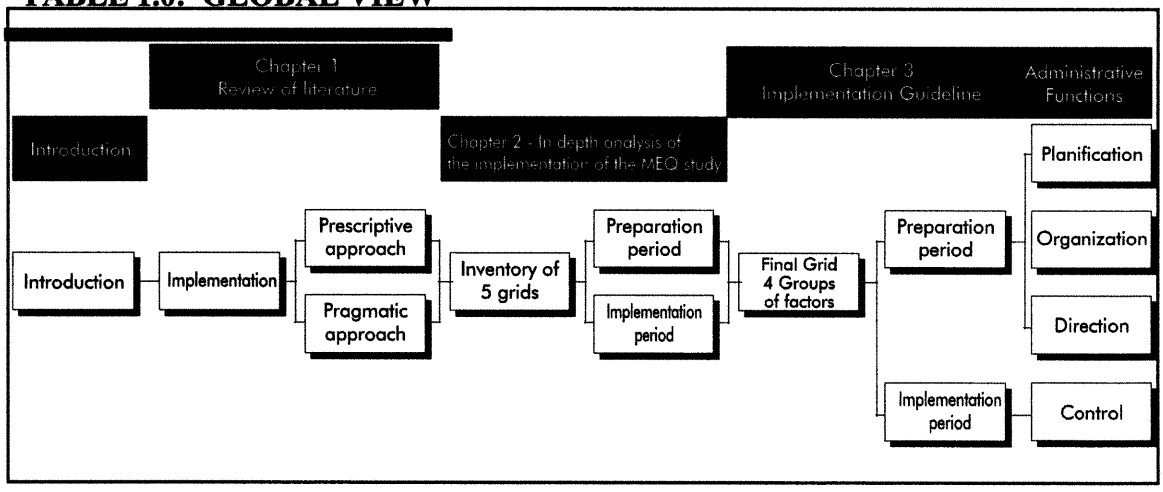
From those observations, a model of guideline is constructed which insert four administrative functions, **Planning, Organization, Direction,** and **Control**.

Respecting the same approach, having the **preparation period** and the **implementation period**, the new guideline and grids of factors will become a prescriptive approach. The guideline inserts at the same time the use of administrative functions and the grids.

This new approach is to ensure consistency in using all factors from the **preparation period** through the **implementation period** in the **implementation phase.**

In order to better understand the organization of the study, we present a schematic of the subjects covered along with the different chapters in which they are covered. For each chapter, we will find the highlight part we are covering.

TABLE 1.0: GLOBAL VIEW



RÉSUMÉ

Cette recherche est dans le domaine de la technologie éducationnelle et vise à investiguer l'implantation d'une nouvelle technologie en apprentissage, celle du vidéodisque interactif que l'on appelle en anglais "Interactive Videodisc Instruction" ou "IVI".

Plusieurs recherches ont démontré que le vidéodisque interactif est un moyen puissant pour apprendre et qui contribue à des économies de temps et à une meilleure rétention chez les étudiants. Plusieurs auteurs ont mentionné que le succès et l'efficacité de cette technologie, qui utilise à la base l'informatique, dépend grandement des programmes d'implantation. Devant l'ampleur de l'utilisation de cette nouvelle technologie, IVI, tant dans les milieux scolaires que corporatifs, il devient donc important d'analyser les conditions idéales et les programmes d'implantation nécessaires pour assurer le succès désiré et trouver l'efficacité recherchée dans cette technologie.

Une recherche dans ce domaine s'est déroulée au Québec. Le rapport de l'étude du MEQ (Ministère de l'Éducation du Québec) de 1993 s'appuie sur un projet pilote qui a pris place dans une école secondaire, dans un programme électromécanique du Ministère de l'Éducation. Le but premier de cette étude était de voir si l'on pouvait obtenir les mêmes résultats en utilisant des cours génériques dans un milieu scolaire hétérogène. Les résultats n'ont pas été aussi évidents que les autres études dans le même domaine qui, après analyse, relevaient des problèmes d'implantation. La revue de littérature de cette étude indique assez clairement l'efficacité du vidéodisque interactif en formation mais qui se base sur des projets sur mesure c'est-à-dire dans des situations de quasi-laboratoire. Dans ces dites études, l'implantation de cette technologie devenait secondaire et attirait moins l'attention. L'autre but de l'étude du MEQ visait à analyser la possibilité d'utiliser des cours génériques dans un programme scolaire tout en identifiant les possibilités d'implanter cette technologie dans toutes les écoles du Québec.

Les problèmes soulevés dans cette étude ont une relation directe avec l'implantation de cette technologie à savoir :

- Aucun programme de formation adéquat pour les professeurs.
- Manque de connaissance des contenus des vidéodisques par les professeurs.
- Manque de connaissance sur l'utilisation des cours IVI.
- Manque de connaissance sur l'utilisation du logiciel de gestion.
- Manque de lien entre les cours existant en classe et le contenu du vidéodisque.
- Manque de manuel d'accompagnement avec le vidéodisque.
- Manque de matériel pédagogique par rapport au nombre d'étudiants.
- Aucun réseau informatique pour recueillir les résultats des étudiants.

Les problèmes rencontrés reposaient en partie sur le manque de planification, d'organisation et d'administration. C'est à la suite de ces différents problèmes que l'étude du MEQ recommande fortement d'investiguer davantage l'implantation visant également à mieux définir l'implantation. La définition de l'implantation doit être élargie afin de permettre un cadre de travail qui couvre tous les éléments de l'implantation.

La problématique est qu'il ne semble pas exister de guide d'implantation rationnel et systématique pour la technologie du vidéodisque interactif. On retrouve plusieurs énoncés soulignant l'importance de la phase d'implantation. Lorsque l'on consulte ce qu'écrivent certains auteurs mentionnant la phase d'implantation, l'on constate que le tout tient en trois ou quatre lignes, un paragraphe tout au plus. D'autre part, les auteurs qui ont participé à l'implantation d'un projet sont plus explicites concernant l'implantation du vidéodisque interactif en employant différents facteurs mais qui ne sont pas utilisés de façon consistente et rationnelle.

But de l'étude

Le but de la présente étude vise à investiguer la phase de l'implantation et de rechercher ce qu'elle doit inclure. Il s'agit de définir les étapes nécessaires pour faire une bonne implantation en déterminant tous les facteurs nécessaires qui seront intégrés dans des grilles, et dans un cheminement logique pour élaborer un guide de fonctionnement "guideline".

Méthodologie

Une approche inductive est utilisée pour la revue de littérature et nous a permis de:

- Classifier les facteurs;
- Développer des grilles;
- Analyser l'implantation dans l'étude du MEQ;
- Inventorier les différents facteurs selon : la revue de littérature, l'étude du MEQ et d'autres considérations provenant des problèmes soulevés;
- Développer un modèle;
- Reclassifier les facteurs;
- Ajouter les fonctions administratives;
- Développer de nouvelles grilles;
- Développer un guide de fonctionnement.

La recherche

La revue de littérature nous a permis de constater que la phase d'implantation s'inscrit dans la dernière phase du modèle de Salisbury (1992), destiné à repenser un modèle éducatif en fonction de l'utilisation des nouvelles technologies. Cependant, autant dans le modèle de Salisbury que dans les 12 modèles décrits par Savoie-Zajc (1993) qui sont unanimes sur l'implantation, on retrouve peu d'élaboration de la phase d'implantation.

Ceci étant mentionné, nous ne nous sommes pas attachés en soi au modèle éducatif puisque l'implantation du vidéodisque interactif se fait à un niveau inférieur dans la structure. Cela n'enlève pas son importance. L'implantation de la technologie du vidéodisque interactif en formation fait suite à une décision réfléchie d'utiliser cette nouvelle technologie.

Une revue de la littérature, orientée sur le vidéodisque interactif utilisé en formation, basée sur une approche inductive nous a permis de structurer cette recherche en deux volets :

. Une approche prescriptive ou théorique dont certains auteurs décrivaient la manière dont une implantation de vidéodisque interactif doit être faite.

. Une approche pragmatique ou pratique, consistant à faire une recherche auprès de différents projets sur IVI qui ont été vraiment implantés et à observer quelles méthodes avaient été utilisés pour implanter cette technologie.

Cette revue de littérature a permis de constater que la phase d'implantation comportait deux périodes :

. La période de préparation qui fait surtout appel à la planification , à l'organisation et à la direction des activités, et

. La période d'implantation qui, effectivement, consiste à vérifier si tous les éléments sont en place, donc le contrôle.

Également, cette revue de littérature a permis de créer des groupes de facteurs menant à la structuration de grilles correspondant aux thèmes suivants :

1. Les **facteurs physiques** concernant tout l'aspect physique d'une implantation et d'une installation de système.

2. Les **facteurs équipements** concernant tous les équipements nécessaires à l'utilisation du vidéodisque interactif.

3. Les **facteurs cours** concernant la bonne qualité d'un cours sur vidéodisque interactif.

4. Les **facteurs ressources humaines** qui sont divisés en deux groupes: **les formateurs et les étudiants**. Ces deux groupes de facteurs visaient tout l'aspect humain de l'introduction de cette technologie, tant du côté des formateurs qui devaient modifier leur approche et apprendre la technologie que du côté des étudiants qui devaient l'utiliser.

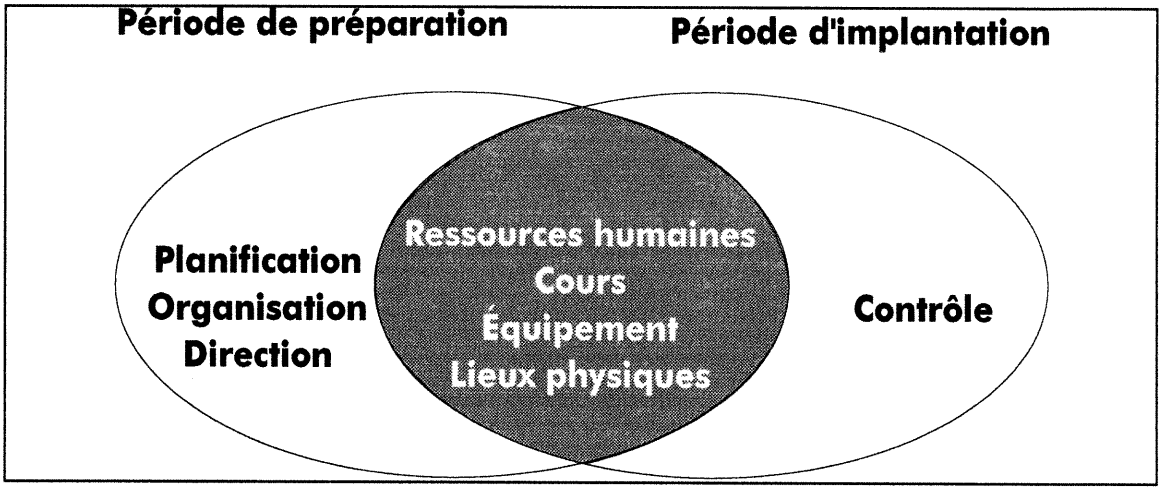
Ces grilles de facteurs ont permis de créer un cadre pour analyser en profondeur la recherche du MEQ afin de déterminer si toutes les étapes avaient été suivies, omises ou encore si on avait tenu compte de d'autres facteurs dans la recherche du MEQ qui n'avaient pas été originalement soulevés par les différents auteurs de la revue de littérature. Suite à l'analyse de l'étude du MEQ, un inventaire de tous les facteurs a été fait incluant ceux utilisés dans la recherche du MEQ ainsi que les problèmes relevés dans l'étude du MEQ qui auraient pu être attribués à des facteurs d'implantation.

Ceci a permis de constater que les fonctions administratives étaient, à l'occasion, utilisées comme facteurs mais sans structure consistante.

Ce rescencement et ces observations ont permis de créer un modèle d'implantation qui tient compte non seulement des facteurs d'implantation mais aussi des fonctions administratives. Cette étape a donné lieu à la création de nouvelles grilles et du guide de fonctionnement incluant les fonctions administratives.

Le modèle ainsi que le guide de fonctionnement et ses grilles de facteurs, permettent une approche rationnelle, consistante et systématique de l'implantation du vidéodisque interactif en formation.

MODELE : PHASE D'IMPLANTATION



La période de préparation, qui utilise les fonctions administratives , Planification, Organisation et Direction, regroupe les quatre groupes de facteurs dans un cheminement rationnel. La période d'implantation utilise la fonction administrative, Contrôle, pour les mêmes quatre groupes de facteurs.

Ce modèle d'implantation permet à la fois d'intégrer les différents facteurs et les fonctions administratives. Le but poursuivi est d'assurer la consistance et la logique dans l'utilisation de tous les facteurs d'implantation.

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To Francine, Cyndy and James

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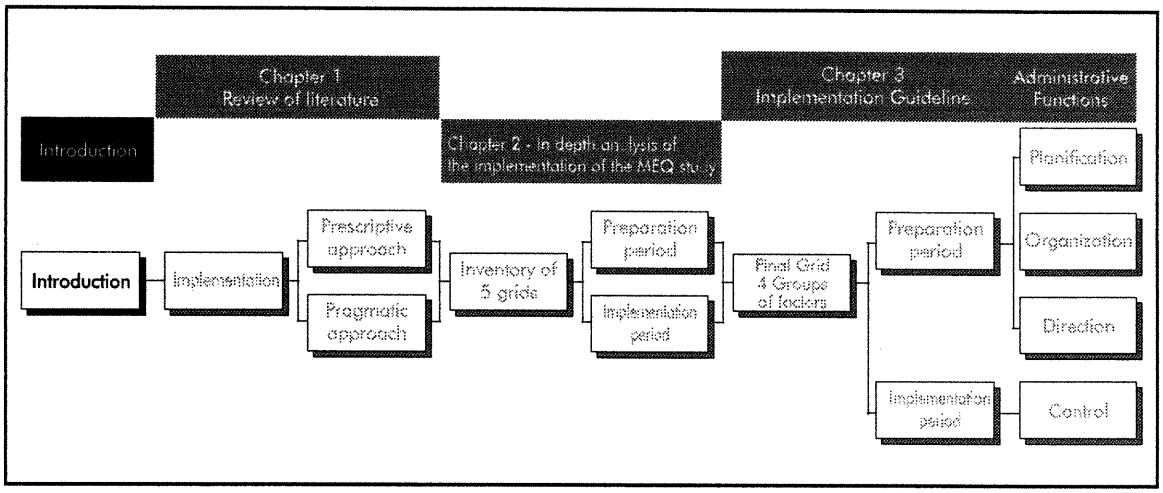
INTRODUCTION



Need for the Study

With the number of interactive videodisc instruction (IVI) programs being used in classrooms/training sites continuing to increase, educators have been gathering descriptive information about the types and the purposes for which they are being used (Videodisc Monitor in 1991 lists more than a thousand courses available). There is an expressed need, however, to investigate further the effect of this new technology in a public school environment.

Butler and Clouse (1996) described clearly the benefit of the computer, the interactive videodisc, CD-ROM and CD-I in their work. Based on Cohen (1983) and Albright & Graf (1992), they mentioned that it is: *"a tremendous time-saver for teachers"*. Those technologies *standardize testing programs* and *enhance the questioning by producing better illustrations and providing endless combinations of questions*. Relying on the studies from Shane (1987), Ravitch (1987), and Romiszowski (1988), Butler and Clouse (1996) said instruction is bringing to life with pictures, sound, words and stories with individualized instruction.

Also, Lippke in 1987 had retrieved the financial benefit on using IVI.

As well, Kalowski in 1987 stated that: *"studies show in training applications that students learn in 50% less time and retain 25% more information"* (p.19).

Already in 1993, Wright clearly established the benefits of using multimedia and illustrates the number of organizations using multimedia in training. The number of users was growing and even more.

Posner, Danielson and Schmidt-Posner (1992 and 1993) mentioned that:

> *"implementation factors play a large role in determining the adoption and use of a computer-based system ... Adoption by key organizational members, user participation, incentives for use and an adaptive planning process are other implementation factors that have been linked to successful introduction of technology in education and industry (Bikson, Gutek & Mankin, 1981, Rice & Case, 1983, and Schmidt-Posmer, 1989)."*

Also, Major in 1993 conducted a study with the Ministry of Education of Quebec (MEQ) for their Electromechanical Program at West Hill High School to verify the time saving and the retention of students using IVI. The study aimed to verify if the use of generic courseware, designed for heterogenous groups would bring similar results to those studies for custom videodisc instruction.

Among all the different definitions of generic courseware, the more appropriate can be found from Perlmutter, 1991 (p. 177). It is short but meaningful: *"Educational courses that are not specific to one organization and thus appeal to a broader market; as opposed to custom courseware, which primarily meets the needs of one specific client or audience."*

The approach used in that study was consistent with similar studies in custom videodisc instruction; with a control group and an Anova statistical analysis. Major (1993), showed that his results were similar to other research and showed that there was a time saving: 15% time saving over traditional classroom delivery compared to other studies varying from 40% to 60%.

Scores of students from labs exercises and final test were used to measure retention and demonstrate to be higher for those using interactive video instruction.

This was consistent with five major traditional reviews of the effectiveness of IVI (Bosco, 1986; DeBloois, 1988; DeBloois, Maki, & Hall, 1984; Manning, Ebner, Brooks, & Balson, 1983; Smith, 1987). Conclusions have been generally positive, though based on inconsistent and contradictory findings (p. 1). Despite this fact, these results were also consistent with McNeil & Neilson (1991), whose latest study assembled 367 studies. Among those studies, 63 only met the criteria for their inclusion in their research. They concluded that *"IV (Interactive Videodisc) is an effective form of instruction"*.

Back on 1989, Bliss, Gorence, and Haight stated that the advent of computers in the classrooms has changed the shape of education. Students now have the opportunity to utilize compact disc - read only memory (CD-ROM) for research and compilation of information.

Although conclusions were generally consistent with other studies, Major (1993) noticed in his analysis that other factors might have played an important role in the results which were not as clear as other studies in the same area. Even though, some elements of implementation were already included, the recommendations of this study clearly stated that **implementation** played a key role in the efficient use of this technology.

Peterson (1989) suggested *"that we have considerable work to do in identifying the most effective ways to design and implement technology-based programs (interactive videodisc instruction) that ameliorate rather than compound the problems of instruction"* (p. 1).

Weiss and Jarvis (1986 and 1987) discussed how most applications of interactive videodisc instruction to date have been pilot projects tailored to individual circumstances, with little or no evaluation or validation of claims of lower costs or improved training effectiveness (like the possibility of using generic courseware).

Salisbury (1992) expressed clearly in his article: The Florida Schoolyear 2000 Initiative, the dedication of the project America 2000 to bring new technology in the schools. The project is mapped in four phases: a design phase (through 1992); a development phase; an operational test phase; and a continuous improvement phase. As written:

> *"Effective use of technology requires changes in the basic structures of schools in the way schools use time, resources, physical space, and personnel. Without changes in these basic structures, technology remains peripheral to the learning process. When this happens, technology cannot produce increases in productivity and efficiency."* (p. 7)

This article is again a clear awareness that the educational system has to change to search for viable learning, and develop instructional strategies based on new roles of teachers and learners in the system, considering the impact of new technologies.

Powell and Reiff (1993) based on OTA Report conducted by Scorgan (1992), were mentioning that: *"vast majority of teachers have had little or no training in the use of new technologies"* (p.134). The same authors underline five barriers to technology acceptance: *"1) technology's potential is largely unexploited, 2) the role of the classroom teacher is critical, 3) most teachers want to learn technology, 4) adopting technology is complex, and 5) technology makes teaching more challenging before it makes it easier"*. In a similar context, Bitter and Yohe (1992) mentioned that: *"the role of technology in education has not been totally defined, nor is it widely accepted by educators"*.

From Cates (1991) and Wite (1991), Butler and Clouse (1996) pointed out that:

> *"The possibilities of technology, of course, are endless. Some of the most exciting practical programs available to history teachers are hypermedia programs, e.g., Martin Luther King, Jr. (developed by ABC News). A blending of text, graphics, audio, and full-motion video, multimedia databases such as this show great promise for students and teachers at all levels. The ability of hypermedia to anticipate a variety of paths through which individuals might take to learning enhances the depth of programs used by students for many purposes"*.

Butler and Clouse (1996) also mentioned that:

> *"To successfully implement the use of computers in history instruction, there are several suggestions:*
>
> . *development of detailed guidelines for orchestrating research projects,*
>
> . *intensive teacher training* investigated from Scanland & Slattery (1983) and Kupisiewicz, School & the Mass Media (1984),
>
> . *design and development of easy-to-use software that facilitates the task at hand rather than hinders it* investigated from Johnson (1987),
>
> . *planning time for teachers, both collaboratively and individually* investigated from DeLeeuw & Waters (1986),
>
> . *reward systems for innovators and pioneers* investigated from Scanland & Slattery (1983)."

Graziadei and McCombs (1995) said:

> *"As a result of the use of technology in education, the traditional roles of teacher and librarian are being questioned. Students are exerting much more of an influence on the direction a class or a search strategy can take. It is a challenge to become more of an observer studying the learning processes of students. E-mail, conferencing, gopher, World Wide Web, and multimedia bring learners closer to teachers, learners closer to each other, as well as creating new contacts among colleagues."*

More over, Graziadei and McCombs (1995) said: *"This involved releasing academic staff from teaching duties so that they could be trained to use multimedia systems or to adopt and adapt material sources from elsewhere into their courses."* The same authors mentioned, from a study of Ryan (1994), that: *"to build an environment where the use of teaching and learning technology is as natural and as well supported as the use of textbooks."*

Implementation is as crucial as the production of a new application. If not properly orchestrated and understood, it can fail even though the initial application developed is very good (Bergman and Moore, 1991).

Generally, we found that authors agreed on the efficiency of IVI but none of them addressed specifically the implementation phase. So, it became important at this time to investigate further more implementation factors to find what they include and which are crucial in using this new IVI technology in training.

Savoie-Zajc (1993) presented 12 different models of educational change which relates to planning and goes through the implementation. The importance of implementation is demonstrated in all educational models presented by this author. Some model of educational change include new technologies and their implementation which obviously include IVI technology.

This study aims at the implementation of IVI technology as such which carry its own considerations as we will see independently of the model of education used. It is at a much lower level.

Educational models look at a broader variable which are out of our considerations in this study as we specifically look at IVI implementation as a tool of training.

Nevertheless, implementation of technological change is crucial as mentioned by Savoie-Zajc in the model of Berman and McLaughlin, as an example (p. 177 to 179). Implementation of IVI would be at phase III of their model but giving only very few indications of how to proceed.

We will not used those educational models as it is assume that there is an existing one. Our implementation model can be inserted in anyone of those models.

Definition of the Problem

Much has been written on how to produce videodisc, how the design should be handle along with the set up of objectives and different activities, but very little has been written on the implementation phase, the conditions that should prevail, and their importance.

The review of literature from the MEQ study establishes clearly that many studies covering the efficiency of the interactive videodisc instruction technology were for pilot projects in lab environment. They were custom productions. All elements to measure the experience were controlled, and none of the authors paid special attention on implementation (Miller, 1988; Hunter, GTE, 1988; & al.)

As time went by companies like Wilson Learning were producing generic courseware for a broad audience. Bainbridge (1992) mentioned then that implementation of this technology was important, starting with the training of the instructor. This statement came from the conclusion of many projects where we tried to sell interactive videodisc courseware. The idea was great but many companies did not know how to use it and how to integrate the interactive video courses within their actual program.

Trainers not familiar with the technology nor with the content of the course could not integrate this new tool in their program and were returning the material to the company.

Major, (1993) in his MEQ study revealed different problems as addressed to generic courseware for a broad audience. The most important problems encountered in the MEQ study were in the following areas:

- There was no adequate training program for teachers;
- There was a lack of knowledge of the content (topics) of the videodiscs;
- There was a lack of knowledge on how to use the courses -Staff was not familiar with the software;
- There was a lack of knowledge on use of administration software for the student - Students were not familiar with the software;

- There was a lack of knowledge in the management of the training program jointly with a traditional classroom delivery program - Staff had no experience in blending the interactive training with traditional classroom delivery programs;
- Not enough attention was given to the selection of courseware matching the scholastic levels of the student;
- There were no workbooks accompanying the videodiscs;
- There was no capability to print screen images from the videodisc and computer;
- There was not an adequate quantity of material (courseware) for the number of students;
- There was no networking capability to ease the retrieval of data from the results of students.

Also, many difficulties which occurred during this project could probably have been resolved if the project had a check list, in a form of a guideline, to follow. Briefly, the problems encountered were due to a lack of planning, organization, and administration, for implementing the new teaching technology.

Major (1993) stated the following:

> *"Based on this study and the different results, we would strongly recommend investigating much further the* ***implementation****, starting by its definition and considering its different implications. The overall organization of the project needs to be taken into consideration including the administration, and the implications for the teachers. Definition of implementation should be enlarged to give a framework on which we can rely to ensure that no element has been left aside."*

No matter how efficient IVI has been found, implementation is a phase that can not be ignored. Major (1993) in his MEQ study encountered many problems in using IVI which clearly relate to the implementation phase. The lack of a clear definition of implementation and the lack of a guideline bring speculative and erratic approaches, to the use and implementation of this technology.

Methodology

Our methodology, as described by Murdick (1969) is based on an inductive process where a review of literature will be performed in two aspects. The first one being the prescriptive approach of the implementation which is more theoretical. The second one being the pragmatic approach of the implementation which rely specifically on real project of IVI being implemented.

From this review of literature, grids will be built to analyze the MEQ study. From the analysis of MEQ study and comments, inventory of factors will take place with additional considerations.

At last, a final grids will be created and the guideline will take place.

Purpose of the Study

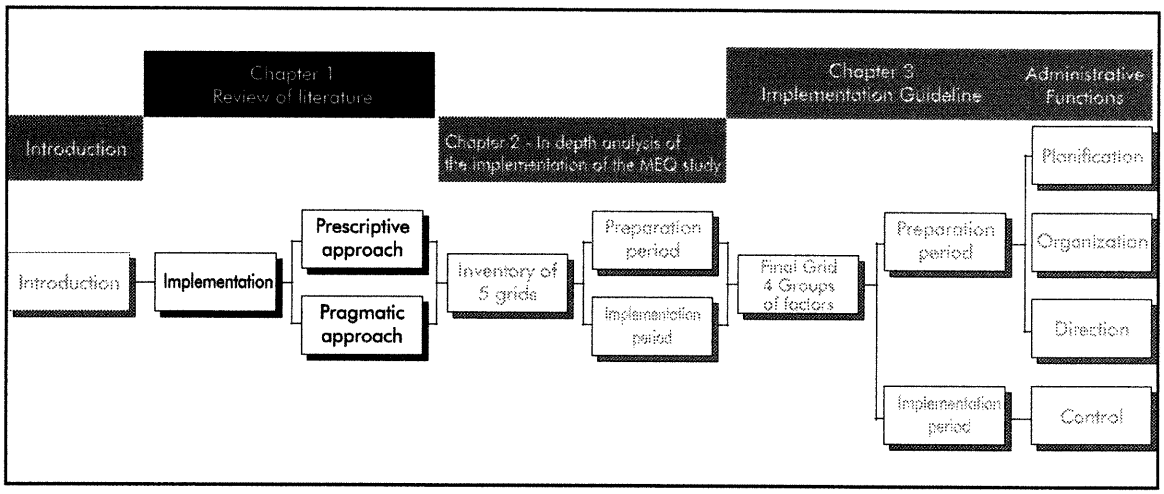
This study intends to investigate the phase of implementation and to find what it does include, and what it should include.

Our approach consists of using an inductive method for conducting the research of literature based on a prescriptive (theoretical) and a pragmatic (practical) approach, including analysis of the experience of MEQ study. It is our intention to define the required steps to insure a successful implementation of IVI technology, in a school system, or in corporate training environment.

Furthermore, this study will bring a comprehensive definition of implementation, including the development of a guideline, which will ensure that no steps will be left out to implement IVI, either in the schools systems (educational environment) or for professional training (corporate environment). This guideline will be easy to use and will help in the management of implementation.

CHAPTER 1

REVIEW OF LITERATURE



This chapter will review different authors focussing on implementation.

First, lets give a definition of "implementation". From the Webster's New World Dictionary (1970) we found that implementation is the synomym of implement, and it is refered to implement. From the Webster's New Dictionary of Synomyms (1973): *"An implement, in general, is anything that is requisite to effecting the end one has in view or to performing the work one undertakes... A tool, in general, is anything that facilitates the accomplishment of the end one has in view."*

In this study, the word **implementation** is used to implement a tool, called the **videodisc technology or Interactive Videodisc Instruction**, in a training situation aimed to train effectively people.

In order to understand better the word **implementation** in this study, we will investigate various studies using the two following approaches to facilitate this review of literature and identify different implementation factors:

- The first one being a ***prescriptive approach*** which is more descriptive and theoretical.

- The second being practical or ***pragmatic approach***, collected from the implementation of different interactive videodisc instruction programs.

1.1 Implementation from a Prescriptive Approach

Expressed as early as 1985 by Floyd, implementation looks at environmental factors which can be described as follows: *"Identify critical environmental factors that may influence the implementation of a project."* In the planning of an application make sure that someone is carefully evaluating environmental factors before the system is field tested or installed. Environmental factors are understood as:

- It begins with the basic facility requirements including temperature and humidity control, heat dispersion, ventilation and fans, service access, ambient light and noise, electrical power and communication devices;
- Systems enclosed in a kiosk configuration, with the ability to move or ship the kiosk easily;
- Physical security;
- Protection of the confidential records that may be stored in the system;
- Support personnel and service.

Briefly, as expressed by Floyd (1985), implementation is understood as a physical facility for students with hardware available at the right time, and also including layout of the facility, and with the most recent authors talking about support with well trained personnel or trainers regarding the use of the equipment, the troubleshooting and providing all the necessary information to use the application or the different courseware package.

Branson and Grow (1987) mentioned that:

> *"Regardless of the course being developed, there are five major phases that have to be carried out. These include an analysis of the situation (establishing the needs), the design of the course, the development of the course materials specified by the design process, the implementation of what has been produced in an actual classroom setting and the evaluation of the product."*

The way they discussed the phase of implementation is as follow:

- Making sure that the necessary equipment is at hand (audio-visual, computer, videodisc, electrical outlets, curtains to darken the room, etc.);
- The audience must then be prepared;
- Make sure that they are well seated in order to receive the messages.

A specific definition of implementation in the context of interactive videodisc instruction was expressed by Bergman and Moore in 1991 as follows:

> *"The phase in which the application is installed...The Implementation Phase comprises all activities needed to prepare, deliver, install and maintain the application in the actual sites. It involves activities separate from the development of the application itself, and is generally performed by in-house personnel and vendors other than the development team. Implementation can be almost as complex in itself as the development phases. The work effort should commence as soon as the project is approved, and proceed in parallel with the development effort. This is especially true if the application is to be installed in new sites. Planning and preparation can make the difference in the success of your application."*

Since the development of a courseware is separate from the implementation, different expertise is used for both activities.

The implementation phase as noted by Bergman and Moore (1991) has two periods: the preparation, and the implementation itself. They also mentioned that the implementation phase must include 3 categories of activities: physical installation, other systems, and people. Those 3 categories of activities which are involved only in the preparation period are similar to that which other authors address when they mentioned **factors**. Note the following:

*"1. **Preparation period***

It includes physical planning, kiosk design and construction if needed, preparing for interfacing with other complementary systems or procedures, training, and preparation of an announcement plan. Specifically, we can find the following:

a. A complete physical installation plan for each host site specifying floor space, wiring, access, lighting and all other information needed to install the application.
b. A complete set of code and procedures for installing, initiating and maintaining the host site systems, with necessary printed instructions and documentation.
c. A complete set of announcement materials and instructions for using and disseminating them.
d. A complete training package for site personnel, including support materials for instructors or administrators.
e. A complete housing for the system (i.e. kiosk, carrel, etc.) delivered to each host site, ready for installation of equipment and application software.
f. All necessary documentation needed to integrate the application into other related or complementary systems.

2. Implementation period

It includes delivery, physical installation, testing and set up for on-going maintenance and monitoring of the application. Specifically, we can find the following:

a. A fully installed and tested application working in each site.
b. A full set of administrative and maintenance documentation at each site, with personnel trained in their use to the satisfaction of site managers.
c. An operating system (on-line and/or off-line) for recording and evaluating monitoring data."

Salisbury (1992) in a special report entitled: Toward a New Generation of Schools, discussed a new design of a schooling system based on the effective used of technology. He said:

"Effective use of technology requires changes in the basic structures of schools in the way schools use time, resources, physical space, and personnel. Without changes in these basic structures, technology remains peripheral to the learning process. When this happens, technology cannot produce increases in productivity and efficiency."

The new Salisbury's model presented is *"mapped out in four phases: a design phase (through 1992), a development phase, an operational test phase, and a continuous improvement phase."* Again, this report presents a prescriptive approach on a Schoolyear 2000. In his model, he is considering computer, videodisc, CD-ROM, etc. The technology will be a support to instruction, management and student services.

Although his report covers all the different aspects in detail, when it reaches the **faithful implementation** as a last phase, the only description we get is: *"All collaborating districts will test the entire model as designed."*

His model is based on a system approach but while describing in detail what everyone should do, nothing much as been said about how each individual phase of the model will be implemented. Importance is put on conceptual aspect of a new school system as a **basic design requirements**. All parts of the system are as follows:

1. Learner Centered
2. Systems Approach
3. Quality System
4. Technology-Based
5. Incrementally Improvable
6. Affordable
7. Learner Contribution
8. Concurrent Design
9. Replicable
10. Electronic Tools
11. Faithful Implementation

Briefly, this conceptual approach toward a new school system takes into consideration many factors that should be included in the implementation phase. The approach relies specifically on coordination and collaboration.

Summary

The different authors in the prescriptive approach mention a lot about what to do. They seem to have a great deal of concern toward environmental factors, such as different aspects of physical facilities and security. Although few mentioned human factors, they still remain not very explicit as those found in the physical factors. Some authors mentioned support and service personnel, training of people, and preparing the audience, without giving a clear description.

Salisbury (1992) developed a very good conceptual system for the schools of year 2000. He brings an awareness of the importance to reconsider the existing school system rather than to use new technology as a peripheral. Even if some of the parts, as he called them, are included in the implementation, he failed to give an explicit description.

In conclusion, it appears that the prescriptive approach paid more attention to the physical aspects of using technological equipment, which they use as environmental factors.

1.2 Implementation from a Pragmatic Approach

In this section, we will investigate how Interactive Videodisc Instruction was implemented based on real experiences. We will see as a fact, how implementation was understood and applied in those experiences.

As we did in the descriptive approach, we will extract all factors that were considerate in the implementation of the different experiences.

But first, lets give a definition of the different levels of interactivity as it will be needed to understand the different projects.

Videodisc as such offer interactive possibilities. However, the nature of the interaction possible depends upon the capabilities of the videodisc delivery system. The Nebraska Videodisc Design and Production Group has developed a well accepted categorization that distinguishes three levels of videodisc systems (Floyd, 1985).

With a Level I system, consisting of simply a videodisc player and a monitor, students may play the videodisc and perform not only rapid single frame access and slow or fast, forward, or reverse motion, but can also stop automatically at the end of a "chapter" to offer a quiz or present a menu of new program selections. Videodisc players which allow only these basic activities are referred to as "consumer" players, and are available for as little as $ 300 (Levin, 1983; Kearsley & Frost, 1985; Floyd, 1984; and Comcowich, 1987).

Barron & Orwig (1993) redefine the definition in this terms: *"Videodisc players can be used with or without a computer connection. Level I interactivity refers to using the disc player without a computer. The disc access is controlled through either the control panel on the player, a remote control unit, or a barcode reader"* (p. 38).

A Level II system also has a monitor, but uses an "industrial" videodisc player with a built-in microprocessor. Videodiscs designed for these intelligent players usually contain encoded programming. The microprocessor in a Level II player reads these programs from the disc and automatically branches to different segments based on the student's response to questions or choices. Although Level II discs are sometimes described as interactive, their sophistication is limited by the 1-Kbyte to 7-Kbyte memory available in Level II players (Levin, 1983; Kearsley & Frost, 1985; Floyd, 1985; and Comcowich, 1987).

Barron and Orwig (1993) mentioned that:

> *"Level II videodiscs are also used without a computer, however, the videodisc itself contains a computer program that can provide increased flexibility over Level I. For example, the disc may stop on a still frame with a multiple-choice question. If the student answers "3" through the remote control, the videodisc would jump to a specific frame for feedback. This all sounds good; the problem is that the program will operate only on particular videodisc players, often the more expensive models. Another problem is that the computer control program is embedded on the videodisc and cannot be changed or revised. Level II videodisc programs are not very common in schools"* (p. 40).

Level III interactivity is achieved when a microcomputer is linked to the videodisc player making possible degrees of interactive complexity that are essentially unlimited. With the addition of the computer, the consumer videodisc player model becomes sufficient for Level III interactivity, although the industrial videodisc player model will provide more rapid frame access. A major advantage of the computer is the possibility for combining computer-generated graphics on top of disc-generated images. This combination of two simultaneous sources of graphic displays means that a given disc can be used for multiple instructional purposes depending on which computer program is controlling the player (Jones, 1985).

As mentioned by Barron and Orwig (1993):

> *"Level III interactivity is achieved when you connect a disc player to a computer, and the computer controls the player through a software program. Level III provides more flexibility because a computer program can offer variety, such as branches based on keyboard and other student inputs. In addition, databases can be stored on the computer, and the student can choose a term, picture, or image on the database that will automatically bring up the corresponding video on the monitor. Level III programs also enable the computer to act as an instructional manager by storing student performances and records"* (p. 40).

Advanced Level III: Capabilities of Level III of interactivity has been pushed to its limit by a group from Montreal. Mr. Herrati (1993) engineer graduated from MIT reported that his company used CD-ROM along with a videodisc player with a computer since 1989. This combination of hardware enable them to enhance the duration of a course which offers now up to 100 hours of instructional information with a tracking system on strengths, weaknesses of trainees and time spend on different tasks compare to a standard generic courseware which vary from 1 to 3 hours maximum. The flexibility of the design is also enhanced as it is not limited by the hardware device and above all it is cost efficient.

Sorge, Russell and Campbell (1991) studied the use of interactive videodisc instruction in mathematics with existing **generic courseware**, level III of interactivity. This project was oriented to adults having problems or *"being functionally illiterate, meaning that they cannot read, write, or do mathematics adequately to satisfy self-determined objectives, meet societal demands, and solve problems of daily life."* Interactive video was use in this project because it *"provides a learning environment that is self-paced, learner controller, and individualized. The decision was made to use it as our instructional delivery system."*

For the project, they use generic courseware from three suppliers in mathematics; high school and college level.

They use a Basic Mathematics and Algebra from a company call Health EduTech, Interactive Mathematics from Ferranti Education, which covers the same topics as Health EduTech, and finally they use Interactive Modumath from The Wisconsin Foundation for technical and adult education, covering the same topics as Health EduTech and Ferranti Education. The hardware used was the InfoWindow from IBM with a PS/2-30 and a Pioneer 6000 videodisc player.

Sorge, Russell and Campbell (1991) found a number of observations that had been made during the implementation of interactive video learning systems, some of which were similar to Eikenger (1987). The authors have noted:

- *". Slow acceptance of interactive video in the classroom can often be attributed to conservative attitudes towards an unknown entity.*
- *Teachers who have not had computer experience are hesitant about its use.*
- *Students have preconceived ideas about how they relate to computers.*
- *Adult learners, not part of a formal educational program, seem to prefer a shorter program. They want to get quickly to the subject matter.*
- *Students are positive about their ability to learn from these systems.*
- *Students prefer IVI due to availability of training which is better than time-specific class (they select 30 minutes session).*
- *Students can personalize their program.*
- *Low computer anxiety and high motivation are a key to success.*
- *Age is not a factor with computer anxiety and use.*
- *Human interaction is important. The amount of intervention from teachers is related to level of academic abilities of students.*
- *Teachers must be oriented to **people skills**.*
- *Motivation and encouraging is important.*
- *Teachers must encourage students to be independent.*
- *Needs and characteristics of learners must be taken into consideration.*
- *Selection of courseware is important."*

Sorge, Russell and Campbell were more precise about the selection of courseware. Before selecting software, other factors such as the characteristics of the learner have to be considered. Specifically, what kinds of images should the students see on the screen; graphics, motion, people? Do the images have meaning to the students? They also mentioned that:

> *"There is no one best software package. Different software works best for different people and for different purposes. No one product is ideal for any location that has many diverse students. For a given institution, you may want a variety of interactive video packages on the same subject."*

Selection criteria should consider:

1. **Relevance between objectives and curriculum content.**

2. **Ability to arouse and maintain interest.** The program must relate to the **life** of the learner and include examples that are relevant to that learner.

3. **Ease to use.** Software should be **user friendly**. (Most current packages are not simple to use.)

4. **Active learner participation.** There should be frequent practice of the skills being learned with feedback. Involvement maintains interest and enhances learning.

5. **Delivery style. Glitz and glamour** are not necessary for effective learning. Often the **bells and whistles** detract from learning. In this case, the student may remember the **special effects** and not the content.

6. **Flexibility.** Certain learning environments require a software package that is flexible. In some situations, students need to be able to get in and out of different sections very easily. In other situations, students need a structured and more detailed instructional package in which they do not have the freedom to move about without their teacher having control.

As we noticed, a lot of attention has been paid about the knowledge of teachers concerning the technology as well as the subject matter to be taught, including the human environment factors for the students. We can find a lot more detail from this pragmatic approach compared to the prescriptive approach. For the first time, the selection of courseware appears as an important factor. The discoveries of the authors in their study brought up other factors which can play an important role in the implementation.

Knapp-Minick, Gottron, and Loven (1991) experienced the use of interactive videodisc technology for a classroom simulation to teach the concepts of Behavior/Discipline model.

It was a **custom production** aimed at the group of teachers of the Commonwealth of Pennsylvania's Department of Education, Bureau of Special Education. The teachers were in the 501 school districts. The technology used was a Macintosh SE, a videodisc player Pioneer 4200 or 2200, a color monitor and a Hypercard. Knapp-Minick, Gottron and Loven (1991) mentioned that their implementation program was as follow:

> *"The training plan that was devised consisted of three different modules. One training module was designed as a train-the-trainer approach and was aimed at statewide consultants who were already knowledgeable about the theory and expert content of the Behavior/Discipline model. The "consultants" were teachers who worked with educators in the school districts in Pennsylvania. A second training module was developed for school building-based teachers who would be used as resources to other teachers in learning the expert content and theory. A third training module was designed for use with large group training sessions as an awareness level vehicle only."*

First module

The first module was *"a step-by-step instructional component providing background information on videodisc technology, the set-up and use of the equipment, and navigation of the interactive videodisc program."*

Each training session had approximately 20 participants from three instructional support centers as well as other designated instructional support consultants:

> *"Large screen projection devices were used so that everyone present could view both the computer screen and the video. Discussions and explanations were provided at the end of each segment and/or period, and questions were answered at all times throughout the training session. The hardware setup, with all connecting cables was thoroughly explained, and each participant was given an opportunity to tear down and reconnect the setup until he/she felt comfortable and confident with the arrangement."*

Participants worked at their own pace and left when they felt comfortable with the program. They were free to work at will with the different interactive video workstations. Trainers were available in answering questions, and did some general troubleshooting during and after the training program. Individual workstations were available in the days following initial training, for additional practice.

Second module

The second module, School Building-Based Resource Teachers, was aimed at teachers *"who were simultaneously learning the content and theory of the Behavior/Discipline model while also learning the technical hook-up and navigation of the videodisc program."*

For this module, there were three sessions of instruction on the concepts of the Behavior/Discipline model, and one day of a group training on the hook-up and how to use the videodisc program. To make this implementation module work, they provide a toll-free number plus a training videotape covering the hook-up and the tear down of the system. They also noted that: *"Teachers needed specific suggestions regarding implementation of the interactive video training in their schools. Some teachers also needed additional training aids on the technical hook-up of the equipment, once they got started."* Also teachers needed to have a set-up of interactive videodisc workstation in the teachers lounge, to use at their convenience to conduct regularly scheduled staff meeting for their departments.

Third module

In the third module, Large Group Awareness Sessions:

> *"once again, large-screen projection devices were used so that everyone could see both computer screen and video portions of the program. It seemed more appropriate in a large group presentation to de-emphasize the computer portion of the program and use the various video segments for discussion and audience participation."*

After, a computer laserdisc player station set-up in each teacher's room was made available for an extended period of time for all teachers to practice whenever they had available time.

From the evaluation program run by Knapp-Minick, Gottron and Loven (1991) the following results have been reported:

> *"1) Educators in Pennsylvania were agreeable and eager to become involved in teacher-training programs using interactive videodisc technology.*
>
> *2) 98% rated the program good to excellent in representing the theory and concepts of the Behavior/Discipline Model.*
>
> *3) 100% rated the program good to excellent, in providing examples of unclear messages that led to inappropriate behavior.*
>
> *4) 100% rated the program good to excellent, in providing examples of clear communication.*
>
> *5) 97% rated the program good to excellent, in providing appropriate practice exercises on the computer.*
>
> *6) 98% rated the program good to excellent, for professional-quality format.*
>
> *7) 92% rated the program good to excellent, in being appropriate for use with both small and large-group presentations.*
>
> *8) 82% rated the program good to excellent, in ease of manoeuvring through the program (majority of participants had little or no computer experience).*
>
> *9) 90% rated the start up manual good to excellent.*
>
> *10) 94% rated the interactive videodisc good to excellent, as a teaching tool.*
>
> *11) 95% rated the overall effectiveness of the program good to excellent."*

Other elements that help to make a success of the project was the very nature of the content of interactive video itself; Behavior/Discipline and classroom management address a major concern within elementary and secondary school today.

This was a first experience for teachers of the 501 school districts of Pennsylvania's Department of Education. Their three modules planed implementation program worked beautifully. This experience reveals that the content chosen for the first experience was the very nature of the content which addressed a major concern for all teachers. People were making the effort to learn the technology in order to have access to the needed content. This could be a major element in the success of this implementation project.

Posner, Danielson and Schmidt-Posner (1992 and 1993) conducted a study at the Jesuits, Santa Clara University (SCU), where a new technology was implemented in a two-year project. These authors mentioned that:

> *"Implementation factors play a large role in determining the adoption and use of a computer-based system. For example, human support for orientation, training and problem solving is a critical element for successful use of computer technology (DeLany & Schmidt-Posner, 1986, and Whitney & Urquhart, 1990). Adoption by key organizational members, user participation, incentives for use and an adaptive planning process are other implementation factors that have been linked to successful introduction of technology in educational and other organizations (Bikson, Gutek & Mankin, 1981, Rice & Case, 1983, and Schmidt-Posner, 1989)."*

The weaknesses of the implementation were in the technical area of configuring computers, the many features that students did not understand how to use. In conclusion, they said that: *"integrating use of electronic communication into a course required a commitment from the professor, program administrative staff, and Academic Computing Center staff, to handle the logistics of getting students onto the system."* No detail on the standard of the technology used was provided.

In general, Posner, Danielson and Schmidt-Posner (1992 and 1993) are consistent with other authors when they mention that implementation factors play a large role in the adoption and use of a computer based system. Human support, which we call inservice support, is crucial as well as an adaptive process including the participation of all people involved; professors, the administration and students.

Hannah and Abate (1991) conducted a study to investigate factors that influence the use of interactive videodisc technology, by the Professional Education Faculty members, who teach the core curricula in the under and postgraduate education program. In this case, *"the Videodisc Project has been available for three years. Its use is centered around one course. As such, there was a perception that the videodisc technology was not meeting its potential"* in terms of utilisation.

Hannah and Abate (1991) mentioned that the reason why the technology has not been widely spread is based on the following findings in regards to implementation factors:

- *". The time it took to learn how to use videodisc technology was mentioned as a prohibitive factor both from teachers or students.*
- *More training was required to use the interactive videodisc technology.*
- *Inservice personnel are required to assist the faculty.*
- *Additional courses and course materials are needed.*
- *The course materials do not seem appropriate, and there are time constraints for learning the systems.*
- *The opportunity to be involved in developing videodiscs instruction, was a need.*
- *Not enough facilities for the number of students, was a concern.*
- *Availability of facilities in relation to classroom instruction, was a consideration.*
- *Finally, the support of the administration which must be demonstrated with an interest in promoting its use, was a prerequisite."*

This is consistent with Salisbury (1992) when he stated that: *"Effective use of technology required changes in the basic structure of school and in the way school use time, resources, physical space and personnel."*

Newren, Waggener and Kopp (1991) understand implementation as:

> *"the allotted period devoted to the students working with the media and technology under the supervision of the module instructor... Instructors express concern that there is not enough time to do all that is necessary. Coordination of, and cooperation among the instructors, of the various modules, in this team-shared environment remains a difficulty, in contrast to one instructor being responsible for and handling an entire course. Also there is a problem in having enough equipment and materials for at least 20 students in each module, and being able to keep it maintained and running especially with the computers. Frequently the computers are under the control of the division's computer lab director rather than the course instructors."*

This is not ideal.

Articulation of the implementation was a main problem. And it turned out that enrolment of students in the course was a problem. Again, Newren, Waggener and Kopp (1991) in their pragmatic approach are consistent with other authors. Also, they mentioned that: *"coordination and cooperation among instructors is very important as well as having enough equipment and materials for students."* This means the insertion of IVI courses within the existing curriculum and the synchronization of the use of the learning center with other teachers must occur without schedule conflict.

Summary

It was common among all different authors: Sorge, Russell and Capmbell (1991); Knapp-Minick, Gotton and Loven (1991); Hannah and Abate (1991); Postner and Danielson (1991); Newren, Waggener and Koop (1991); that the following elements should be addressed specifically.

1. Train the trainers on new technology as they will be reluctant to use it. Also, there is a need to give enough time to learn, assimilate the technology and plan its use. This is part of the acceptance. Barrier to its use is the lack of knowledge.
2. Programs must be of an interest for all participants working with a curriculum. A topic that will be of interest for a large group, is most important.
3. Other programs must be in process of development or available to use.
4. Programs must be easy to use or navigate.
5. Active learning for the student, with frequent practice, is needed for a studious and interesting environment.
6. Having teachers and students involved by giving them enough time to plan the integration into the classroom, and the incorporation into the students workload are major elements to consider.
7. Service support must be provided so that teachers can troubleshoot the interactive video system, responding to students' needs. This should be independent of the computer department.
8. Have the teachers involved in developing new interactive videodisc instruction courses.
9. Have enough system capacity, and courseware materials available for all students in the program.
10. Have support from the administration as well as the willingness of the teachers to be totally involved.

IVI implementation: Prescriptive Approach Versus Pragmatic approach

As we noticed, the prescriptive approach addressed much importance to the hardware system as does the pragmatic approach. But they differ substantially in the content of the hardware system. While the prescriptive approach seems to focus on layout, security, ventilation, electrical system, and all the physical aspect of it, the pragmatic approach focuses on the understanding of the hardware system by trainers, and their use with a course matching curriculum.

We found in the pragmatic approach, which is the implementation of different interactive videodisc projects, many elements barely touched by the prescriptive approach.

Nevertheless, both approaches mentioned that implementation is a complex phase.

The definition of implementation found in the prescriptive approach by Bergman and Moore (1991) is slightly different from the pragmatic approach found with Newren, Waggener and Kopp (1991).

Bergman and Moore pay a lot of attention on the physical aspect, giving a detailed description, and very little on training people and the selection of courseware. On the other hand Newren, Waggener and Kropp (1991) refer mainly to the human relations between machines and people (student). For them, the relations between students and instructors is very important, as well as the cooperation and coordination among instructors.

Both definitions intended to include a lot and are very general. In our opinion, they overlooked the importance of many factors in the implementation phase. Both authors illustrated only a few factors, without addressing other factors that could play important roles in the implementation phase.

Although both are very general in their understanding of implementation, they address only few factors without having an explicit and comprehensive view of the implementation phase.

Also, they do not relate to the relative importance of their factors.

We agreed with Posner, Danielson and Schmidt-Posner (1992 and 1993) saying that *"implementation factors play a large role in determining the adoption and use of a computer-base system."*

As mentioned by Hannah and Abate (1991): *"More research and extended use of the technology is necessary to understand how it can be beneficial to teachers and learners and how it could be successfully implemented."*

Finally, we have to rely on a good implementation program, as no matter how well designed is the courseware, the efficiency can be compromised if this technology is not well understood and introduced within the actual training program, making sure that trainers and teachers understand their new role.

The use of generic courseware brings an additional concern on how to fit the existing courseware, available on the market, within the existing curriculum, as opposed to a custom courseware where it fits a very specific need. This means that for the development of an IVI custom courseware, experts of content including the trainers are involved in the delivery of such a course. In this team work, it is to be expected that problems noted by student during classroom delivery will influence the development of the IVI courses. In this situation, automatically, trainers will be exposed to the technology as well as the content at the beginning of the project. As the course has already been delivered, during the production period, trainers will have plenty of time to readjust the curriculum, and the training program, to the specific course to be delivered on IVI. Objectives of training are specifically designed for one application.

On the other hand, off-the-shelf courseware is offered in many topics and many areas. Although courseware might be of an excellent quality, they rarely meet the existing curriculum of a school or a company. Therefore, the integration of IVI technology in training needs additional attention such as:

- The implementation of IVI courses can happen in different topics and courses;
- Often trainers are not aware of the new technology;
- Trainers are not aware of the content of the videodisc;
- Evaluation of these existing courseware is needed;
- Trainers don't know what to select or what to replace from their traditional classroom delivery course;
- Trainers don't know how to integrate the IVI course with the existing training program.

All this needs specific training to trainers, different from a custom course application on one topic.

We can find some similitude between using custom and generic courseware but what differ is the acquaintance of the technology where the course needs only to be selected and used. The use of the technology can be more brutal than with a custom application, where it takes six months to produce.

The use of more materials is also very important as well as the implication of trainers to combine existing curriculum on videodisc with the development of new materials. This means that not only one course in one topic is requested. At the beginning, the use of one course and one topic could be adequate but once all students are trained, if no additional material is offered in the technology, it will fall into a limbo.

To keep the interest of students and trainers in this technology, it is important to offer other courses, including involvement of trainers in developing complementary material or IVI courses, to complete the curriculum.

We could not find, at this time, a complete set of recommendations on how interactive videodisc instruction should be implemented and what elements or components should be considered to assure an effective use or implementation of this new technology in the teaching area.

Conclusion

Briefly, it seems that the pragmatic approach has been more realistic and related to the users' needs. Among the different interactive video projects implemented, we can observe a certain convergence in different factors such as: train the trainers, inservice personnel, and an adequate number of equipment for students.

The understanding about the subject seems to stop at the physical aspect for most of the authors in the prescriptive approach, while the pragmatic approach has more concerned for the users and the trainers. Nevertheless, it raises many questions as far as we are concerned since implementation seems to go far beyond what has been written so far.

Implementation, as we understand it, is much more universal and should include the following:

- Understanding where multimedia courseware should fit in the existing curriculum of the same course and as well within an existing training program.
  Where should multimedia training start; where should it end, and by what additional training should it be followed ?

- Train the trainers, not only on how to use equipment, facilities and enrolling students, but understanding this new tool which provides statistical data on each student, what to do with the data, how to follow-up on student training with wrap up seminars, or additional courses which could enhance the training on certain topics.

- This new tool, multimedia training, brings many advantages which are not always understood by trainers; they will become managers of training rather than delivering the expertise or the expert subject.

- How to create a learning center starting with one topic, and moving on with additional different topics, and how to make it available to the general use of the organization. This is the challenge.

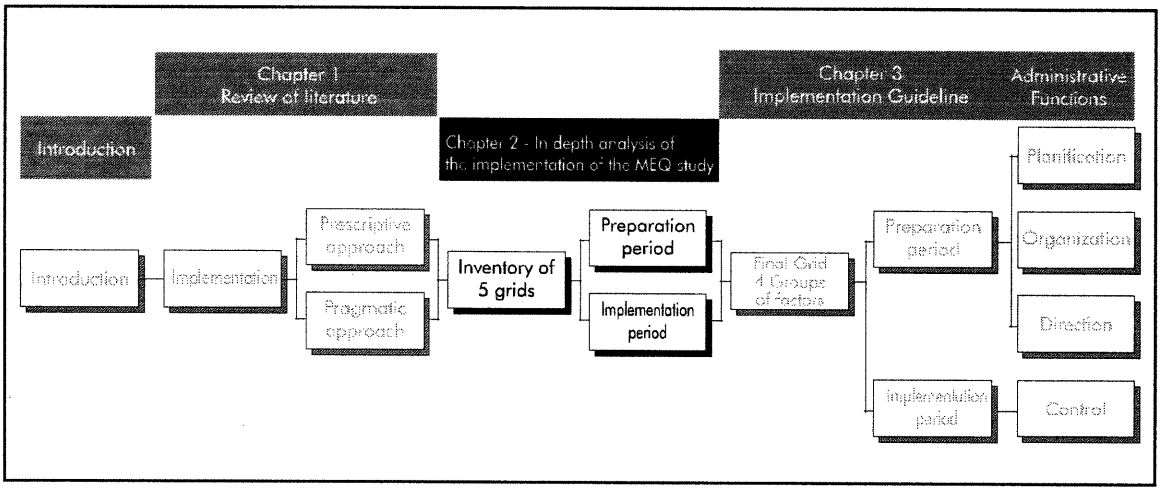
. How to fit in different schedules of training especially if we are talking about a school system.

Considering different factors illustrated in the theoretical approach, as well as the observations of the different studies from the pragmatic approach, there is a need to investigate further the factors of implementation within a structure.

In the following chapter, we will analyze a pragmatic approach where IVI was implemented. We will use a specific project in a school system with the MEQ (Ministry of Education of Quebec). We will first define our structure identifying and regrouping, when necessary, all factors found in our review of literature, in order to make an in depth analysis of the MEQ project.

CHAPTER 2

IN DEPTH ANALYSIS OF THE IMPLEMENTATION OF THE MEQ STUDY



This chapter is divided in three sections:

- The first section is called **Definition of a structure**. It intends to present a structure by building different grids of factors retreived from various authors. This is consistent with this study being a development research where the review of literature is used to define, to select, and to build the groups of factors. All different grids of factors will therefore be considerated as a prescriptive approach.

- The second section presents a **Description of the MEQ study**. This study aimed to verify the efficiency of IVI in a school environment with generic courseware. Also it addressed to the required steps to spread this technology in the MEQ school system.

- And, finally, the third section allows us to review each factors against the result of the MEQ study. Such validation shall enable us to make the final selection and the composition of the different groups of factors leading to develop a guideline facilitating the implementation of IVI.

2.1 Definition of structure

From the review of literature with the prescriptive and pragmatic approaches, we created an exhaustive list of factors divided in four (4) groups which gives us the necessary framework for the MEQ analysis. The four (4) groups of factors are:

1. Physical Facility
2. Hardware/Equipment
3. Courseware/Course
4. Human Resources

The MEQ study will help us to verify if these four (4) groups of factors are not only applicable but also usable. Also, by using the four (4) groups of factors in the MEQ study and its result, we will see if other factors should be included. Before we define the four groups of factors, it is appropriate to mention that we will use the Bergman and Moore approach who describe the implementation phase as having two periods: **Preparation** and **Implementation**. Therefore, in justifying our four groups of factors, we will classified them within these two periods mentioned by Bergman and Moore (1991).

No particular order has been set in which appear all factors for all grids, only the order of the groups of factors which reflect the way they have been used in the review of literature.

2.1.1 Physical Facility

Physical facility means environmental factors such as: space where training takes place, temperature, humidity and security. It is the physical aspect of the space lights, layout, etc. This is consistent with Floyd (1985), Branson and Grow (1987), and Bergman and Moore (1991). It is interesting to notice that this aspect was not specifically covered in the pragmatic approach.

This group of factors is considered part of the preparation period. The implementation period would be the use of the facilities which means the effective type of security used, the hours of the availability of the facilities, and the monitoring of the temperature on site.

The following factors have been inventoried:

TABLE 2.1: PHYSICAL FACILITY GRID

FACTORS		#
Preparation Period		
Adequate floor space	*Bergman and Moore, 1991*	1
Temperature	*Floyd, 1985*	2
Humidity control	*Floyd, 1985*	3
Ventilation and heat dispersion	*Floyd, 1985*	4
Ambient light and noise	*Floyd, 1985; Bergman and Moore, 1991*	5
Electrical power	*Floyd, 1985; Bergman and Moore, 1991*	6
Curtains	*Branson and Grow, 1987*	7
Communication devices	*Floyd, 1985*	8
Physical security	*Floyd, 1985*	9
Service access	*Floyd, 1985; Bergman and Moore, 1991*	10
Implementation Period		
Facilities ready on time	*Floyd, 1985*	11

2.1.2 Hardware / Equipment

It means electronic components such as: computers, screens, videodisc players, CD-ROM players, audio-visual equipments, electrical outlets, etc... equipment required to use the application or the course.

As mentioned by Floyd (1985), this is an environmental factor. This author uses the term **hardware**. He mentioned that hardware must be available at the right time.

Branson and Grow (1987) said about the educational technologist: *"He will then prepare the environment, making sure that the necessary equipment is at hand (audio-visual, computer, videodisc, electrical outlets, curtains to darken the room, etc.)".*

As per Bergman and Moore (1991) hardware is part of their three (3) categories for implementation: *"physical installation, other systems and people".* Implementation is then the physical installation of the application which includes equipment and software. **Other systems** could be considered as other training systems such as classroom delivery, training, and people, all individuals involved such as teachers and students.

In the pragmatic approach, Sorge, Russell and Campbell (1991) related to computers and interactive video learning system.

Knapp-Minick, Gottron and Loven (1991) used the terms: *"individual workstations"* and they referred to the computer, laserdisc player and color monitor.

This group of factors can be divided into two periods: Preparation and Implementation. The preparation period includes all activities regarding the planning and the selection of the hardware equipment; also, the quantity of hardware and the physical aspect of components related to hardware equipment. The diffent considerations in the section of the equipment standard for the hardware factors (Major, 1993; Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991) are the following:

- Selection of computers and color monitors
- Selection of printers
- Selection of overlay interface card IVI standards (Matrox, Visage, InfoWindow, M-Motion, VideoLogic, M-PEG, CD-I, DVI)
- Selection of videodisc players (Pioneer, Sony. Hitachi, Philips)
- Selection of CD-ROM players (1X, 2X, 4X, or better)

- Selection of audio components (OnLine, SoundBlaster, Audiovation)
- Selection of audio equipment (amplifier, speakers, headphone)
- Number of workstations according to the needs
- Communication devices (Modem, Network)
- Power bar with surge and UPS

The implementation period, as such, is the installation and the testing of the hardware on site, on time and on schedule according to the plan. A full set of administrative and maintenance documentation must be available.

The inventory of those factors are as follows:

TABLE 2.2: HARDWARE / EQUIPMENT GRID

FACTORS	#
Preparation Period	
Preparation of facilities to accept equipment (furniture, chairs, etc.) *Bergman and Moore, 1991; Branson and Grow, 1987*	1
Selection of standard of interactive video systems *Major, 1993; Bergman and Moore, 1991; Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991*	2
Acquire equipment and material for the number of students *Newren, Waggener and Kopp, 1991; Hannah and Abate, 1991*	3
Set procedures for installing, initiating and maintaining the host site systems *Bergman and Moore, 1991*	4
Insure hardware availability at the right time *Floyd, 1985; Branson & Grow, 1987*	5
Prepare for troubleshooting *Floyd, 1985*	6
Implementation Period	
Fully installed and tested hardware in place *Bergman and Moore, 1991*	7
Full set of administrative and maintenance documentation at each site *Bergman and Moore, 1991*	8

2.1.3 Courseware / Course

Courseware is a term used to designate a course delivered on multimedia technology. Among all the different definitions of generic courseware, the best one can be found from Perlmutter, 1991 (p.177). It is short but meaningful: *"Educational courses that are not specific to one organization, and thus appeal to a broader market, as opposed to custom courseware, which primarily meets the needs of one specific client or audience."*

Floyd (1985) refers to courseware package being the application software to train students.

Bergman and Moore (1991) refer to the term application. The application should be trouble free and working properly with the system hardware.

Sorge, Russell and Campbell (1991) in the pragmatic approach use the term generic courseware. They refer to the quality of the contents.

Knapp-Minick, Gottron and Loven (1991) in their implementation said that the quality of the courseware played an important role.

This group of factors can be divided into two periods. The preparation period includes all activities regarding the selection and the analysis of the quality of the courseware, and the tracking system for the students performance which can be described as follows:

- The selection of the courseware should be related to the needs of training and the established training objectives.
- The selection of content that is a major interest either for teachers and students.
- The ability to arouse and maintain interest.
- The easy of use.
- Active learner participation with practice.
- Delivery style.
- Flexibility.
- The courseware matching the adequate level for students.

- Having an adequate quantity of material.
- Making certain that there is sufficient existing materials on videodisc, already available in many areas.

The implementation period refers to the physical implementation or delivery of courseware, with the hardware, which should work properly and trouble free. Note documentation on the courseware, how they work and how to extract data from students' performance. This period can include operating systems on-line and off-line for recording and evaluating monitoring data.

The inventory of those factors are as follows:

TABLE 2.3: COURSEWARE GRID

FACTORS	#
Preparation Period	
Related to training needs and objectives *Hannah and Abate, 1991; Sorge, Russell and Campbell, 1991*	1
Relevance between objectives and curriculum content *Sorge, Russell and Campbell, 1991*	2
Needs and characteristics of learners must be taken into consideration *Sorge, Russell and Campbell, 1991*	3
Courseware matching the adequate level for students (selection) *Sorge, Russell and Campbell, 1991*	4
Major interest for teachers and students *Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991*	5
All necessary documentation needed to integrate the application into other related or complementary systems *Bergman and Moore, 1991*	6
Adequate quantity of material *Hannah and Abate, 1991, Newren, Waggener and* Kopp, 1991	7
Ability to arouse and maintain interest *Sorge, Russell and Campbell, 1991*	8

Easy to use	*Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991*	9
Active learner participation	*Sorge, Russell and Campbell, 1991*	10
Delivery style	*Sorge, Russell and Campbell, 1991*	11
Flexibility	*Sorge, Russell and Campbell, 1991*	12
Program good to excellent	*Knapp-Minick, Gottron and Loven, 1991*	13
Effectiveness of the program	*Knapp-Minick, Gottron and Loven, 1991*	14
Additional courses and materials	*Hannah and Abate, 1991*	15
Protection of the confidential records that may be stored in the system	*Floyd, 1985*	16
Implementation Period		
Delivery of courseware	*Bergman and Moore, 1991*	17
Work properly and trouble free	*Bergman and Moore, 1991*	18
Documentation of courseware	*Bergman and Moore, 1991*	19
How courseware works	*Bergman and Moore, 1991*	20
Operation system (on-line/off-line) for recording and evaluating	*Bergman and Moore, 1991*	21

2.1.4 Human Resources

It refers to all people involved in organizing the delivery of multimedia courseware and those using the courseware in a learning process.

Floyd (1985) refers to human resource as *"a person who is carefully evaluating environmental factor before the system is field tested or installed."* Have a service person available on site or readily available. Well trained personnel or trainers are required for the use of the equipment, the troubleshooting, and the providing of the necessary information to use the application or the different courseware packages.

Branson and Grow (1987) talked about the educational technologist as being a key person to see, and provide equipment, as well as to prepare the audience.

Bergman and Moore (1991) in their phase implementation talk about the readiness of host site personnel to accept the application.

In the pragmatic approach, Sorge, Russell and Campbell (1991) paid attention to teachers and students. In their project, they paid more attention to the content of the courseware and its quality.

Knapp-Minick, Gottron and Loven (1991) had emphasized their project over the organization of the implementation to ensure that all people involved had the necessary awareness and training, before delivery of the multimedia training to the targeted group of trainers. The importance of a **consultant** as a resource was very important, making sure that they understood fully the use of the workstation and the content of the courseware.

Train the trainer was very important . Hannah and Abate (1991) in their study demonstrate clearly that human resources are the key factor to implement interactive video instruction. Lack of understanding by the faculty members as well by the students block the general use of IVI.

Posner, Danielson and Schmidt-Posner (1992-93) mentioned that human support for orientation, training and problem solving is a critical element for successful use of computer technology.

This group of factors can again be divided into two periods.

The preparation period can reflect on the following factors:

- Train the personnel:
  - To give inservice demonstrations of the hardware and software;
  - To allot sufficient time for the trainers to learn the technology;

- To allow teachers the opportunity to contribute material to existing courseware, and the opportunity to contribute new materials;
- Seek support from the administration;
- Create incentive programs.

- Train the trainers:
  - On the technology;
  - On the contents of the courseware;
  - On the administration of the courseware;
  - How to integrate IVI courseware within the existing training program;
  - How to use the administration software for student performance.
- Train the students:
  - To use the technology within an existing training program;
  - Make the programs interesting;
  - Continually make additional IVI programs.

In the implementation period we must find well trained personnel to response to problems, to assist students and manage the learning center.

The inventory of those factors are as follows:

TABLE 2.4: HUMAN FACTORS FOR TEACHERS GRID

FACTORS	#
Preparation Period	
Support from administration *Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	1
Participation from administration *Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	2
Participation from teachers *Knapp-Minick, Gottron and Loven, 1991; Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	3

Sufficient time allowed to learn the technology *Hannah and Abate, 1991*	4
Knowledge of the content to be taught on IVI *Sorge, Russell and Capmbell, 1991*	5
Teachers oriented People skills *Sorge, Russell and Capmbell, 1991*	6
Teachers to motivate students *Sorge, Russell and Capmbell, 1991*	7
Human support / Problem solving *Knapp-Minick, Gottron and Loven, 1991*	8
Adaptive planning process *Posner, Danielson and Scmidt-Posner, 1992-93; Birson, Gutek and Mankin, 1981*	9
Training package on site for teachers *Bergman and Moore, 1991*	10
Training package on site for administrators *Bergman and Moore, 1991*	11
On site service support personnel *Floyd, 1985; Hannah and Abate, 1991 Posner, Danielson and Scmidt-Posner, 1992-93*	12
Coordination (human support for orientation training) *Newren, Waggener and Kopp, 1991*	13
Synchronization *Newren, Waggener and Kopp, 1991*	14
Cooperation *Newren, Waggener and Kopp, 1991*	15
Enrollment of students *Newren, Waggener and Kopp, 1991*	16
Opportunity to be involved in new IVI development *Hannah and Abate, 1991*	17
Incentive to use system *Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	18
Implementation Period	
Personnel trained in their use to the satisfaction of the site managers *Berman and Moore, 1991*	I-1
Well skilled service person on site *Bergman and Moore, 1991; Floyd, 1985; Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	I-2

TABLE 2.5: HUMAN FACTORS FOR STUDENTS GRID

FACTORS	#
Preparation Period	
Participation (audience must be prepared) *Branson and Grow, 1987* *Sorge,Russell & Campbell, 1991; Posner, Danielson and Scmidt-Posner, 1992-93*	1
Time to learn the technology *Hannah and Abate, 1991*	2
To be able to personalize the course *Sorge,Russell & Campbell, 1991*	3
Implementation Period	
Personnel trained in their use to the satisfaction of the site managers *Bergman and Moore, 1991*	I-1
Well skilled service person on site *Bergman and Moore, 1991; Floyd, 1985; Posner, Danielson and Scmidt-Posner, 1992-93; Hannah and Abate, 1991*	I-2

The purpose of this section was to create a structure also called grids of factors to enable us to analyse the MEQ study and to determine if all factors can be applied and usuable as they came from many different sources.

2.2 Description of the project

The project was initiated by the Ministry of Education of Quebec (MEQ). They wanted to look at the possibility of using interactive videodisc instruction for an electro-mechanical program aimed at their high school vocational school. West Hill High School located in Montreal was designated as the laboratory for the study. It is an English high school delivering the complete program in electromechanics, leading to a high school diploma.

The study wanted to use generic courseware in Electronics and Hydraulics that would reduce the curriculum to 3 courses:

. Hydraulics	Module 26
. Operational Logic Circuit	Module 18
. Sequential Logic	Module 19

The project was intended to answer questions raised by MEQ concerning the effectiveness of generic courseware in their curriculum, and to explore if interactive videodisc instruction technology could be applied successfully in all other vocational schools in the Province of Quebec. The analysis of the result of the project, and the study of the various factors that we included in the project, raised more questions about implementation and what steps should be followed to assure its success. Using the result of the MEQ study, we will analyze each step that was undertaken, and comment on them with our findings, in regards to the factors identified previously. From this analysis, we will give our definition of **implementation** and identify required steps that we will use as a guideline to ensure efficiency in future implementation of IVI, in training for school systems, as well as for the industry.

2.3 MEQ - Study Analysis

The MEQ study was used in this study because all data and details on how IVI was implemented was accessible. Following the request of MEQ senior officers to investigate IVI in the school system, we started by using a systemic approach called **S'ASSURER** developed by Heinich, Molenda and Russell (1982) and Pérusse (1987). Although a systemic approach was used, no implementation guideline was available at that time and therefore the factors used were most likely a list of things to do.

This study was requested by the MEQ to verify the efficiency of this technology in a school environment with off-the-shelf courseware (generic courseware) for their electromechanical program.

Also, part of the study was to identify what conditions should prevale for an implementation in the school system. This study was presented at SALT (Society for Applied Learning Technology) in 1993 and at Queensland University in Australia in 1993.

The results were also published in the Journal of Instruction Delivery System in 1993. Extention of these results and implementation conditions were presented at LearnTec 1995 conference entitled the "Implementation of Multimedia Training" held at Miramichi College in New-Brunswick. An other extension of these results was developed and integrated in an educational design. The model was presented in a 3-day workshop conference with Dr. Pérusse at ITESO (Instituto Tecnologico y de Estudios Superiores de Occidente) at Guadalajara, Mexico in February 1996.

Using all the different factors from the prescriptive and pragmatic approaches for which we set 4 groups of factors, we are now ready to screen the MEQ study. We will comment how factors were used. In the appendix 1, you will find the complete grid for the four (4) groups of factors divided into two periods:

1. The preparation period
2. The implementation period.

2.3.1 Physical Facility Factors (for the grid, see TABLE 2.1)

2.3.1.1 Preparation Period

Factor # 1: Adequate floor space *(Bergman and Moore, 1991)*

Comments

The decision was made to conduct the study in the existing Hydraulic Lab next to all technical classrooms at West Hill High School. It was a very large room that could easily accommodate additional equipment. This factor was taken into consideration and used. No instruction to set a perfect layout was supplied by the author. It was adequate for the circumstance, specially in the case of a pilot project. This factor must be considerated.

A very large wooden table was used on which 5 interactive video workstations were placed, one for each student, including individual headphones. Students had enough space to move around. It was convenient because after their learning session, students had direct access to the labs for their testing. This factor is applicable and useful.

Factor # 2: Temperature *(Floyd, 1985)*

Factor # 3: Humidity control *(Floyd, 1985)*

Factor # 4: Ventilation and heat dispersion *(Floyd, 1985)*

Comments

The ventilation, the temperature and the humidity control were the existing systems normally found in an hydraulic lab and were considerate convenient for the project. The lab was very large and could easily accommodate other equipment. These factors were taken into consideration without being part of a special attention. It was adequate for computer systems. No specification is supplied by authors. These factors must be considerated.

Factor # 5: Ambient light and noise *(Floyd, 1985; Bergman and Moore, 1991)*

Factor # 6: Electrical power *(Floyd, 1985; Bergman and Moore, 1991)*

Factor # 7: Curtains *(Branson and Grow, 1987)*

Comments

Curtains were already installed to shade the sun light; lights were adequate, as well as the electrical outlets found in the hydraulic lab environment. These factors were considerated. No specification is supplied by authors.

Factor # 8: Communications devices *(Floyd, 1985)*

Comments

No communication device was necessary as the experiment was conducted next to all classrooms and across the hallway from the teachers' office. Access to information and support were available, so, no telephone and no hot key on the keyboard were necessary. In this project, this factor was not considerated but for a permanent implementation it should be.

Factor # 9: Physical security *(Floyd, 1985)*

Comments

Regarding the security, all doors were locked from 15:00 to 7:00 hours. Only the two teachers involved had keys to open the door of the labs. An alarm system and special electrical magnetic lock were installed on doors. This factor is applicable and useful.

Factor # 10: Service access *(Floyd, 1985; Bergman and Moore, 1991)*

Comments

The service access was adequate for the project. No additional service was provided or deemed necessary. It was in a school environment, cafeteria was available and coffee pot available at the teachers' office for students. Teachers were available for pedagogical support. This factor is applicable and useful.

2.3.1.2 Implementation Period

Factor # 11: Facilities ready on time *(Floyd, 1985)*

Comments

As the facilities were already existing, the only preparation and installation needed was an adequate number of power bars for each IVI system. This factor is applicable and useful.

In general

All these steps were consistent with Floyd (1985), Branson and Grow (1987), and Bergman and Moore (1991). We did not find in any author's work a step by step procedure, or guidelines for space required per student and for other factors. No data was available.

2.3.2 Hardware / Equipment Factors (for the grid, see TABLE 2.2)

2.3.2.1 Preparation Period

Factor # 1: Preparation of facilities to accept equipment (furniture and chairs)

(Bergman and Moore, 1991; Branson and Grow, 1991)

Comments

A very large wood table was organized to accept all IVI workstations. Chairs were convenient, space adequate. A bookshelf was organized to accept all the videodiscs and instructions. No specification is supplied by authors. It is applicable and useful.

Factor # 2: Selection of standard of interactive video systems

(Major, 1993; Bergman and Moore, 1991; Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991)

Comments

The description of the interactive videodisc workstation was as follows: IBM M-Motion technology with IBM PS/2 Model 50Z - 286 -10 MHz - 1 MB of RAM - 60 MB Hard disc. A mouse was provided as the input device with an extended keyboard. The color monitor was an IBM VGA 8514. The videodisc player was a LD-V4200 from Pioneer. Audio source was provided with a Radio Shack amplifier with headphones. Teachers used an IBM PS/2 Model 70 - 386 - 25 MHz - 8 MB of RAM - 370 MB Hard disc, including a M-Motion board. An OS/2 operating system was loaded with a LAN network for all systems. This new technology compatible with InfoWindow from IBM is an advanced feature of interactive video, digitizing the video in real time. This new technology takes advantage of the new courses released on the market using small video windows while being able to use generic courseware, which are available for sometime on the market (older technology).

This factor become very important if the organization intend to use already available courseware rather to produce their own material (Major, 1993). This factor is applicable and useful.

Factor # 3: Acquire equipment and material for the number of students

(Newren, Waggener and Kopp, 1991; Hannah and Abate, 1991)

Comments

Each student had his own interactive videodisc workstation for which he was accountable. The number of IVI workstations was adequate as each student had his own system for the project. This factor is applicable and useful.

Factor # 4: Set procedures for installing, initiating and maintaining the host site systems *(Bergman and Moore, 1991)*

Comments

Set of manuals to maintain the system was provided. All interface cards and special software were already installed and tested. This factor is applicable and useful.

Factor # 5: Insure hardware availability at the right time

(Floyd, 1985; Branson and Grow, 1987)

Comments

Systems arrived only a few days before the starting date of the training program. Hardware would have been needed few weeks before to test them thoroughly and to initiate the use of the hardware to the people involved in the project. This factor is applicable and useful.

Factor # 6: Prepare for troubleshooting *(Floyd, 1985)*

Comments

Some hardware problems were encountered which could not have been anticipated during the planning:.

- The interactive workstations experienced random problems when running the courseware so systems had to be rebooted on many occasions, loosing some initial data.
- The problems encountered in the MEQ study could have been solve before launching the project if we could have enough time to test the IVI systems. The problem was the imcompatibility of the interface card (IBM Mmotion) with the mother board of the computer (also an IBM).

This factor is crucial in a project because we cannot rely solely on the supplier's expertise.

2.3.2.2 Implementation Period

Factor # 7: Fully installed and tested hardware in place *(Bergman & Moore, 1991)*

Comments

The M-Motion interface card had some incompatibility with the computer mother board on the PS/2 Model 50Z. It was impossible to suspect that kind of problem nor could IBM have suspected it. It brought some interruption in the course used by the student. The problem was corrected by changing all the mother boards in computers. This problem caused a 3-week delay in the project. All software was loaded and tested but not thoroughly tested because the systems arrived two weeks late than originally planed, but on time to start the training project. Students using extensively hardware and software started to experience *bugs*. This was investigated further and pined down to the main board incompatibility. It took time. This factor is also very important and we should not neglect the time.

Factor # 8: Full set of administrative and maintenance documentation at each site *(Bergman and Moore, 1991)*

Comments

Full sets of manuals and documents were provided on site. No one on site could service the equipment, IBM serviceman provided exceptional service such as changing the mother board of the computer. This factor is applicable and useful.

In general

The approach used was consistent with Floyd (1985) and Branson and Grow (1987) which say hardware must be available at the right time. Although Bergman and Moore (1991) mentioned that the *"installation of the application in each host site must be on schedule and without disruption of normal host site activities"*. This is unlikely to happen with a new facility since a new technology will be introduced in training, and which will change the way that training will be delivered. Nevertheless, some orderly steps need to be established which we did not find in our study of available literature. Also, we learn that we should never under estimate the time for the delivery of equipments. Allow additional time.

2.3.3 Courseware Factors (for the grid, see TABLE 2.3)

2.3.3.1 Preparation Period

Factor # 1: Related to training needs and objectives

(Hannah and Abate, 1991; Sorge, Russell and Campbell, 1991)

Comments

An initial analysis was performed with the MEQ officers and the teachers examinating the written provincial program of the MEQ - needs and objectives. It was found that the training needs and objectives could be found in the curriculum developed by teachers for their course although the contents were different in some parts. This step was imperative in order to select the videodiscs program and material.

Factor # 2: Relevance between objectives and curriculum content

(Sorge, Russell and Campbell, 1991)

Comments

The objective in the MEQ study was to find generic courseware matching their curriculum for the electromechanical program. It was found that there was a discrepancy from the curriculum of what teachers were using from the program established by the MEQ. The project enable the revision of the curriculum used in order to select the videodiscs courseware in line with the MEQ approved program. The MEQ's electromechanical program leads to high school diploma.

We inventoried all available generic courseware on the market considering all possible suppliers, in line with MEQ's curriculum and objectives of the program. We considered all suppliers and all producers of generic courseware on the market. The inventory of generic courseware on videodisc was produced by the following companies: National Education, ITC and VTR. Selecting courses that met the MEQ's curriculum requirement was important. The selection of generic courseware met MEQ's curriculum guidelines for the forth semester, on the subjects of Hydraulics and Electronics.

Courses selected for the experience were:

i) Hydraulics: 842-256, Module 26, 90 hours of classroom

ii) Electronics: 843-094, Module 18, 60 hours of classroom

842-304, Module 19, 60 hours of classroom

This factor is applicable and useful.

Factor # 3: Needs and characteristics of learners must be taken into consideration

(Sorge, Russell and Campbell, 1991)

Comments

The learners were high school student in vocational school training between the age of 25 and 40 years. All had previous experience in different trades and workshops. Therefore, the selection of courseware took into consideration not only the subject matter but as well the way the course was presenting the material. This factor is applicable and useful.

Factor # 4: Courseware matching the adequate level for students (selection)

(Sorge, Russell and Campbell, 1991)

Comments

The selected courseware for the MEQ study aimed at different level of students. From different suppliers, it was possible to supply the same topic in different levels, as an example: Hydraulic, two companies covered the very same topics but the approach used in one IVI course was aesier to understand for the student. Also, in other case, supportive courseware was provided for a refresher before entering in Electronic topics.

The selection of the courseware needed to take into consideration the following:

- Students had no previous background in Electromechanics except what they had learned in the program, from the course in the previous semester. Students were at their last semester of their 2-year (4 semesters) program.
- Students were high school drop outs and enrolled in an electromechanical high school program, leading to high school degree. Students had no previous experience in IVI training.
- The average age was 30 years old.

Our approach was consistent with Sorge, Russell and Campbell (1991) that said: *There is no one best software package-different software works best for different people and for different purposes. ... No one product is ideal for any location that many diverse students."* This factor is applicable and useful.

Factor # 5: Major interest for teachers and students

(Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991)

Comments

The course was of major interest for teachers and students as it brought additional information and images on the topics which were taught. It even assisted teachers to improve their classroom delivery because of the visual presentation. Both teachers and students were overwhelm by the content of the IVI courses. This factor is applicable and useful.

Factor # 6: All necessary documentation needed to integrate the application into other related or complementary systems *(Bergman and Moore, 1991)*

Comments

This was not planned, as the objective of the project was to test only few courses with the IVI technology, rather than to integrate this new training technology into the existing training program. This factor is applicable and useful.

Factor # 7: Adequate quantity of material (Hannah and Abate, 1991; Newren, Waggener,and Kopp, 1991)

Comments

The project had five students, and due to budget's constraint, it was decided to use only one copy of each courseware. With the exception for the beginning of the project, only one student was working on a course at one time. To start the project, the quantity of one courseware was not sufficient. This factor is applicable and useful.

Factor # 8: Ability to arouse and maintain interest

(Sorge, Russell and Campbell, 1991)

Comments

The selected courseware were able to arouse and maintain interest. The said courseware were used successfully by different organizations in the past 4 years. They have been evaluated and the approach used in the presentation of the audio-visual material combine to the interactivity stimulated not only the interest of the students but as well the teachers. This factor is applicable and useful.

Factor # 9: Easy to use *(Sorge, Russell and Campbell, 1991; Knapp-Minick, Gottron and Loven, 1991)*

Comments

A menuing system enabled students to have a direct access to any course as long as he entered his access code (each student has his own access code or student number). The menuing system was linked to a **time on task** program, accumulating the total time the student spent on each course, with a cumulative time on the workstation. All questions appear on the screen with audio and boxes to give their answers. This factor is applicable and useful.

Factor # 10: Active learner participation *(Sorge, Russell and Campbell, 1991)*

Comments

Quality of the content: The curriculum of the videodiscs matched the MEQ requirements. National Education courseware were rejected because of mistakes in content and because the navigation of the courseware with the workbook were difficult to use. Therefore ITC and VTR were retained for further evaluation.

Quality of interactive program: It is the frequency and accuracy of the interactivity between the student and the content. The appropriateness of the questions verified the acquisition of knowledge of the student. We refer to a level III program. ITC was retained as desirable courseware as opposed at VTR which was a level II program.

Quality of images and audio: The quality of video and audio was excellent with appropriate images for the content.

Quality of the tracking training system: ITC offers a program that monitors the student's performance. First, a pre-test to evaluate the students' knowledge. Second, simulations/ exercises with reinforcement after presenting each topic to verify students' knowledge. And third, a final test to have an overhaul evaluation. All data were accessible to teachers only. The final results were given to the involved student.

This factor is applicable and useful.

Factor # 11: Delivery style *(Sorge, Russell and Campbell, 1991)*

Comments

The style of delivery was based on a cognitive approach without glamour and glitches to disturb the students' attention. All courses had the same pattern of presentation. This factor is applicable and useful.

Factor # 12: Flexibility *(Sorge, Russell and Campbell, 1991)*

Comments

The flexibility of the courses enabled students to move around at will in the course. Review was easy, and simulation and exercises with questions appeared randomly and were accessible at all times. It was easy to leave a course and come back later on at the place the student had left off. This factor is applicable and useful.

Factor # 13: Program good to excellent *(Knapp-Minick, Gottron and Loven, 1991)*

Comments

Inquiries were made to find which organizations were using the courseware: few colleges in Ontario and USA, plus many companies such as Dow Chemical, Shell US and Canada, GM, Ford, etc. The comments were that courses were excellent and succeed to train people covering two aspect, theory and practice. This factor is applicable and useful.

Factor # 14: Effectiveness of the program *(Knapp-Minick, Gottron and Loven, 1991)*

Comments

The quality and the effectiveness of the courses was measured by investigating companies and colleges using the very same selected courses for the MEQ project. All selected courses were rated good to excellent, and were considered effective. Also, teachers involved viewed each course, and came to the same conclusions. This factor is applicable and useful.

Factor # 15: Additional courses and materials *(Hannah and Abate, 1991)*

Comments

It was decided to select as well additional supportive courseware to reinforce student's knowledge, such as Mathematic course and advanced Electronic courses such as: Introduction to Digital Electronics courses including Programmable Controller. This factor is applicable and useful.

Factor # 16: Protection of the confidential records that may be stored in the system *(Floyd, 1985)*

Comments

All data from the students' performance was only accessible to teachers with a special access code. Final results were also available to the involved student. Each student has their own code and a special password of their own.

2.3.3.2 Implementation Period

Factor # 17: Delivery of courseware *(Bergman and Moore, 1991)*

Comments

All the courses were delivered on time with the hardware system. This factor is applicable and useful.

Factor # 18: Work properly and trouble free *(Bergman and Moore, 1991)*

Comments

The courses worked properly except at the beginning due to hardware problem. Incompatibility between the M-Motion overlay board and the mother board of the computer was the problem. This factor is applicable and useful.

Factor # 19: Documentation of courseware *(Bergman and Moore, 1991)*

Comments

The documentation of the courseware consisted of an accompanied book highlighting the main objective and the different topics. This was available to student. Teachers had their own administrative manual which included the student manual. Both manuals explained how the courseware worked. This factor is applicable and useful.

Factor # 20: How courseware works *(Bergman and Moore, 1991)*

Comments

Necessary documentation was provided on how the IVI courses worked, description of objectives, highlight of content, and how to retrieve students' performance. This factor is applicable and useful.

Factor # 21: Operation system (on-line/off-line) for recording and evaluating *(Bergman and Moore, 1991)*

Comments

Possibility of networking: None of the suppliers of generic courseware offer this opportunity. It would be possible to develop this feature but the time available for the project made it impossible. Regarding interactive videodisc program evaluation, Reeves (1988 and 1989) has developed a methodology that can be of some assistance. So, it was an off-line system. This factor is applicable and useful.

2.3.3.3 Area of problems

Factor # 10: Active learner participation *(Sorge, Russell and Campbell, 1991)*

Factor # 11: Delivery style *(Sorge, Russell and Campbell, 1991)*

Factor # 12: Flexibility *(Sorge, Russell and Campbell, 1991)*

Factor # 13: Program good to excellent *(Knapp-Minick, Gottron and Loven, 1991)*

Factor # 14: Effectiveness of the program *(Knapp-Minick, Gottron and Loven, 1991)*

Comments

In Hydraulics, the students had some problems in using the Industrial Training Corporation (ITC) courseware as they felt that the course was too advanced for them and had problems understanding the contents. The text book from the school was not synchronized with the content of the videodisc, making it worthless for studying. Therefore, we went back to the company VTR's videodiscs in hydraulics. It was an 8 videodiscs program in hydraulics. This course proved to be more effective than the ITC courseware in hydraulics. VTR courseware was a level II discs using a television monitor and a videodisc player with a remote control. No computer was needed and of course no tracking of the student performance was possible.

After going through the VTR programs, students felt very comfortable with the ITC program and they really felt that the ITC program should be following the VTR program. The main problem for each disc lesson was to get text book which related to the videodisc. Also, we required a printer in order to print all graphics and schematics from the screen, so the students could relate this back to their text book.

Factor # 7: Adequate quantity of material *(Hannah and Abate, 1991; Newren, Waggener and Kopp, 1991)*

Comments

The fact that only one videodisc per subject was available to all 5 students caused a bottle neck, at the beginning of the program. This phenomenon had a tendency to disappear as students moved along with more advanced subjects ormoved into other topics. Slower learners could use a disc longer, without affecting the others.

Factor # 21: Operation system (on-line/off-line) for recording and evaluating

(Bergman and Moore, 1991)

Comments

As the network was not functioning for the project, this cause the problems for the teachers. They had to go through each workstation to get the information on each student. The administration of the project became more time consuming, as a result. Other factors should have been considerated in selecting courseware: the kind of images that the student should see on the screen, graphics, motion video, people. Do the images have the same meaning to all students?

2.3.4 Human Resources Factors

Human resources implies teachers and trainers are involved in the technology, as well as students who are the targeted group. The grid for human resources is divided in two parts: One grid addresses factors related to teachers while the second one addresses factors related to students.

2.3.4.1 Human factors for Teachers (for the grid, see TABLE 2.4)

2.3.4.1.1 Preparation Period - for Teachers

Factor # 1: Support from administration

(Postner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)

Factor # 2: Participation from administration

(Postner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)

Comments

MEQ educational officers initiated the project and we contacted the West Hill High School to get acquainted with the principal and the two teachers involved, in order to explain the project. We had all the support, a budget and incentive for the teachers to get their interest.

The MEQ supplied additional information and designated two officers to supervise the project (off site). This factor is applicable and useful.

Factor # 3: Participation from teachers *(Knapp-Minick, Gottron and Loven, 1991; Postner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)*

Factor # 4: Sufficient time allowed to learn the technology *(Hannah & Abate, 1991)*

Comments

First, a questionnaire was given to the teachers to find out their age group, background, area of teaching, also if they experience difficulties in teaching certain topics. We asked if they had exposure to, or apprehension about interactive videodisc instruction. Two weeks later, a preliminary 3-hour seminar was conducted for the teachers; one teaching hydraulics and the other teaching electronics. The seminar aimed at introducing the technology in training, the benefits, pit falls and conditions of implementation. Also, an interactive videodisc workstation was made available, along with 3 courses in electronics matching the MEQ curriculum. These courses were part of the projects' library. Workstation and courses were left at the premises for further investigation by teachers. They had some computer anxiety and both were motivated to get additional help from IVI. These factors are applicable and useful.

Factor # 3: Participation from teachers *(Knapp-Minick, Gottron and Loven, 1991; Postner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)*

Factor # 4: Sufficient time allowed to learn the technology *(Hannah & Abate, 1991)*

Factor # 5: Knowledge of the content to be taught on IVI

(Sorge, Russell and Campbell, 1991)

Comments

Three weeks from the beginning of the project, a description of all interactive videodisc courseware (detailed contents), matching the MEQ curriculum, was brought to teachers. This step aimed to involve the two teachers in selecting and setting the appropriate organization of courses, for the experiment (hydraulics and electronics).

Following the teachers' experience and the difficulties encountered, they were able to select topics from the videodiscs that match perfectly the MEQ curriculum, and topics which would be most representative for the experiment. More topics were selected to counter the weaknesses in Math before entering in Digital Electronics. Advanced courses like Programmable Controller were also provided for students who wish to move ahead. These factors are applicable and useful.

Factor # 3: Participation from teachers *(Knapp-Minick, Gottron and Loven, 1991; Postner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)*

Factor # 4: Sufficient time allowed to learn the technology *(Hannah & Abate, 1991)*

Factor # 16: Enrollment of students *(Newren, Waggener and Kopp, 1991)*

Comments

A second meeting was set on the fifth week of the project:

- To review their experience with the interactive videodisc workstation;
- To answer questions;
- To establish the list of generic courseware matching the curriculum for the experiment;
- To review the use of the workstation and the courseware;
- To review the administration software involved and extract data from students' performance, specifically time spent on tasks;
- To organize the hydraulic lab where equipment had to be installed;
- To select students to form group B (experimental group), using IVI.

These factors are applicable and useful.

Factor # 5: Knowledge of the content to be taught on IVI

(Sorge, Russell and Campbell, 1991)

Factor # 13: Coordination (human support for orientation training)

(Newren, Waggener and Kopp, 1991)

Factor # 14: Synchronization *(Newren, Waggener and Kopp, 1991)*

Comments

Seven weeks after the first meeting, a last meeting was set to coordinate and synchronize the last selection of videodisc program with the classroom instruction and the time schedule to use the IVI system. These factors are applicable and useful.

Factor # 16: Enrollment of students *(Newren, Waggener and Kopp, 1991)*

Comments

A questionnaire was left to the teachers to be filled by each student in the Group B (interactive videodisc instruction). This questionnaire, similar to the one given to the teachers, sought to find the difficulties, if any, that students encounter toward different topics. Also we wished to find out how much they knew about IVI. This factor is applicable and useful.

Factor # 3: Participation from teachers *(Knapp-Minick, Gottron and Loven, 1991; Posner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)*

Factor # 4: Sufficient time allowed to learn the technology *(Hannah & Abate, 1991)*

Factor # 16: Enrollment of students *(Newren, Waggener and Kopp, 1991)*

Comments

The next step was to set an appointment to deliver and install the 5 workstations, including the courseware. We also collected the students' questionnaires. Teachers assisted us in installing, testing the systems, and checking students' enrollment.

- Workstations and courseware were delivered on January 15th - on time to start the training project.
- Meeting with the students and collection of all questionnaires.
- Explanation of the project to students with the MEQ officers and teachers.

. Students were enrolled in the courses in which they needed to be train.

These factors are applicable and useful.

Factor # 13: Coordination (human support for orientation training)

(Newren, Waggener and Kopp, 1991)

Factor # 15: Cooperation *(Newren, Waggener and Kopp, 1991)*

Comments

From this point, teachers were able to provide explanations to the missing students, and to provide support. The starting date for the semester was January 22nd. From this point in time, students were able to use their working station, and were able to begin training. The ending date of the semester was fixed on June 7th. Both teachers share tasks and cooperated in sharing the training time for the IVI and classroom instruction. The cooperation of the teacher in Electronics was not adequate since he had problems to relate to the technology. These factors are applicable and useful.

Factor # 6: Teachers oriented People skills *(Sorge, Russell and Campbell, 1991)*

Comments

Both teachers had very good relationship with all students and related very well. We can say that both teachers had people skills, but one of them still felt uneasy with the technology. This factor is applicable and useful.

Factor # 7: Teachers to motivate students *(Sorge, Russell and Campbell, 1991)*

Comments

The teacher in hydraulics was more comfortable with the technology and tried to encourage and motivate students as much as possible. The other teacher in electronics encourage students to use the technology, but tried to avoid questions. He felt uneasy with the technology, and the content of the videodiscs. Sorge, Russell and Campbell (1991) were clear in stating that: *"Regardless of the quality and sophistication of the computer hardware and software, the success of the instruction with most adults depends upon the support and encouragement they receive from teachers, facilitators, and other students."*

This was one of the reason why two research assistants were later appointed to the project. It became obvious the teachers had their hand full and could not keep up with the stress of their new tasks. This factor is applicable and useful.

Factor # 8: Human support / Problem solving

(Knapp-Minick, Gottron and Loven, 1991)

Comments

To bring human support and problem solving techniques, and to overcome these weaknesses, two research assistants were appointed on the project. Mrs. Francine Hébert, M.Ed. was appointed to fix all hardware and software problems including retraining students on how to use courseware and their contents. Mr. Michel Allard, student at the graduate program in education, was also appointed to the project to monitor the administration and the schedule of training. Teachers had very little time to relate the content of each classroom lesson to the content of the videodisc, Mrs Hébert assisted them. She also monitored scheduling of training sessions and to ensure that interactive videodisc training was readily available. This was to assure that interactive videodisc training was available at all times when needed and not only when teachers could supervise the learning center. It also helped the coordination between the classroom sessions and videodisc time schedules. Mrs. Hébert and Mr. Allard were able to answer students' questions on the use of the technology as well as on the content of the videodisc, relying in part on the programs' text book. This support was brought to the project as no teacher was in a position to relate this factor to IVI, or very partially. This factor is applicable and useful.

Factor # 12: On site service support personnel *(Floyd, 1985; Posner, Danielson and Schmidt-Posner, 1992-93; Hannah and Abate, 1991)*

Comments

For security reasons, doors of the hydraulic lab were locked when the teachers were delivering a course in the classroom. Having an on site service support would have facilitated access to the premises. An on site service was provided by external source with the contribution of Mrs. Hébert and Mr. Allard. They were on site from 8:30 to 14:00. This factor is applicable and useful.

Factor # 14: Synchronization *(Newren, Waggener and Kopp, 1991)*

Comments

Our observations indicated that teachers were using the content of the interactive videodisc lessons to improve their classroom presentations. Synchronization among hydraulic topics was easy since it was in the hydraulic labs. After students' learning session, they were able to perform their exercises on the lab's equipments. Synchronization was not so easy between topics in electronics with those in hydraulic, and also with classroom instruction. Teachers were not familiar enough with the technology and topics on IVI. This factor is applicable and useful.

Factor # 4: Sufficient time allowed to learn the technology

(Newren, Waggener and Kopp, 1991)

Factor # 13: Coordination (human support for orientation training)

(Newren, Waggener and Kopp, 1991)

Comments

The problems encountered reflect on the time issue. Teachers were overloaded with additional tasks and were not able to devote the necessary time to learn how to implement the technology. An additional teaching load was requisted from the management of the school. This lack of time to devote to the IVI project was reflected when teachers had to coordinate the subject taught with the content of the videodiscs.

Questions raised by the students on how to use the content of the videodiscs were not answered by the teachers because they did not have enough time to learn the content themselves. The fact that the teachers kept the same time schedule for the traditional classroom delivery, created a conflict for the IVI.

Students who wanted to use IVI at will were unable to do so because the lab was locked. These factors are applicable and useful.

Factor # 9: Adaptive planning process

(Posner, Danielson and Schmidt-Posner, 1992-93; Birson, Gutek and Mankin, 1981)

Comments

No adaptive planning process as such was developed in this project. This was simply because we were looking at three courses to be filled with IVI for a limited period of time, one semester. This factor is applicable and useful.

Factor # 10: Training package on site for teachers *(Bergman and Moore, 1991)*

Comments

No on site training package was provided for teachers except for the initial training. Before the project start although support was provided all during the semester. The available training before the project involved two teachers. No one else was scheduled to replace or take over. Two on site permanent support assistants were available. This factor is applicable and useful.

Factor # 11: Training package on site for administrators *(Bergman & Moore, 1991)*

Comments

No on site training package was available for administrators. At the initial training, administrators were present but never got involved in the implementation of the technology. They paid regular visit to see how the project was progressing taking notes about the problems and how they were solved. All administrators were located at different offices about 45 minutes away from the school. Others were located in Quebec City, approximately 300 km from the school. This factor is applicable and useful.

Factor # 17: Opportunity to be involved in new IVI development

(Hannah and Abate, 1991)

Comments

From a second questionnaire administrated to teachers at the end of the project, both mentioned that they would appreciate being involved in developing new materials on IVI. This factor was not appropriate for the project except to seek the interest of teachers. This factor is applicable and useful.

Factor # 18: Incentive to use system *(Posner, Danielson, Schmidt-Posner, 1992-93)*

Comments

The additional traditional classroom teaching load undertaken by the teachers brought them additional money and, much more, in fact, than the incentive received for the IVI project. The administration welcomed the IVI project but did not give any additional support, or assistance by reducing the work load. As they were short of teachers, they asked the two involved teachers to take the additional work load, on top of the IVI project. This was the only possible incentive since it was a pilot project. So, all incentive for the future use of the technology or to develop additional content was not a consideration. Nevertheless, it was nice to learn from a questionnaire that teachers would be interested in getting involved to produce other IVI material. This factor is applicable and useful.

2.3.4.1.2 Implementation Period - for Teachers

The implementation period for teachers is covered with the students implementation as it relate to the same factors.

2.3.4.1.3 General Comments from Teachers

This awareness and preparation of teachers was consistent with Sorge, Russell and Campbell (1991). We found that only one teacher had the ability to act as a facilitator. The other teacher in electronics felt uneasy with computer and IVI system. It was also consistent with Knapp-Minick, Gottron and Loven (1991) in terms of human resources awareness, although the MEQ project was quite smaller. Some topics in electronics from the last semester were not all completed and had to be presented in the January semester, in addition to the regular courses. Also, teachers were asked to fill an additional teaching load, which left them very little time to supervise the interactive videodisc project. Consequently they did not devoted the time they should have to the project. MEQ wanted to launch the study to meet a time frame, and rushed the project. There was not enough time for the people involved to study the new technology, and learn the content of the videodiscs.

This problem occurred only in the implementation period. The problems encountered could have been avoided if we could have taken into consideration the recommendation of Salisbury (1992):

> *"Effective use of technology requires changes in the basic structures of schools-in the way schools use time, resources, physical space, and personnel. Without changes in these basic structures, technology remains peripheral to the learning process. When this happens, technology cannot produce increases in productivity and efficiency."*

Also, if we would have taken into consideration the approach used by Knapp-Minick, Gottron and Loven (1991), many problems could have been avoide[illegible].

The problems found in MEQ are similar to those raised by Hannah and Abate (1991) where:

" . *The time is took to learn how to use videodisc technology was mentioned as a prohibitive factor (for teacher carrying their regular task).*
. *The time to plan how to use this technology effectively was mentioned by many of the faculty who had used it as well as those who had not implemented it in their course. A respondent who had used the technology stated, "It's very time consuming to plan for how exactly the videodisc may fit into your course."*
. *In order to implement this technology, sacrifices had to be made by some professors.*
. *Thus, in order for faculty to decide to implement the interactive videodisc technology the issues of time to plan, revise, and learn the technology must be addressed.*
. *Limited facilities or the difficulty in getting to the facilities in the time available for the class.*
. *Faculty would like to be more of a part of the development of materials.*
. *Support from all levels of the administration is very important to the acceptance of new methods (Griffin, 1987).*
. *Opportunities to learn how to use the equipment and become proficient with the technology."*

In this case teachers mentioned that they would also appreciate being part of a team to develop new material. Since the project involved only the use of generic courseware, it did not apply but considerate important for the implementation of this technology on a permanent basis for the future. The problem of coordination between the teachers in the same time frame is reflected by Newren, Waggener and Kopp (1991): *"Coordination of and cooperation among the instructors of the various modules in this team-shared environment remains a difficulty in contrast to one instructor being responsible for and handling an entire course."*

This was true in the project as teachers in Electronics and Hydraulics had their traditional classroom responsibilities in addition to the IVI project which they had to coordinate and synchronize. Even though cooperation existed between both teachers, the program was difficult to implement because of conflicts of scheduling between the traditional classes and the IVI classes, plus the coordination of students' schedules. The general comment of teachers was: *"We did not have enough time to learn the technology and the content of the videodiscs to implement [the courses properly]."* Interactive video does not work just by having the hardware and software available for the adult learning. MEQ study proves it, as does the Sorge, Russell and Campbell, 1991' study. More over, Murphy, in 1978, stated that the impact of computer assisted instruction, a precursor to interactive video, is not determined by technology, but by the manner in which the instructors perceive a sense of responsibility for the technology. Someone needs to encourage students to use it. Both teachers did not devote the require time to do so. Additional help had to be provided. At the beginning of the project, no problems were encountered. It was only at the implementation period that problems start to occur. We then realized that the teachers did not take the appropriate time to thoroughly learn the technology and the content of the IVI courses. Even though we allowed enough time between training sessions for teachers, they did not take the time to learn. They were busy with other tasks. In front of the MEQ's officers, no one dared to raise questions, or raise the problems. The thinking was that the problems would go away during the implementation, but in fact, they did not.

2.3.4.2 Human factors for Students

2.3.4.2.1 Preparation Period - for Students (for the grid, see TABLE 2.5)

Factor # 1: Participation *(Branson and Grow, 1987; Sorge,Russell and Campbell, 1991;* Posner, Danielson and Schmidt-Posner, 1992-93)

Comments

Students got involved only in organizing the use of the technology among themself: the videodiscs, the courseware, and the IVI systems.

They coordinated the use of the material, and even share the use of the same course, as only one copy of the course was available. Students mentioned that they would appreciate being part of the team at the beginning of the project. Having only one copy of the courseware did cause some problems when the training started. This factor is applicable and useful.

Factor # 2: Time to learn the technology *(Hannah and Abate, 1991)*

Comments

Students had a 3-hour seminar to learn how to use the technology and the videodiscs program. Also, teachers spent another 3-hour session explaining which disc to use first, and how to get access to training. This factor is applicable and useful.

Factor # 3: To be able to personalize the course ***(Sorge, Russell & Campbell, 1991)***

Comments

Students were able to personalize the course as they saw fit for them. They were able to view video sequences with explanations, and later get involved in answering questions. Simulations with real situations were available and students were free to try them as many time as they wanted since they were generated at random from a bank of simulations, and even at the beginning of the course. The only constraint was to take the pre-test at the beginning of the course in order to analyze their strengths and weaknesses. This factor is applicable and useful.

2.3.4.2.2 General Comments - from Students

The group:

The group was young adult (age averaging 30), part of the vocational program in electromechanics. Students had no previous background in electromechanics, except what they learned from courses in their three previous semesters.

Program and Environment

- The electromechanical high school diploma is a 2 years program divided into 4 semesters.
- This study covers three (3) topics of the last semester:
  a) Hydraulics - 842-256 Module 26 - 90 hours of classroom instruction
  b) Operational Logic Circuit - 843-094 Module 18 - 60 hours
     Sequential Logic - 842-304 Module 19 - 60 hours
- Others course topics to be learned, leading to the same high school diploma in electromechanics were taught in the classroom environment. These were teacher led instruction with both groups in the same classroom.

Particular of the Environment of the Student:

Hydraulics: All contents of the previous semester were covered, and students began in January with new topics.

Electronics: Some electronic topics from the previous semester, had not been covered. All students had to catch up on past material, in addition to the new topics of the new semester. It was decided that Group A would cover those missing topics with classroom instruction. The 5 students in Group B (experimental) would cover the same missing topics with interactive videodisc instruction, as those courses were available on interactive videodisc instruction.

The project had a negative effect on **group A** receiving traditional course delivery. They felt left aside and were less motivated. The **group B**, using IVI, were very motivated and eager to learn, and use the new technology.

Access Time to the IVI System:

The **IVI Group** had access to an interactive video training system during the same period of time that the **Traditional Classroom** Group had its classroom training instruction.

This IVI Group had access to the interactive video system at any time of the day (from 8:00 to 15:00 hours), except for those periods when they were involved in other classroom instruction, on other topics. This Group of students also had the opportunity to take any interactive video courses they wished, especially if they felt they had a need for additional supportive instruction. As an example: if they were taking a course that demanded certain mathematical ability and they were weak, they were able to postpone the IVI program while their mathematics was being upgraded. At any time, when they felt they were ready, they could move to lab exercises. The final test was administered once, after both groups had concluded all their work.

Awareness:

As confirmed by Sorge, Russell and Campbell (1991), we did notice that adult learners who are not part of a formal educational program seem to prefer shorter programs. They wanted to receive their information quickly. Students were very positive about their ability to learn from these systems. Interactive video instruction is more available than a time specific class and they can spend as much time as necessary learning the material. This is despite problems encountered in the scheduling of time. Bringing research assistants into the project helped the students in accessing theIVI system. Adult learners liked the personal nature of the IVI training. The lack of time for the teachers to relate content of the videodiscs to the content of the classroom studies, as well as to the inadequate reference book with the videodisc forced the students to innovate for themselves.

2.3.4.3 Implementation Period - for Teachers and Students

Factor # I-1: Personnel trained in their use to the satisfaction of the site managers

(Bergman and Moore, 1991)

Comments

In the MEQ project, there was no project manager as such. Claude Major was responsible for the study and was the coordinator and provided all necessary assistance. In fact, no one within the school had the necessary training to take over an IVI project nor with the MEQ.

Eventhough we had enough time, the training was not appropriate as the teachers were overload with other teaching task. This factor is applicable and useful.

Factor # I-2: Well skilled service person on site ***(Bergman and Moore, 1991; Floyd, 1985; Posner, Danielson and Schmidt-Posner, 1992-93)***

Comments

A well skilled inservice person was not available from the MEQ nor from the school. Nevertheless, it was necessary to have inservice persons. This function was provided by Mrs. Hébert and Mr. Allard. The project proved that such person should be mandatory in this type of IVI project. This factor is applicable and useful.

Their general comments were as follow:

> *"The electronic program provided more information than the hydraulic program. An independent handbook should be provided with each videodisc lesson. A handbook would have made home study easier. The interactive video program taught us more than the traditional school program. There was better demonstration of equipment, and the IVI program had realism."*

Summary

Gathering information and rules to follow from the prescriptive and pragmatic approaches gave us indication on how to get involved in implementing IVI training. The comparison of the philosophy over the practical experiment with the MEQ project gave us additional information. With MEQ project we were able to compare the accuracy of different authors, with the systematic administrative approach. Although that information gathered seems to follow the same pattern, or factors, we still have no indication on how clearly to approach the problem. In neither case, review of literature nor with MEQ study, we can get a rather complete pattern of steps to follow to ensure a successful implementation. We did not find any guideline or a check list to follow. It is clear that a guideline would have been very appropriate to lead teachers in implementing this new technology in training. Also, from the MEQ study, we discovered new factors such as:

TABLE 2.6: NEW FACTORS

NEW FACTORS	#
To have an accompanying workbook with videodiscs	1
To have a print screen function	2
To have a network to retreive information	3
To integrate IVI courses within the existing training programs	4
New role of trainers and teachers	5

These factors did not appear in the review of literature. They were created from comments of teachers and students. Those factors need special consideration for additional factors. Implementation, as we understand it, is more universal, and should include the following:

- Understanding where IVI courseware fits in the existing curriculum, within the same course, and within an existing training program. By this we mean where should IVI training start, where it should end, and by what additional training should it be followed. This was barley considered in the MEQ study nor in the review of literature.

- The quality of courseware, content, interactivity and tracking system, was well cover by the literature, as well as by the MEQ study. Then, a good structure would be very helpful.

- Train the trainers, not only on how to use equipment, facilities and enrolling students, but understanding this new tool, which provides statistical data on each student. Utilizing the student data, following up on the IVI courses with additional courses would enhance the existing program. This has been mentioned in the literature, and has been demonstrated by the MEQ study, but no framework exists to organize it.

- Trainers must be pro-active, eager to get involved in this new teaching technology. It seems up to now that trainers and teachers were dragged into this technology by accident, not foreseeing the implications, and not being prepared for them. Involvement is a key to success, a fact which can be found in the literature and again illustrated in the MEQ study.

- This new tool, IVI training, brings many advantages which are not always understood by trainers, as they will become **managers of training** rather than **managers of the subject**. This is not found clearly in the literature nor in the MEQ study. This is part of training the trainer.

- IVI is a new way of learning for a student. How to make them understand and use the technology efficiently is the primary goal.
  We can find in the literature that age was not a barrier to use this technology, and people were confident in their abilities to use it. The MEQ study demonstrated that students did not find any problem getting acquainted with this technology.

- The MEQ study brings to mind the question of how a learning center could be developed, wherein many different topics could be developed, and be made available for general used. Literature reveals projects that use only one topic at the time.

Math for Sorge and al. (1991), Forcement Behavior/Discipline for Knapp and al. (1991), etc. Whereas the MEQ project covered two topics, Electronics and Hydraulics, but both topics related to the same course. Creating a learning center raise more questions on how to implement IVI.

How does one fit in different schedules of training especially, if we are talking about school system, and how does one plan the efficient use of this new technology ? This implies more than just installing the IVI system. It changes the structure of how training is delivered. Salisburry (1992), mentioned clearly that school systems need to revised their way of thinking. The utilization of resources will change. This has been demonstrated with the MEQ study.

The implementation should insure that the technology (hardware and software) is not only cost effective but used efficiently as well. There is no well organized structure or guideline to help every step of the way on the implement of IVI. All factors we found came from different sources, some redundant, and some not consistently used.

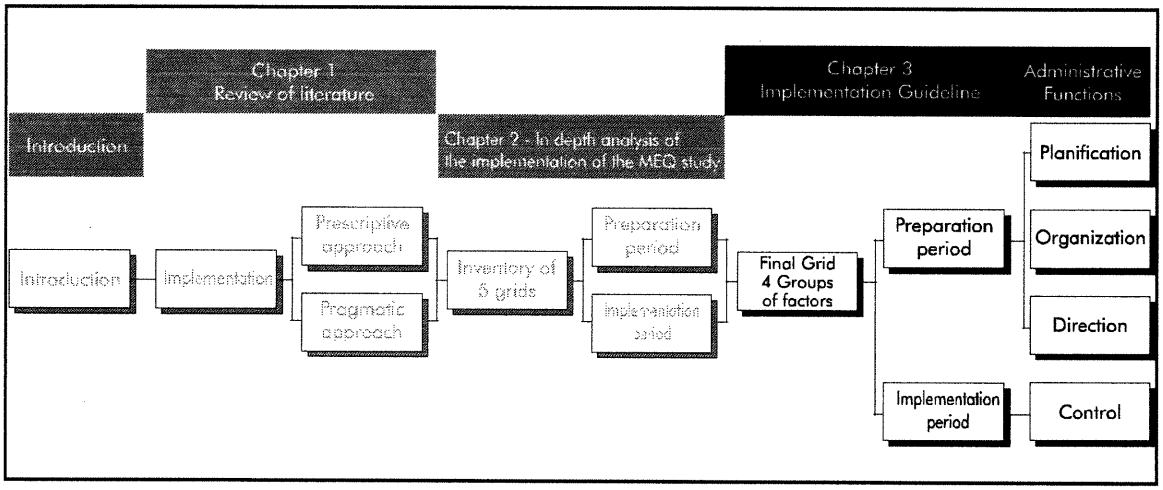
Our definition of implementation is as follows:

An essential step to guaranty the efficiency of training, which includes a good understanding of the technology, where the effective courseware fits in a training program, and where teachers and trainers are involved in responding to students' needs.

In the following chapter, we will build a formal guideline to implement IVI. We will use the review of literature as a background and the experience of MEQ study to lead us in our different steps.

CHAPTER 3

IMPLEMENTATION GUIDELINE



This chapter aims at the development of a structured guideline to implement the Interactive Videodisc Instruction, in a school, or corporate environment. The required steps to build this guideline will consist of the following:

.1 The grids of factors constructed from the review of the literature; enabled us to analyze the MEQ study. The screening of the MEQ study brought consideration to many factors which needed to be inserted in the guideline.

.2 Explanation of each retained factor.

.3 Set all factors in a grid for the guideline, with explanatory notes for each group of factors.

In general

Our investigation through different authors in the review of the literature brought us to the conclusion that there was no definite structure on how factors were defined and used. This was the reason why we regroup those factors in four groups, to analyze MEQ study:

- Physical factors
- Hardware factors
- Courseware factors
- Human resources

From the regroupment of the different factors and through the different grids, during the MEQ Study analysis, we noticed that some factors, classified as such, were more related to administrative functions in an administrative process (Sikula, 1992) such as:

- Planning
- Organization
- Direction
- Control

As an example, in the hardware / equipment grid, we refer to preparation of facilities to accept equipment in the preparation period which refers to planning. We can find a similar case in the human resources grid at the preparation period when we have factors on adaptive planning, coordination and synchronization. It is our intention to use those administrative functions and integrate them in the different grids within our two periods defined as: **Preparation Period** and **Implementation Period**. Before we go any further, we will give the definition of those administrative functions and apply them as we see them fit into our structure to form the guideline. Druker (1954), and Simon (1973) give the following definition of the managerial functions, also called administrative functions:

Planning: To plan the future, establish a plan of action according to the objective set. This is to foresee the action to be taken.

Organization: Consists of organizing the required activities with the means and methods needed to achieve the objective.

Direction: Consists of guiding and managing people to assure that activities are fulfilled according to plan, to reach the objectives. It includes coordination, synchronization, communication and decision.

Control: Above all, Control is a feedback from our activities. Each activity is measured to assure that it will fulfil plans to reach the objectives. Adaptive action might be required to adapt to new situations in order to reach objectives.

There are similarities between the **Planning** and the **Preparation period** in our implementation program. The preparation period refers to all activities related to different factors before the implementation period. Therefore, we will use the planning in the same way as the preparation period, which will apply to the four groups of factors. Two other administrative functions such as: **Organization,** and **Direction** will also be incorporated in the **Preparation period**, and addressed to all factors as it is a continuum of analysis. The administrative function, **Control** will be used in the **Implementation period** as it is a measure of final activities according to plan. The implementation phase must reflect the planning and the organization of activities leading to the achievement of goal. This step will ensure that all factors will have a continuum from the planning throughout all other administrative functions. We could not find in the review of the literature, nor from the analysis of the MEQ's study, a consistent approach toward those administrative functions which are needed to support good implementation.

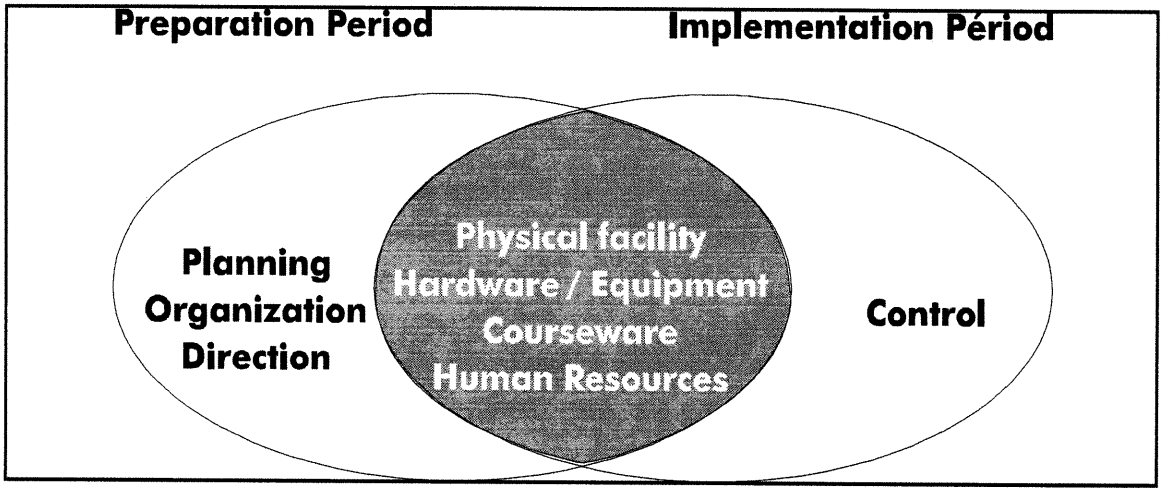
The model of implementation we will present, does not intend to bring new tools to the needs analysis for training, or present a set of tools to set training objectives. At the implementation phase those analysis are supposed to be addressed.

The implementation guideline model intends to present a guide to ensure that those previous analyses will be reflected in the implementation, process and guarantee that if all factors were used properly they will lead to a successful implementation of the technology.

The model of the guideline applies to custom courseware, as well as to generic courseware. This model of the guideline is classified in the Prescriptive Approach as it is a description of steps which should be taken, based on factual results from the MEQ study analysis.

The initial model proposed should be as follows:

FIGURE 3.1: INITIAL MODEL



This model of the guideline brings additional elements such as; the organization and the control, which have never been found neither in the review of the literature nor in the MEQ analysis. The term **Organization** was not used. In the review of literature, including the MEQ Study analysis, we organized things, but not in a systematic way, it seems to be implicite. The use of different factors by all authors is not consistent. Also **Control** was never used. We reacted to some problems rather than to have a real control chart to measure, evaluate and correct activities.

3.1 Inventory of retained factors

It took various authors from the review of literature to construct the five (5) grids. For the **physical** and **hardware** factors, we noticed that many factors were used by different authors.

On the other hand, for the **courseware** and **human resources (teachers and students)**, factors came from a various sources and were used differently by the authors. The four (4) groups of factors were an exhaustive list of all factors found in the review of literature and we had no reason to exclude any of them to screen the MEQ study. After screening the MEQ study with the five (5) grids, all factors were applicable and useful, so, we have no reason again to exclude any of them.

The inventory of retained factors is based on the group of factors retained from the review of literature and from additional factors found in the MEQ study analysis. The screening of the MEQ study enable us to find five (5) new factors applicable to courseware and human resources.

We will keep the same consistent general approach having the preparation period and the implementation period.

The classification of different grids of factors and factors within their respective grid reflect their general use in the review of literature and from the MEQ study analysis.

After each grid, additional considerations are mentioned which will enhance the new factors from which our guideline will be constructed. The additional considerations, which come from the MEQ study analysis, will highlight what was missing and will identify new factors.

3.1.1 Physical Facility Factors

TABLE 3.1: PHYSICAL FACILITY GRID

FACTORS	#
Preparation Period	
Adequate floor space	1
Temperature	2
Humidity control	3
Ventilation and Heat dispersion	4
Ambient light and noise	5
Electrical power	6
Curtains	7
Communication devices	8
Physical security	9
Service Access	10
Implementation Period	
Facilities ready on time	11

Other considerations:

The preparation period should include:

- Layout that takes into consideration the health care of students and number of hardware. We could modify the factors number 1 **Adequate floor space** by **Layout of required space**, layout that takes into consideration the health care of students and a number of systems which includes more that strictly the adequate floor space. Layout looks at an efficient use of the floor space taking into consideration other elements.
- Administration functions such as Planning, Organization and, Direction.

The implementation period should include:

- Administration function such as Control

3.1.2 Hardware / Equipment Factors

TABLE 3.2: HARDWARE / EQUIPMENT GRID

FACTORS	#
Preparation Period	
Preparation of facilities to accept equipment	1
Selection of standard of interactive video systems	2
Acquire equipment and material for the number of students	3
Set procedures for installing, initiating and maintaining the host site systems	4
Insure hardware availability at the right time	5
Prepare for troubleshooting	6
Implementation Period	
Fully installed and tested hardware in place	7
Full set of administrative and maintenance documentation at each site	8

Other considerations:

The preparation period should include:

. Time for testing (to thoroughly test the system)

. Administration functions such as Planning, Organization and, Direction.

The implementation period should include:

. Administration function such as Control

3.1.3 Courseware Factors

TABLE 3.3: COURSEWARE GRID

FACTORS	#
Preparation Period	
Related to training needs and objectives	1
Relevance between objectives and curriculum content	2
Needs and characteristics of learners must be taken into consideration	3
Courseware matching the adequate level for students	4
Major interest for teachers and students	5
All necessary documentation needed to integrate the application into other related or complementary systems	6
Adequate quantity of material	7
Ability to arouse and maintain interest	8
Easy to use	9
Active learner participation	10
Delivery style	11
Flexibility	12
Program good to excellent	13
Effectiveness of the program	14
Additional courses and materials	15
Protection of the confidential records that may be stored in the system	16
Implementation Period	
Delivery of courseware	17
Work properly and trouble free	18
Documentation of courseware	19
How courseware work	20
Operation system (on-line/off-line) for recording and evaluating	21

Other considerations:

The preparation period should include:

- Suppliers
- Easy access to the courseware
- To be able to print any screen from the program
- To have a network system for the data
- Selection of images, motion video, related to topics
- To have an accompanied workbook with videodiscs
- To integrate IVI courses within the existing training program
- Administration functions such as Planning, Organization and, Direction.

The implementation period should include:

- Administration function such as Control

3.1.4 Human Resource Factors - For Teachers

TABLE 3.4: HUMAN FACTORS FOR TEACHERS GRID

FACTORS	#
Preparation Period	
Support from administration	1
Participation from administration	2
Participation from teachers	3
Sufficient time allowed to learn the technology	4
Knowledge of the content to be taught on IVI	5
Teachers oriented People skills	6
Teachers to motivate students	7
Human support / Problem solving	8
Adaptive planning process	9
Training package on site for teachers	10
Training package on site for administrators	11
On site service support personnel	12
Coordination (human support for orientation training)	13
Synchronization	14
Cooperation	15
Enrollment of students	16
Opportunity to be involved in new IVI development	17
Incentive to use system	18
Implementation Period	
Personnel trained in their use to the satisfaction of the site managers	I-1
Well skilled service person on site	I-2

Other considerations:

In the preparation period, special attention should be brought on how teachers and trainers will relate, use or insert the new technology with the existing training program. How they can be complementary, etc.

Other supportive personnel that can take over existing personnel

Enabling the structure to use existing traditional classroom courses delivery with the new technology which is:

- Available at all time with the maximum of expertise
- Self pace program
- Students using training at will

The preparation period should include:

. New role of trainers and teachers

. Administration functions such as Planning, Organization and, Direction.

The implementation period should include:

. Administration function such as Control

3.1.5 Human factors for Students

TABLE 3.5: HUMAN FACTORS FOR STUDENTS GRID

FACTORS	#
Preparation Period	
Participation	1
Time to learn the technology	2
To be able to personalize the course	3
Implementation Period	
Personnel trained in their use to the satisfaction of the site managers	I-1
Well skilled service person on site	I-2

Other considerations:

In the preparation period we should make sure that all study of a same topic will have access to this new technology as it can have a negative effect as it happen in the MEQ study. Also it is important that teachers or trainers went through the content of the videodisc and know every part of it. It is the new role of teachers and trainers.

The preparation period should include:

- All students have access to the technology
- Administration functions such as Planning, Organization and, Direction.

The implementation period should include:

- Administration function such as Control

3.2 Explanation of the Retained Factors

In this section, we will proceed with an in depth description of all the retained factors to understand how and where each factor should be used. This is to avoid any misunderstanding in using each factor. As we saw in the review of the literature and within the analysis of the MEQ study, we realize that some of the factors are not consistently used. As an example, the participation of the administration in the implementation phase had a lack of precision and goes beyond the consideration of accepting a project.

Thus this procedure will enable us to be consistent in using each factors and making sure that no misinterpretation will takes place. We will proceed in the same consistent way where we regrouped the preparation period factors and the implementation period factors, in the implementation phase.

The administrative functions which will be integrated in our guideline will be treated in the next section, in the creation of the guideline, followed with explanation on how the administrative functions will be supportive for each group of factors.

As well, we will insert the factors in a chronological classification justifying the classification of such factors within each grid.

In the following pages, you will find new grids combining the retained factors with additional factors coming from the considerations of the previous section.

Appendix 2 gives a full description of each factor within their grid.

3.2.1 Physical facility factors

TABLE 3.6: FINAL PHYSICAL FACILITY GRID

FACTORS	Old #	New #	Check
Preparation Period			
Layout of required space (Adequate floor space)	1	1	
Temperature	2	2	
Humidity control	3	3	
Ventilation and Heat dispersion	4	4	
Ambient light and noise	5	5	
Electrical power	6	6	
Curtains	7	7	
Communication devices	8	8	
Physical security	9	9	
Service Access	10	10	
Implementation Period			
Facilities ready on time	11	11	

3.2.2 Hardware / Equipment Factors

TABLE 3.7: FINAL HARDWARE / EQUIPMENT GRID

FACTORS	Old #	New #	Check
Preparation Period			
Preparation of facilities to accept equipment	1	1	
Selection of standard of interactive video systems	2	2	
Acquire equipment and material for the number of students	3	3	
Set procedures for installing, initiating and maintaining the host site systems	4	4	
Insure hardware availability at the right time	5	5	
Prepare for troubleshooting	6	6	
Time for Testing		7	
Implementation Period			
Fully installed and tested hardware in place	7	8	
Full set of administrative and maintenance documentation at each site	8	9	

3.2.3 Courseware Factors

TABLE 3.8: FINAL COURSEWARE GRID

FACTORS	Old #	New #	Check
Preparation Period			
Suppliers		1	
Related to training needs and objectives	1	2	
Relevance between objectives and curriculum content	2	3	
Needs and characteristics of learners must be taken into consideration	3	4	
Courseware matching the adequate level for students	4	5	
Major interest for teachers and students	5	6	
All necessary documentation needed to integrate the application into other related or complementary systems	6	7	
Adequate quantity of material	7	8	
Ability to arouse and maintain interest	8	9	
Easy to use	9	10	
Active learner participation	10	11	
Delivery style	11	12	
Flexibility	12	13	
Program good to excellent	13	14	
Effectiveness of the program	14	15	
Possibility to get additional courses and materials other than those for the project	15	16	
Protection of the confidential records that may be stored in the system	16	17	
Easy access to the courseware		18	
To be able to print any screen from the program		19	

To have a network system for the data		20	
Selection of images, motion video, related to topics		21	
To have an accompained workbook with videodiscs		22	
To integrate IVI courses within the existing training program		23	
Implementation Period			
Delivery of courseware	17	24	
Work properly and trouble free	18	25	
Documentation of courseware	19	26	
How courseware work	20	27	
Operation system (on-line/off-line) for recording and evaluating	21	28	

3.2.4 Human Resource Factors - for Teachers

TABLE 3.9: FINAL HUMAN FACTORS FOR TEACHERS GRID

FACTORS	Old #	New #	Check
Preparation Period			
Support from administration	1	1	
Participation from administration	2	2	
Participation from teachers	3	3	
Adaptive planning process	9	4	
Sufficient time allowed to learn the technology	4	5	
Knowledge of the content to be taught on IVI	5	6	
Teachers oriented People skills	6	7	
Teachers to motivate students	7	8	
Human support / Problem solving	8	9	
Training package on site for teachers	10	10	
Training package on site for administrators	11	11	
On site service support personnel	12	12	
Coordination (human support for orientation training)	13	13	
Synchronization	14	14	
Cooperation	15	15	
Enrollment of students	16	16	
Opportunity to be involved in new IVI development	17	17	
Incentive to use system	18	18	
New role of trainers and teachers		19	
Implementation Period			
Personnel trained in their use to the satisfaction of the site managers	I-1	20	
Well skilled service person on site	I-2	21	

3.2.5 Human Resource Factors - for Students

TABLE 3.10: FINAL HUMAN FACTORS FOR STUDENTS GRID

FACTORS	Old #	New #	Check
Preparation Period			
Participation	1	1	
Time to learn the technology	2	2	
To be able to personalize the course	3	3	
All students have access to the technology		4	
Implementation Period			
Personnel trained in their use to the satisfaction of the site managers	I-1	5	
Well skilled service person on site	I-2	6	

3.3 The Creation of the Guideline

In this last section, we will present the guideline along with the different grids of factors.

We will use the 4 groups of factors **grids** in a different order to maximize their role in our guideline. We will then introduce our administrative functions to complete the guideline along with the different grids of factors.

The 4 groups of factors **grids** will be classified as follows:

1) Human Resources
2) Courseware
3) Hardware / Equipment
4) Physical Facility

The reasons that motivated us to change the order are based on the following:

The implementation phase takes place:

- after the assessment of needs for training has been performed;
- after training objectives has been set; and
- after the decision to move toward new training technology has been taken.

Then, the question is raised: *"How can we make the implementation a success and reach our goal ?"*

First, we need people; without the adequate human resource, no project can take place. Therefore, the group of factors **Human Resources** should be considerate first.

Once we have our human resources, we have the manpower to generate activities including the evaluation tasks. Therefore **Courseware** factors should be considerate as the second group. This group of factors will give answer to the assessment of training and their training objectives.

The third point will be: *"On what type of hardware should we run the courseware ?" This brings us to the third group of factors "Hardware / Equipment".*

The final question is: *"Where should the training take place ?"* As we have the people, the courseware and the hardware, we are in a position to establish the type of premises that is required to do the training. We now need the group of factors **Physical Facility**.

Now that we placed our 4 different groups of factors, let look at our **Administrative Functions**.

All business practitioners and academicians are involved with administrative process required administration functions such as planning, organization, and control (Sikula, 1982).

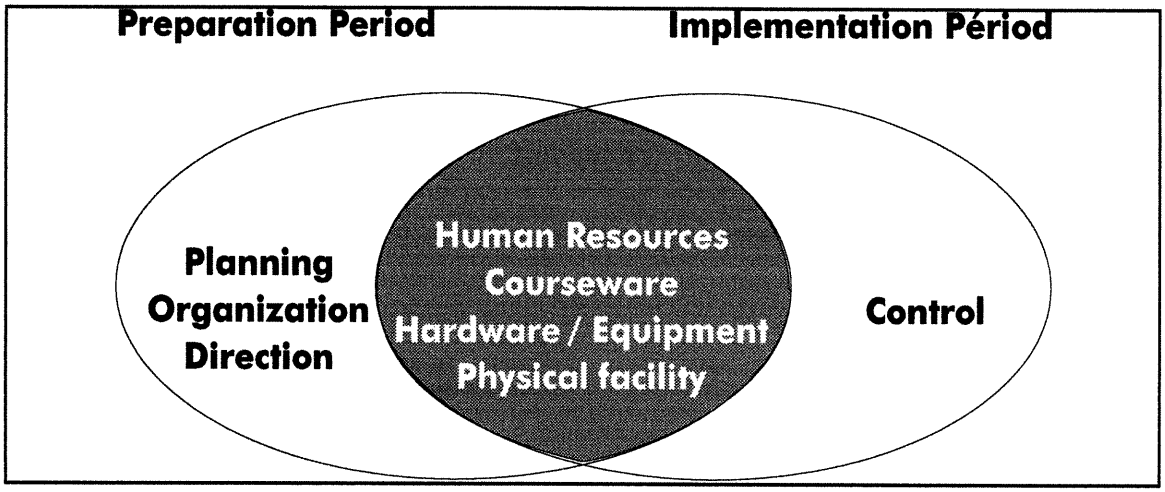
Therefore, any type of project requires that all administrative functions take place to ensure that goals will be reached. It is a mean to ensure that the proper objectives are set and that the activities required will lead to the reach of those objectives. Some people are selected to accomplish activities and where the **Control** will measure the activities to ensure that they are in the right direction.

Therefore, our implementation phase which includes activities in the preparation period and in the implementation period, is no exception and should be lead by those administrative functions. The proposed model was inspired from studies of applications of Sikula (1982).

They should be integrated in such a way that they will give full freedom to investigate the 4 groups of factors.

Our revised model will then be as follows:

FIGURE 3.2: IMPLEMENTATION PHASE MODEL



This brings us to the construction of our grid following this model.

3.4 Guideline

TABLE 3.11: BLANK GUIDELINE

		PREPARATTION PERIOD							IMPLEMENTATION PERIOD		
	GROUP OF FACTORS:	Physical Facilities :									
	Factors	PLANNING :	ORGANIZATION:			DIRECTION:			CONTROL:		
		Define/Set Objectives	Set Required Activities	Required Steps	Time Schedule	Decision Maker	Activities	Coordinator	Activities	Date of Activities Ended	Follow-up	Action to Be Taken
1.												
2.												
3.												
4.												
5.												
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3.5 Using the Guideline and Grids

In this section, we will give two examples on how the grids and the guideline work.

The first one will present a simple application for the **Physical Factor #3** applied for the **Humidity Control** hereby described at the end of this section on tables 3.12 and 3.14. We will extend the application to the use of the grids and guideline to the **Human Resources Factor #3** which is **Participation from Teachers or Trainers**. You will see the details of the grids followed by the guideline on tables 3.13 and 1.14.

Our first step is to select a grid. Five grids are available to us: Human Resources for Teachers, Human Resources for Students, Courseware, Hardware, and Physical Facilities Factors.

In our first example, we will demonstrate the selection of the Humidity Factor which is in the group of physical Facilities Factors.

Each time a factor is used, it is important to identify that a factor has been selected with a mark check in the colomn of "check" for the check list. This will indicate which factors were used from those which were not.

We enter in the guideline by first identifying the group of factors we wish to work on, as an example: **Physical Factors**. Then we need to identify a factor from the grid, as an example: **Humidity Control Factor** which is factor #3 from the grid.

The first task would be to consult the definition to assure that the understanding about humidity control is accordance with the factor's description.

Then, we have to refer to the guideline to complete the following.

3.5.1 Preparation Period

We are now entering in the preparation period which start with the first administrative function: **The Planning**.

3.5.1.1 Planning

Define/Set Objectives

We have to define the objective in term of the maximum and minimum acceptable level of humidity in the premisses.

The set up of these objectives will take into consideration analysis of:

1) the variation of temperature of the country you are in,
2) the construction of the building, and
3) the requirement of equipment to be installed.

As an example: The most sensitive electronic equipment to be used will function under those specifications:

- the maximum of level of humidity could be 80%
- the minimum of level of humidity could be 34%

Once these objectives are setted, the second administrative function: **The Organization** has to be completed.

3.5.1.2 Organization

Set Required Activities

Now, it is time to fix the required activities to meet the objectives setted. To continue with our example, the **Humidity Control**, we could find the following activities:

Activity 1: Seek information on the required device;
Activity 2: Request the installation of a humidifyer and/or a deshumidifyer;
Activity 3: Determine the frequency of monitoring;
Activity 4: Identify a person to call in case of the malfunction of the system.

When the identification of the required activities is completed, it is necessary to identify the steps needed for each activities.

Required Steps

1) According to Activity 1, **Seek information on the required device**: Contact a specialist following the organization procedures and policies. The purchasing department of the organization might be the step to undertake.

2) According to Activity 2, **Request the installation of a humidifyer and/or a deshumidifyer**: Define the required equipment and its cost following the organizations' policies and rules. Again, contacting the purchasing department of the organization might be the required step. Attention must be paid for servicing of the device.

3) According to Activity 3, **Determine the frequency of monitoring**: Establish how often the humidity must be monitor: morning, noon, evening... If it is an automatic monitoring device, how to check if it is working. Establish a schedule.

4) According to Activity 4, **Identify a person to call in case of the malfunction of the system**: In case of a malfunction of the monitoring device or the system: Whom to call and who will call the service person. Define clearly the information and above all make sure that this information is available to all people, in a place where it can be easily found.

Once the required steps have been clearly identified, we can establish the time schedule for each activity.

Time Schedule

1) According to Activity 1, **Seek information on the required device**: Give a time frame to get all required answers from the expert. Estimate the time it will take to get information on the type of equipments required and their costs, how the equipment works and identify if there is a need for training to monitor humidity or to use the equipment.

2) According to Activity 2, **Request the installation of a humidifyer and/or a deshumidifyer**: With your purchasing department, determine how many quotations are required, whom will be the bidders, when construction will start and end, who will inspect the work and test the system.

3) According to Activity 3, **Determine the frequency of monitoring**: Determine how and when should the humidity be monitor. Establish a schedule to meet your targeted objectives.

4) According to Activity 4, **Identify a person to call in case of the malfunction of the system**: In case of an irregular situation or a malfunction of the system whom to call. Establish the lenght of time that the learning center can be open without the system functionning. Establish the required service time after the service call is placed.

3.5.1.3 Direction

After the **Organization function** is completed, another administrative function call **Direction** will take place for the same factor.

This administrative function **Direction** is divided into two groups; one relates to the decision maker and its activities and, the second one to the coordinator and its activities.

This **Direction function** is to determine who is the decision maker for each activity and who will be the coordinator with its activities. Following our same example we can find:

According to Activity 1, **Seek information on the required device** and,
According to Activity 2, **Request the installation of a humidifyer and/or a deshumidifyer**:

Decision Maker: The decision maker for these activities could be the director of the learning center.

Activities: The director of the learning center must participate to the required analysis and decide on best equipments to be selected for the learning center. This activity will put the director of the learning center in a better position to manage the learning center and respond to problems in regards to this matter.

Coordinator: The coordinator is the person who brings all information to the decision maker and look after the execution of the required activities. The coordinator, as an example, can be in some cases the purchasing agent, the director of a department or a person specially named for the project.

Activities: The person in the purchasing department will establish his activities following the priorities of the director of the learning center. As an example, he will list all possible suppliers, establish conditions of installation and the time frame.

According to Activity 3, **Determine the frequency of monitoring**, and
According to Activity 4, **Identify a person to call in case of the malfunction of the system**:

Decision Maker: For those activities, the assistant to the director of the learning center or a person responsible of the learning center during the day could monitor the humidity level and take the decision to call a service person in case of a breakdown.

Activities: The person responsible would need to take the decision whether the data collected are in compliance with the established standard or if a service person has to be called. In case of a breakdown, the person in charge would need to evaluate the situation as per a guide and decide to call a service person.

Coordinator: It could be the person responsible for the set up of the learning center on a day to day work schedule or the person responsible for the general maintenance.

Activities: The coordinator would collect accurately all data, record them and present them in a grid easy to analyse for the decision maker. In case of a breakdown, the person will bring all data and if possible the circumstances of the breakdown: the time, what was the conditions (ex: a very hot day), and other components that might have played a role.

Once all these administrative functions have been completed in the **preparation period**, it is time to complete the implementation period.

3.5.2 Implementation Period

The implementation period has only one administrative function which is **The Control.**

3.5.2.1 Control

The control is to verify if all activities have been completed in compliance with different requirements for each factor. In our example, we used only the factor **Humidity Control** factor number 3 of the grid.

Following each activity, which in our example there are four (4), it is necessary to write down the date that each of them ended.

According to Activity 1, **Seek information on the required device** and,
According to Activity 2, **Request the installation of a humidifyer and/or a deshumidifyer**:

Date of Activities Ended: These activities would need to be completed on time as it is a prerequisite for the installation of the hardware systems.

Follow-up: After the activities are completed successfully, it is important to indicate if those activities required a follow-up. As per our example, it might be necessary to clean up filters and service equipments after 3, 6 or 12 months.

It is important to indicate the time or the date.

Action to Be Taken: The action to be taken could be, to call a service person or get a service contract with a schedule of service and to verify if the work has been done.

According to Activity 3, **Determine the frequency of monitoring**, and
According to Activity 4, **Identify a person to call in case of the malfunction of the system**:

Date of Activities Ended: As already mentioned, these activities are more at the operational level of the learning center. Reports of data can be made available to analyze the performance of the system and to verify the humidity level, according to objectives. These reports will follow the completion of the indicated activities including the required schedule.

Follow-up: The follow-up could be the next time frame to monitor the humidity as per the established schedule. The follow-up could be referring to some one in charge following irregularity.

Action to Be Taken: The action to be taken could be only in the case of irregularity of data which could lead to call a service person by the person responsible of the learning center.

We have to remember that not all the activities will take place at the same time. As an example:

Seek information on the required device has to be fulfill before the installation. Therefore at the administrative function **Control** the completion of this activity is essential before undertake the bidding for costing and installation. So, follow-up and action to be taken of the seek of information will lead to the appropriate step to follow.

From this guideline, a specific model can be generated according to your organization or corporation's need. As well, a factored analysis can be run to establish the relative importance of factors with evaluation criteria for each objectives.

See example of guideline on tables 3.12 and 3.14.

TABLE 3.12: EXAMPLE OF PHYSICAL FACILITY GRID

FACTORS	Old #	New #	Check
Preparation Period			
Layout of required space (Adequate floor space)	1	1	
Temperature	2	2	
Humidity control	3	3	√
Ventilation and Heat dispersion	4	4	
Ambient light and noise	5	5	
Electrical power	6	6	
Curtains	7	7	
Communication devices	8	8	
Physical security	9	9	
Service Access	10	10	
Implementation Period			
Facilities ready on time	11	11	

TABLE 3.13: EXAMPLE OF HUMAN FACTORS FOR TEACHERS GRID

FACTORS	Old #	New #	Check
Preparation Period			
Support from administration	1	1	
Participation from administration	2	2	
Participation from teachers	3	3	√
Adaptive planning process	9	4	
Sufficient time allowed to learn the technology	4	5	
Knowledge of the content to be taught on IVI	5	6	
Teachers oriented People skills	6	7	
Teachers to motivate students	7	8	
Human support / Problem solving	8	9	
Training package on site for teachers	10	10	
Training package on site for administrators	11	11	
On site service support personnel	12	12	
Coordination (human support for orientation training)	13	13	
Synchronization	14	14	
Cooperation	15	15	
Enrollment of students	16	16	
Opportunity to be involved in new IVI development	17	17	
Incentive to use system	18	18	
New role of trainers and teachers		19	
Implementation Period			
Personnel trained in their use to the satisfaction of the site managers	I-1	20	
Well skilled service person on site	I-2	21	

TABLE 3.14: EXAMPLE OF COMPLETED GUIDELINE

		PREPARATION PERIOD							IMPLEMENTATION PERIOD		
	GROUP OF FACTORS:	Physical Facilities :									
	Factors	PLANNING :	ORGANIZATION:			DIRECTION:			CONTROL:		
		Define/Set Objectives	Set Required Activities	Required Steps	Time Schedule	Decision Maker	Activities	Coordinator	Activities	Date of Activities Ended	Follow-up	Action to Be Taken
1.												
2.	Humidity Control	Minimum 34 - Maximum 80	1. Seek information on the required device	Contact the purchase department	2 days	Director of the learning center	Participate to the required analysis and decide on	Resource Person or Assistant to the Director	List all possible suppliers, establish conditions of	June 01 1996 (Installation)	Clean up filters and service equipments after 3 months	Call a service person or get a service contract with a schedule
3.			2. Request the installation of a humidifyer and/or a deshumidifyer	Contact the purchase department	1 week	Same as activity 1	best equipment to be selected for the learning center	of the Learning Center or	installation and the time frame	June 03 1996		of service Verify if the work has been done
4.											Next time frame to monitor the	
5.			3. Determine the frequence of monitoring	Establish a schedule	Each hour	Assistant to the director	Take the decision whether the data collected are in	Purchasing Agent	Collect accurately all data, record them and	Following the monitoring schedule	humidity as per the established	Only in the case of irregularity of data Call a service person
6.			4. Identify a person to call in case of the malfunction of the system	MrXYZ (514) 333-3333		of the learning center	compliance with the established standard or if a service person has to be called		present them in a grid easy to analyse for the decision maker		schedule	with a clear ID of the person and Phone Number
7.					3 hours	Same as activity 3						
8.												
9.												

		PREPARATION PERIOD							IMPLEMENTATION PERIOD		
	GROUP OF FACTORS:	Human Resources									
	Factors	PLANNING :	ORGANIZATION:			DIRECTION:			CONTROL:		
		Define/Set Objectives	Set Required Activities	Required Steps	Time Schedule	Decision Maker	Activities	Coordinator	Activities	Date of Activities Ended	Follow-up	Action to Be Taken
1.												
2.	Participation from	Recrute 10 Teachers	Awareness Meeting	Preparation and Organization of	Establish the Time Required to	Director of Learning Center	1. Investigate Names of Teachers to be Part of the	Assistant of the Learning Center	1. Organize the Seminar	Invitation Cards On Time	Register Teachers to the Training Program	Organize and Deliver the
3.	Teachers		to Get Teacher's	Awareness Program Get Hardware and	Complete Each Required Steps and a		Awareness Program 2. Set the Organization of	Director	2. Prepare Package and Schedule	Meeting Delivery On Time With		Training Course to Train
4.			Attention	Courseware Ready Have an Hands On	Target Date When It Should Be		the Program Pros and Cons - How the Subject		3. Set criteria to Accept Teachers	Equipments and Courses		Teachers
5.				Seminar Prepared Get Names of People	Completed		Matter Has to be Covered 3. Set the Level		4. Evalution Form According to the Learning			
6.				for the Meeting Prepare an Invitation			implication for Teachers in the Seminar 4. Set		Center's needs	Involvment of Teachers According		
7.				Card to the Meeting			Expectation from Teachers 5. See that Teachers Get		5. Define the Training Program needed	to Package Offered		
8.							Necessary Time for the Seminars					
9.												

Summary

We gave an example of two factors:

- **Humidity Control**, factor number 3 in the grid within the group of factors **Physical Facility**
- **Participation from Teachers or Trainers**, factor number 3 in the grid within the group of factors **Human Resources - For Teachers**.

It is clear that not all factors needed to be analyzed in such a detail. It could be because they simply do not need to be analyzed in such a detail or simply because it does not apply.

We tried to demonstrate how the guideline and grids are functionning. It is to each individual to use the guideline as it may see fit within their organization and circumstance of implementation phase.

The guideline along with the grids has been created to assure that all factors are used in a consistent approach leading to a successful implementation.

If one factor does not apply at least the person responsible for the implementation phase will take note on why it does not apply. The check list incorporated will help in this matter.

The administrative functions give a structured approach for each factor which as assure a consistent analysis.

Planning the implementation phase must include an operational level of activities of the learning center.

The example used was simple but it meant to highlight the implication of the implementation phase.

Limitation

This guideline is a first major step in offering a systematic approach toward the implementation of IVI. For once, all factors for an implementation have been regrouped under one operational guideline.

Nevertheless, we realize that this guideline has not been tested in a real world on a real IVI implementation which would need to be done.

We are also realistic that other factors could be found and which would needed to be included. At this time, it is not possible to give an optimal ranking to each factor or to propose an optimal value for each factor. This would take place only after testing the guideline in an implementation project.

People and organizations will use the factors as they may see them fit. Some factors might be appropriate, others not, but at least, people can use a check list that will lead them to implement successfully an IVI project. The reason to use a factor or not belong to the organization's needs as well as the value or the rating for each factor.

Using the guideline in different country would bring a different way on how factors will be used. It would need substantial testing in implementing IVI to justify a specific order on how factors should be used, specially in an educational environment or for corporate environment which are different.

CONCLUSION

We noticed that no general pattern existed in the way factors were used for the implementation phase.

Neither from the review of literature nor from the MEQ study analysis, we were able to find a comprehensive structure toward the implementation phase.

Chapman (1995) presents his model of instructional design covering 5 phases which are: Analyze, Design, Develop, Implement and Evaluate. Again, the implementation phase was mentioned but not developed at all and, of course, no grids of factors or guideline.

This study aimed to bring a structured and systematic approach toward the implementation phase.

The guideline is issued from the general use of factors in the prescriptive approach as well as the pragmatic approach including the analysis of the MEQ study.

The model presented which has been developed as a guideline and rendered operational through grids intends to guarantee a successful implementation by covering two periods which are: the **preparation period** and the **implementation period**.

Those two periods are associated with administrative functions such as planning, organization, direction and control. These periods intend to separate completely how and when should activities be planned from the time they are taking place.

The model of implementation through its guideline and grids intends to guarantee that if all factors are used properly they will lead to a successful implementation. It is a first step to improve implementation of IVI training. It brings a structured and systematic approach to assist people in this area.

This guideline is issued as well from reflection of five (5) implementations performed in the past five (5) years. Two (2) implementation at Shell Canada, one (1) in Norsk-Hydro, one (1) at Iron Ore Company, and one (1) at Saint-Sacrement Hospital. Implementation process has been improved from the first to the last one but it was a list of things to do more like an educated guess with tries and errors process.

This guideline become a corner stone as it enables people not only to work rationally toward the implementation but as well to understand the different factors and use them in a systematic approach where they see them are acheiving.

Development

The completion of this model and grids will soon be added with financial factors. The financial factors will includes different costing factors as well as principal of financial analysis such as ROI (Return On Investment), PB (Payback period), and BEP (Break Even Point) for groups of students, per student and for a learning center.

More over, an interactive multimedia version on CD-ROM is on production at this time with a software call Visual FoxPro. The interactive multimedia version, supported with audio and images to help to understand the factors better, will offer an auto control of the factors used and abandoned by the users. A compilation of data with printout of the complete guideline will be possible for the benefit of the users. As well, follow-up date with action to be taken will be recordered as an agenda. The software, interactive multimedia application, will be released within 6 months.

The challenge is to offer the possibility to use a complete grids of factors with the administrative functions without giving up the freedom and the flexibility of this model of implementation.

The implementation guideline is a major step toward a successful implementation of interactive videodisc instruction.

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APPENDIX 1

GROUPS OF FACTORS

Groups of Factors

PHYSICAL FACILITY	X	HARDWARE / EQUIPMENT	X	COURSEWARE FACTORS	X	HUMAN RESOURCE	
	X		X		X	TEACHER	STUDENT
PREPARATION PERIOD	X	PREPARATION PERIOD	X	PREPARATION PERIOD	X	PREPARATION PERIOD	PREPARATION PERIOD
	X		X		X		
1. Layout of required space	X	1. Preparation of facilities to accept equipment	X	1. Related to training needs and objectives	X	1. Support from administration	1. Participation
2. Temperature	X	2. Selection of standard of interactive video	X	2. Relevance between objectives and	X	2. Participation from administration	2. Time to learn the technology
3. Humidity control	X	systems	X	curriculum content	X	3. Participation from teachers	3. To be able to personalize the course
4. Ventilation and heat dispersion	X	3. Acquire equipment and material for the	X	3. Needs and characteristics of learners must	X	4. Sufficient time allowed to learn technology	
5. Ambient light and noise	X	of students	X	be taken into consideration	X	5. Knowledge of content to be taught on IVI	
6. Electrical power	X	4. Set procedures for installing, initiating and	X	4. Courseware matching the adequate level for	X	6. Teachers oriented "People skills"	
7. Curtains	X	maintaining the host site systems	X	students	X	7. Teachers to motivate students	
8. Communications devices	X	5. Insure hardware availability at the right time	X	5. Major interest for teachers and students	X	8. Human support / problem solving	
9. Physical security	X	6. Prepare for troubleshooting	X	6. All necessary documentation needed to	X	9. Adaptive planning process	
10. Service access	X		X	integrate the application into other related	X	10. Training package on site for teachers	
	X		X	or complementary systems	X	11. Training package on site for administrators	
	X		X	7. Adequate quantity of material	X	12. On site service support personnel	
	X		X	8. Ability to arouse and maintain interest	X	13. Coordination (human support for	
	X		X	9. Easy to use	X	orientation training)	
	X		X	10. Active learner participation	X	14. Synchronization	
	X		X	11. Delivery style	X	15. Cooperation	
	X		X	12. Flexibility	X	16. Enrollment of students	
	X		X	13. Program good to excellent	X	17. Opportunity to be involved in new IVI	
	X		X	14. Effectiveness of the program	X	development	
	X		X	15. Additional courses and materials	X	18. Incentive to use system	
	X		X	16. Protection of the confidential records that	X		
	X		X	may be stored in the system	X		
	X		X		X		
IMPLEMENTATION PERIOD	X	IMPLEMENTATION PERIOD	X	IMPLEMENTATION PERIOD	X	IMPLEMENTATION PERIOD	IMPLEMENTATION PERIOD
	X		X		X		
11. Facilities ready on time	X	7. Fully installed and tested hardware in place	X	17. Delivery of courseware	X	I-1. Personnel trained in their use to the	I-1. Personnel trained in their use to the
	X	8. Full set of administrative and maintenance	X	18. Work properly and trouble free	X	satisfaction of the site managers	satisfaction of the site managers
	X	documentation at each site	X	19. Documentation of courseware	X	I-2. Well skilled service person on site	I-2. Well skilled service person on site
	X		X	20. How courseware work			
	X		X	21. Operation system (on-line/off-line) for			
	X		X	recording and evaluating			
	X		X				

APPENDIX 2

DEFINITIONS OF FACTORS

A2.1 Physical facility factors

TABLE A.1: FINAL PHYSICAL FACILITY GRID

FACTORS	Old #	New #
Preparation Period		
Layout of required space	1	1
Temperature	2	2
Humidity control	3	3
Ventilation and Heat dispersion	4	4
Ambient light and noise	5	5
Electrical power	6	6
Curtains	7	7
Communication devices	8	8
Physical security	9	9
Service Access	10	10
Implementation Period		
Facilities ready on time	11	11

Preparation Period

A2.1.1 Layout of required space

Means the viable space for a student. With different experiences, we figure that a space of four by six feet (4'X6') for each student which means 24 square feet is the minimum per student. In metric, we approximate the figure to 1,5 by 2,0 meter for a total of 3,0 square meters.

This minimum of viable space allows a student to use a workstation and be able to put his workbook beside on the table and takes notes. For health safety, we must ensure there is at least 1.5 meter distance between the back of the monitor and the neck of the student. We suggest that you refer to your federal, state or provincial health agency to get their regulation (OSHA in USA, CSST in Quebec, etc.)

There is no ideal layout for interactive videodisc workstation. We can use facilities from an existing learning center. We have to consider a space easily accessible to put where the library of videodiscs is stored, a place to make some photocopies, and printers. The layout is not very different from a CBT learning center.

We have to take into consideration that additional equipment is required such as a videodisc player, CD-ROM and therefore, we have to plan more space.

A2.1.2 Temperature

The temperature means the temperature in the learning center to be comfortable. The ideal temperature would range between 68 F to 72 F (18 C to 21 C).

A2.1.3 Humidity Control

Humidity control is very important depending on the country you are in and where the learning center is situated. Dehumidifier might be necessary for certain time of the day or the year. A high density of humidity might damage some of the equipment like monitors and where it could be costly to repair or replace. We strongly suggest that not only to use the thermometer should be planned but as well as a humidity device to control the humidity.

You have to ensure that the humidity and the temperature will comply with the required of equipment suppliers, information you can usually find in the user guide.

A2.1.4 Ventilation and Heat Dispersion

Ventilation and heat dispersion is mostly related to the equipment where the heat is being generated. A ventilation and heat dispersion is then mandatory to all equipment and adequate ventilation should be planned according to the number of workstations installed in the learning center. Depending on the country you are living in, the type of building, the construction, the ventilation specifications or codes can be available from contractors, architects or engineering firms. You have to ensure that special device will be installed to prevent excessive dust in equipment, heat for equipment and people.

A2.1.5 Ambient light and noise

Ambient light means to have enough light to be able to read and write but not excessive to glare the monitor or to make it difficult to see what is shown on the screen. The same guide as the one used to implement a CBT learning center can be used in this aspect.

Noise is considered an important factor in order to make an adequate environment for students to learn. It should be as quiet as possible, avoiding all ways, next to a canteen, restaurant, classroom or facing a heavily travel street by trucks where extensive noise can be expected.

A2.1.6 Electrical Power

Electrical power means the sufficient energy to power all equipment in the learning center.

We have to ensure that there is adequate electrical outlet for all workstations including the printers and other devices. Special electrical device should be installed to avoid any interference with other electrical device or variation in the electrical tension such as UPS. One power bar per workstation should be used.

The electrical requirement can be established once you have the total number of workstations to be installed. By referring to the user manual of each equipment, you can easily get the technical specifications to enable the electrical power required for a workstation.

A2.1.7 Curtains

Curtains, vertical blinds, or other similar devices should be used to prevent too much sunshine. If the learning center is too bright, it will make difficult to reach what's appearing on the monitor.

This can be also thru in the evening when outside spotlight directed to a parking lot, as an example, glare in a window of the learning center.

A2.1.8 Communication Devices

We understand by communication devices: a telephone, a hot key on the computer with a modem, or any other means of communication to communicate outside the learning center. This purpose of communication devices can be used in case of emergencies, fire, security or get access to a trainer or human resources.

We can distinguish two types of communication:

- For emergency, fire, security, electrical apparatus
- For communicating with a trainer or teacher for assistance to the course.

The first one should be mandatory, the second one relates to the type of training and the courseware involved and the learning strategy.

A2.1.9 Physical Security

We understand by physical security all devices, equipments that could also be included in building code. It aims to prevent any bodely injuries, damage to properties to all persons having access to the learning center. Included is all equipments and accessories needed for disable persons. Part of, it is the selection of the furniture, tables, desks, chairs, including the organization of electrical wires.

Physical security includes the prevention against theft and mistcheif. Locking devices, alarm systems, smoke detectors, and extinguishers appropriate to computer equipment must be installed.

A2.1.10 Service Access

It means to have access to restrooms in the vicinity of the learning center, to have a small coffee shop, transportation facilities for commuting, a pedagogical office where people can get additional support either to use the equipment, to get the equipment service or any other kind of pedagogical support.

Implementation Period

A2.1.11 Facilities Ready on Time

It means that the construction, the electrical wiring of the learning center are ready on time, on schedule when the equipment is ready to be deliver. We have to rule out any on site construction while equipment has been installed. Necessary measure must then be taken to secure equipment for dust, debri, theft, etc.

A2.1.12 Administrative Functions: Planning, Organization, Direction

Implementation should cover administrative functions such as Planning, Organization, Direction, and Control. Those administrative functions are covered in details in the implementation guideline. Each factor has its planning, organization, and direction in the preparation period. The control is in the implementation period.

As an example, in the case of humidity control:

- The planning: fixing the objective, keeping the humidity level at 35% as an example.
- The organization:
  - Set the required activities: Inventory of different systems and data;
    Find an engineer in ventilation;
    Contact different contractors.
  - Steps: Get information from equipment suppliers - like hardware
    Establish set of requirements
    Contact engineer in ventilation
    Etc.
  - Time schedule: When should each activities and steps be completed.

- The direction: Who is the decision maker in this area;
  Who will monitor the humidity level
  - Activities: Analysis
  - Coordinator: Who will bring data, information to decision maker.
- The control: Date of completion of the installation of the humidity device.
  - Follow-up: What is the next action. How frequent, when should the device be service.
  - Action to be taken: In case of malfunction, problem, whom to call, when, delay of service, etc.

A2.2 Hardware / Equipment Factors

TABLE A.2: FINAL HARDWARE / EQUIPMENT GRID

FACTORS	Old #	New #
Preparation Period		
Preparation of facilities to accept equipment	1	1
Selection of standard of interactive video systems	2	2
Acquire equipment and material for the number of students	3	3
Set procedures for installing, initiating and maintaining the host site systems	4	4
Insure hardware availability at the right time	5	5
Prepare for troubleshooting	6	6
Time for Testing		7
Implementation Period		
Fully installed and tested hardware in place	7	8
Full set of administrative and maintenance documentation at each site	8	9

Hardware or equipment refers to the necessary equipment to run the application. We understand by application, the courseware which could be a custom application meaning dedicated to only one purpose of training, with one dedicated subject, or generic courseware which could be a very specialized course but that can be used in many industries and in many companies.

In both cases, the application, also called the courseware, needs a hardware system to run onto. The different types of hardware or equipment offered on the market are generally

reliable, and of a good quality, on which we can rely on. Factors related to the selection of hardware become important upon the objectives you are trying to reach.

Preparation Period

A2.2.1 Preparation of Place (tables) to Accept Equipment

We put this factor in the hardware as opposed to facilities because the tables to accept the equipment is directly related to the equipment itself and might change from time to time depending on configuration of the equipment. In general, a four foot table can accept one hardware system or what we call a workstation. Some people prefer to have a larger table like an eight foot table to put two workstation on the same table. Computer tables are not suitable for this type of application because of the peripherals to the computer which require a larger space and a different way to set the table.

A2.2.2 Selection of the Standard of Interactive Video System

The selection of the hardware system or equipment standard mainly relies on the objectives of your project. If your organization is mainly looking to use existing material already available on the market, among more or less 2,000 existing courses, special attention must be paid to the hardware standard on which those courses are running.

A very dedicated hardware system can be very reliable, and of a very good quality, but might refrain you of using all existing courses on the market. If your project involves a single custom application, all IVI systems are generally reliable and sold by reliable hardware companies. It is very important that you first establish your objectives and then contact different vendors to make sure that they will first meet your requirements. You will find that some hardware systems offer bells and whistle that you do not really need.

When we mention workstation standard, it means a video overlay computer board which process the information differently to the monitor. It is a combination from an analog source, the video on the videodisc, on which the computer information is over the video.

The interactive videodisc standards can be found among the following:
IBM: InfoWindow, M-Motion
Matrox: EIDS
Sony: View2000, View3000
VideoLogic: IVA-2000, IVA-3000, DVA-4000
Visage: V-Link1550, V-Link1602

At this point in time, people are now paying attention to CD-ROM, digitized video, CD-I, and M-PEG on CD-ROM. Also, new laserdiscs are appearing on the market called SD-ROM which will offer 10 gigabytes of data or 130 minutes of real time digitized video, with a rate of transfer of 5 Mb/sec.(also called SDDVD).

Looking at this new technology, it becomes more and more complex to select a standard. Nevertheless, if you are an organization that is looking at using mainly the existing courseware, your decision should consider a system using existing videodisc technology, the CD-ROM, and the M-PEG technology. The system should be versatile enough to use those technologies simultaneously or separately but under the same system without changing the wires or anything else.

New equipment is appearing on the market as well, like a laserdisc that will accept all formats of videodisc: laservision (for older technology), SD-ROM, and CD-ROM.

You must be aware that in using some of the newest technology at this time on CD-ROM, you might have to sacrifice the quality in the pedagogical and interactive courseware design (Major and Herrati, 1995).

You should invite all different vendors to make presentations of their material. Do not let anyone influence you by gadget, bells and whistles of their hardware system especially if they do not fit your needs and objectives.

Videodisc courseware (laservision) are going to be available for the next decade as expressed by Hank Evers, 1995. New courseware are still produced with the laservision technology.

A2.2.3 Enough Equipment and Material for the Number of Students

Enough equipment means the number of workstations for a classroom corresponding to the number of the students to be train.

As well all material referring to the equipment explaining configuration should be in adequate numbers for the number of workstations.

We have to understand that this type of training require the student to use a workstation on basis of two hours per learning session. As an example, the classroom with twenty workstations will train more than twenty students in a day. On an eight hours shift, you can expect to train approximately eighty students per workstation, depending on the type of courses. A course can have 1 to 20 modules and each module is expected to last 2 hours.

A2.2.4 Set of Code and Procedures for Installing, Initiating and Maintaining the Host Site Systems

A complete set of information is required on how the system works, explaining the components of each workstation. Information on how to use and maintain the system in good working condition should as well be provided.

Also, a set of limited information should be available to students telling them how to get their score. As well, more explicite and extensive information should be provided to trainer to get information on students and how to manage students.

A2.2.5 Hardware Available at the Right Time

This means to coordinate the delivery of the workstation at the proper time and to avoid accepting partial delivery. Partial delivery lead to have a partial look at the setup, and even the lost or the disappearance of some equipment. Everything has to come together, in one time and has to be installed in one time.

It is important not to rush in a project and try to skip steps, especially when hardware installation is planned.

Before accepting hardware, premises has to be prepared.

A2.2.6 Troubleshooting

Hardware should be installed as planned with the operational systems including, in some cases, the networking.

Extensive troubleshooting period should be planned especially for a network system.

The installation of the courseware should have the same importance. This will give the adequate time to test thoroughly according to all specifications. Testing is the only way to ensure that the hardware and courseware will not fail.

A2.2.7 Time for Testing

We emphasis a lot on the troubleshooting of the hardware which includes the loading and testing of the courseware on the workstation. This factor mention the necessary time to test thoroughly the system and each workstation.

Testing the operational system is one thing but taking the time to test thoroughly each workstation with the courseware is different. Experience had proved that unless we spend the required time in testing the workstation, we can expect few surprises which can jeopardize not only your training session but as well the credibility of your new training facility.

From different experience, it is important to allow at least two weeks of testing and to run equipment for extensive period including the use of the network. Retrieval of information has to be tested. The best way is to get the contribution of people not familiar with the system and see if the information and the systems are running properly. A crash means not only to start up the system again with the courses but also lost of the existing data on the student.

Implementation Period

As we know, the implementation period is the factual period that the systems or workstations have been implemented which means **ready to be used**.

A2.2.8 Fully Installed and Tested Hardware

A fully installed and tested hardware mean that we are certain that no crash will occur unless unpredictable situation and that we are fairly confident that the system will work independently of the number of students that would use the workstation.

A2.2.9 Full Set of Administrative and Maintenance Documentation at Each Site

Once the workstations have been installed, we have to make sure that a full set of administrative and maintenance documentations are available to all trainers.

Trainers should have access to the full set of administrative documentation and the technician, full access to the maintenance documentation for each workstation.

Administrative documentation means full information on how to manage the learning center in term of retrieval of information from student's data, also all information related on how to enroll or delete a student, add or delete trainers. Also the required documentation should include the maintenance of the software meaning the clean up of the hard disc and the backup procedures on tape or other media device such as CD-ROM, WORM drive, etc. Documentation on how system works is important: operational systems, networking as well as some configuration. Administrative documentation should include the opening hours of the center, who to contact in case of emergencies, service of equipment, etc. A list of students should be provided on who has access to facilities, whom should take what course and when.

A2.2.10 Administration Functions: Planning, Organization, Direction and Control

Those administrative functions is integrated in the grid.

A2.3 Courseware Factors

TABLE A.3: FINAL COURSEWARE GRID

FACTORS	Old #	New #
Preparation Period		
Suppliers		1
Related to training needs and objectives	1	2
Relevance between objectives and curriculum content	2	3
Needs and characteristics of learners must be taken into consideration	3	4
Courseware matching the adequate level for students	4	5
Major interest for teachers and students	5	6
All necessary documentation needed to integrate the application into other related or complementary systems	6	7
Adequate quantity of material	7	8
Ability to arouse and maintain interest	8	9
Easy to use	9	10
Active learner participation	10	11
Delivery style	11	12
Flexibility	12	13
Program good to excellent	13	14
Effectiveness of the program	14	15
Possibility to get additional courses and materials other than those for the project	15	16
Protection of the confidential records that may be stored in the system	16	17
Easy access to the courseware		18

To be able to print any screen from the program		19
To have a network system for the data		20
Selection of images, motion video, related to topics		21
To have an accompained workbook with videodiscs		22
To integrate IVI courses within the existing training program		23
Implementation Period		
Delivery of courseware	17	24
Work properly and trouble free	18	25
Documentation of courseware	19	26
How courseware work	20	27
Operation system (on-line/off-line) for recording and evaluating	21	28

A courseware which is also called application can be found in two versions: a custom courseware or a generic courseware.

A custom application is for a unique application on one topics for one corporation or one department within a company and generally for one group of students. It is a dedicated application which will not apply to other industries or companies.

A generic courseware is a course which could apply to one specific topics that could be very specialized but applicable to many companies in one industries or even to many industries. As an example: The Telephone Skills which apply to the receptionists, secretaries, up to the higher manager. The course is about different technics on how to handle difficult calls and how to answer the phone.

The quality of instruction we should expect in both courses, custom or generic courseware, is the same including for their implementation. The expectations in term of the quality instructional material, interactivity, and tracking system are the same for custom or generic courseware.

The strategy of delivery for a custom or generic courseware might request additional material which need to be evaluated for each individual case.

The courseware grid does not intend to present or suggest any method for a need analysis or a procedure to establish training objectives. The implementation grid takes place after those analysis. The objective of the implementation grid is to give a guideline to follow, to stick to your objectives while selecting courseware. It helps to ensure that the selection of the courses will be sound and effective according totraining objectives.

To fully analyze the quality of a courseware with its objectives and pedagogical approach, we suggest you to use Reeves' grids, 1988 and 1989.

We mentioned only few factors in this grid which that we think should be taken into consideration while implementing this technology without having to go through an extensive evaluation grid for a courseware.

Preparation Period

A2.3.1 Suppliers

No one suppliers should be left a side at the beginning. First, we have to consider all suppliers having courseware in the area where we need training which fit the training objectives.

Even if you are in the situation that your project involves a custom application but that your intention is to use generic courseware after, this will influence the selection of hardware system.

The first step is to make an inventory of suppliers offering courseware in ligne with your training objectives that correspond to the major videodisc standard available on the market.

The inventory of those courses should be classified in terms of prerequisite, the topics to be taught according to your training needs and objectives including additional topics that can follow existing training needs and existing objectives.

The second step would be to consider all other suppliers which have courseware on videodisc which could be adapted to the standardized plate-forme chosen or from any other VHS video cassette that could apply and be redesigned onto interactive videodisc format according to the needs.

A2.3.2 Related to Training Needs and Objectives

From the preliminary selection of suppliers, link the different topics offered on interactive videodisc courseware to the established training needs and established objectives. It is important to establish the percentage of the content that could match the training needs and objectives.

Usually, training needs as well as training objectives are established for a group of persons which does not often match the individual needs of each person to be trained.

Therefore it is important to pay great attention to those training needs in order to establish the prerequisite for the training program as well as for advanced courses. This broader view of interactive self pace training program will help to keep students interested in the training program. This way, students can get complementary training if they do not have all required prerequisite for the course and for those better prepare they can get advanced course in the topics.

A2.3.3 Relevance Between Objectives and Curriculum Content

The selected generic courseware from different topics must match the training objectives including the established curriculum content of the existing training program. There is no sense to create a complete new curriculum content to match existing generic courseware or just because we are choosing a new technology. Even if you think about re-writing your complete training program based on existing generic courseware, you risk to fall short of interactive videodisc content or courseware. Despite the fact that we can find 2000 courseware on the market, it does not mean that you can fill your complete curriculum.

A2.3.4 Needs and Characteristics of Learners Must Be Taken into Consideration

Needs and characteristics of learners are very important when selecting courseware.

Experience has proved that even if you have the right topics on the right interactive videodisc standard, but that does not match the needs and characteristics of learners, student would be inclined to quit the course. As an example, trade man prefer to have a course that give them instruction with the audio rather than to have to read the screen and also prefer to use a touch screen as an input device. If you are training people in the medical field like General Practitioners and Nurses, they would use either a mouse or a touch screen but they would prefer to read the screen instead of hearing a voice reading it for them. The latter will tend to kill the audio to be able to read quietly. These observations were obtained by Major (1994) from a report of different implementation in corporate and hospital environment.

Discussion with suppliers will ensure that the courseware selected can meet those needs and characteristics or can be modify. Also remember that it is not to your organization to pay for those changes. Those characteristics are generally needed by other companies in the market. Producers of courseware should, at the beginning, have considered those characteristics.

You have to remember that selected courseware has to match your organization's needs. Although your organization's needs might be specific from time to time, but as well they can generally be found among many other organizations or companies within the same industry or even among different industries.

As an example, the need for a tracking system to keep track of the performance of the students is required for many companies in different industries. If the selected course does not have that option, it is not to your company alone to carry the development of this option.

A2.3.5 Courseware Matching the Adequate Level for Students

The courseware should match the adequate level for students which means not too advanced nor to represent "déjà vu".

This is especially thru when a student is alone in front of its workstation where no other resource is available.

Although the courses might contain some review or background of the topics to be taught, it is necessary that the course be very relevant to the training needs and the established objectives. Some vendors might try to sell you a complete package where you have no use for certain modules. You should buy only those modules specific to your training needs.

First, meet your training needs. Only as a second step, you will consider courseware to fit prerequisite or advance topic.

The courseware's presentation must be significative to the student in relating to the topic, and to a situation or environment of the institution or company. Make sure that the selected courseware will meet student's needs avoiding to have different strategies of delivery groups (IVI and classroom delivery for the very same topic).

If some students need special prerequisite, try to find interactive videodisc courseware that can fill the gap.

We have to avoid using different methods of training for one topic among different groups. The group not using IVI will have a feeling to be left aside which will end up with a lack of motivation.

A2.3.6 Major Interest for Teachers and Students

In the selection of courseware, you have to keep in mind the interest of teachers and students. This means that the evaluation of the courseware must seek the participation of teachers in terms of presentation of the topic and the expertise. This step is crucial to get the teachers or trainers interest. Courseware subjects have to be related to teaching concern of teachers or trainers. Students need to be part of this process (see human resources factors).

A2.3.7 All Necessary Documentation Needed to Integrate the Application into, other Related or Complementary Systems

In the selection of the courseware, you have to provide all documentation on how the course operate, how the accompanied manual is integrated with the course and how the IVI course fit into the training program.

You have to ensure that the new training tool, interactive videodisc courseware, will be integrated as a complementary system and not as a final solution. In other word, both, trainers and students, need to understand the complete training program either from traditional classroom delivery, interactive videodisc courseware training, labs training or any other means. IVI courseware training does not exist as a whole but be integrated in the learning program.

Teachers and students need to have a clear picture of where the IVI training program starts, where it ends, and by what it is going to follow with. This means to integrate the courseware within the existing training program. Documentation of the complete training must be available first to the teachers or trainers to guide them and then to students in order to inform them of their training program.

A2.3.8 Adequate Quantity of Courseware Material

The adequate quantity of material means to have enough courseware per workstation and adequate quantity of supportive material per student (such as workstation). Following the training needs and objectives you might select a courseware that has six modules (videodiscs). In this case, it might not be necessary to have the same number of copies as the number of workstation. In fact, you might need only ten copies of the course, as only one student would work on one module at the time. Since a module required approximately 2 hours of training, you can schedule students accordingly for an 8-hour shift. Nevertheless, it is important that the accompanying workbooks will be in sufficient quantity for each student as well as for teachers or trainers.

A2.3.9 Ability to Arouse and Maintain Interest

It is important that we put aside the glamour of the new technology to focus on the content of the videodisc including the way that the strategies of presentation maintain interest to both, students and teachers. Report from Major, 1988, in evaluating two courseware for the same topic and addressed for same level of student conduct to contradictory conclusion. Although both courses meet the objectives to be taught including an evaluation of the students with questions and answers, one of the courses succeed in the ability to arouse and maintain interest of the students while the other fail to do so and students were quitting after 10 minutes.

Strategies of presentation, part of the instructional design, are crucial to keep the content lively and interesting. There are no automatic solutions, you have to evaluate thoroughly the courseware to make sure that criterions are met (see Reeves 1988-89). Dr. Reeves from University of Georgia elaborated different evaluation grids for courseware to ensure that the quality of the formative material and presentation are existent in order to classified courseware as good to acceptable.

A2.3.10 Easy to Use

Interactive training system has to be easy to use, meaning that when the workstation is turned on, a menu should appear which should be clear, easy to read and to understand. A situation that required the student to enter his access code easily and where the student needs only to make the selection of the courseware required.

The system and the courseware should include clear instructions, easy to understand with graphics on how the student would select the course, put the videodisc in the videodisc player, and how he would use the course. This type of friendly instruction is required no matter what type of learner you would get either from tradesman to medical fields.

A2.3.11 Active Learner Participation

Active learner participation means that the learner is going to be active in his self pace courseware. Active, means that the learner would participate in activities where questions are asked, simulation will appear and where the student will need to bring his own input. The degree of participation, also called interactivity should be frequent enough to keep the interest of the learner. This means that the learner needs frequent practice of the learned skills with adequate feedback. Retry an exercise, redo a simulation differently, where the student can see the impact of its own input.

A2.3.12 Delivery Style

Delivery style means glitz and glamour or bells and whistles which distract more the student from learning the content.

We have to remember that a learning program is not a commercial and that all special effects could perhaps attract the learner at the beginning but are proved to inefficient. From different studies it has been noticed that student remember the special effects but not very much the content. The delivery style should be sober but active bringing action, requiring input from the student. As an example, multiple choice questions over selecting video sequences or researching for a typical process in the video. Dr Reeves grids are very helpful in this matter.

A2.3.13 Flexibility

Flexibility means the ability for a student to navigate around getting in and out of different sections of the courseware.

In different situations, students need a structured instructional package in which they do not have the freedom to move around or navigate around without completing successfully a section. For novice students in a topic, many existing courseware offer a structured approach. As the student get more knowledge it becomes more flexible and possible for the student to navigate in the course. This is based on the principle that the student at the beginning needs more guidance. We now can find on the market certain type of courseware that enable a teacher or trainer to select the type of flexibility for different learners. Structured instructions should be selected, for a first session in a course. As the student goes along with certification or accomplishment, it open up to more freedom which make it possible to navigate in the course.

In a refresher training session, student will be free to move around and organize its training as he may see fit with the guidance of his teacher or trainer.

A2.3.14 Program Good to Excellent

This factor mean that the content representing the theory, the concept and the practice are evaluated by the expert-content and the trainers and be classified to be good to excellent. The course needs to have good learning material and presentation to ascertain that the student will learn from it. Evaluation grids and scales can be found from the work of Dr. Reeves, University of Georgia.

A2.3.15 Effectiveness of the Program

The effectiveness of the program is based on the way that the pedagogical and interactive design enable a person to learn easier and faster.

Therefore, the course must have a pre-test, simulation / exercise and, post-test or final test in order to measure the knowledge acquired by the student.

The pre-test will measure the knowledge of the topic before taking the course. The different task inside the course, like simulation, exercise, questions, will measure the rentention of the student and, the final test can be compared to the pre-test in order to assess the knowledge of the student.

This automatically involves being able to monitor and grade every steps of the student's performance in the pre-test, during the course, with the simulation / exercises, and for the post-test or the final test.

Also, the effectiveness of the program can be measured on how well a student can do the job after the training.

It is not easy to find answer to all those questions while selecting a courseware. You should get references on how a particular generic courseware was used in the past in different institutions or companies. Moreover, get the type of companies, type of workers or students who were trained, and and the type of environment the course was used.

Suppliers of the courseware should be able to provide you with the information. This should be a mandatory requirement before buying a courseware. This inquiry will give you useful information on how good was the training, what problems were encountered and how effective generally the course was.

A2.3.16 Possibility to Get Additional Courses and Materials other than those for the Project

In many projects, the selection of courseware addressed to a specific topic. The selection of hardware and the organization of the project are aimed at one specific course material for one topic.

It has been demonstrated that unless there are additional courseware material in other or supportive topics, trainers will loose their interest in using and promoting this type of training. Trainers and students demanded other courseware material in supportive topics. A project may start with one specific topic but it is important, at the beginning, to consider other topics to stimulate the implementation of and get other people interest.

You need to plan additional courseware material in other topics, even though it is not in your intention to implement them at the same time. Trainers and students need to know **What is next ?**

A2.3.17 Protection of the Confidential Records that may be Stored in the System

As already mentioned, the courseware must have a tracking system for every student not only for the time spend on task but as well on student's progress all along the different steps of the courseware.

Monitoring the progress of the student is crucial in order to be able to assess the strengths, the weaknesses and to be able to follow up with additional training.

Those records should be kept confidential but available to the designated personnel which could be the trainers and the head trainer.

The results of pre-test, exercise/simulation and post-test, should also be available to the student. The option to send a personal message to the student within the course must be available. Thus following its results, the student could be asked to contact the trainer or refer him to a reference book, additional exercise, etc.

The complete results of each student giving the strengths, the weaknesses, the time on task should be available to the designated trainer or the head trainer. Those results could then be put in the students' file, transfer over a mainframe where all student records are kept confidential. Each trainer should have access to the results of its own groups for which he is responsible.

Access code with a password is generally used to assure that the records are kept confidential. Some courseware allow students to change password as many time as they want. This additional security does not prevent the trainers to have access to the results. Access code can be an employee's number or a social security number but the additional password bring the security to a personnel level where no one else can have access to the course.

A2.3.18 Easy Access to the Courseware

It means to have an easy access to a workstation with courseware. The courseware should be stored and displayed by group of topics with an easy access. Instructions must be available to trainers and students to help them in the selection of topics.

The person responsible of the learning center should have all the documentation including the student's profile in order to assist him in its training session.

It should be a menu driven access with the list of the title of the course including a small description of the course supported with audio to assure that the student will select the right disc to insert it in the videodisc player. We should avoid all access to the "C prompt" or having the student typing some special commands to have access to the courseware.

These factors can be divided into two sections:

1) the physical access to the workstation and courseware; and
2) the administrative software of the courseware.

A2.3.19 To be Able to Print any Screen from the Program

It is important to be able to print a screen from the program or the courseware when specific information from the course is needed. This command helps to complete a workbook without having to write pages from information on the screen.

This feature should be required from the supplier of courseware to help student to link between the program and the text book.

A2.3.20 To have a Network System for the Data

A network is recommended when your learning center has more than three workstations. Having a network eliminates the obligation of the trainers to move around to each workstation to retrieve information for each student.

It eliminates the lost and the cost of diskettes.

Also, it can enable trainer to have access to anyone student's performance record from its own computer in his office. This is especially important if the workstations are in different areas of a school or a company's facilities. Regrouping and compilation of data and a full analysis become easier.

A2.3.21 Selection of Images, Motion Video, Related to Topics

While evaluating the courseware, the images appearing in the courseware must be related to the topic taught and also related to any voice over giving explanation.

It is surprising to see how often a courseware can show pictures with a voice over with no meaning full information on the topic taught. It then becomes a disturbing element rather than supportive to the student.

We have to make sure that the images appearing on the screen means something to the student as a reference of the working place, of the topic taught or the text book the student is using.

A2.3.22 To Have an Accompanied Workbook with the Videodiscs

Courseware must have a workbook to accompany the videodiscs. It helps the student to revise at home along with his textbook supply by the school or the technical training facilities.

The workbooks should also have blank pages or blank spaces where the student can fill them while taking the course.

The workbook does not need to be very detailed on the topics but should highlight the most important points covered in the videodiscs. Generally, suppliers of videodisc courseware are in a position to supply those workbooks.

A2.3.23 To Integrate IVI Courses within the Existing Training Program

To make it work, IVI must be integrated within a training program rather to see it as a peripheral tool. From the needs analysis and the set up of objectives, you have to consider IVI within a training program and clearly identify what will come before and after the IVI training.

You might start with an IVI courseware then continue with other types of training to complete the programs, or you may start with a traditional classroom delivery training program and pursue with IVI. IVI shall not be seen as something additional to the existing training or in dual application with traditional classroom delivery training on the same topic.

Implementation Period

A2.3.24 Delivery of Courseware

Courseware should be delivered on time with all its component and according to plan. Do not accept partial delivery of courseware that does not offer the complete solution. Delivery date is important to allow enough time to test the courses and see that they are meeting compliance.

A2.3.25 Courses should Work Properly and Trouble Free

After the delivery of the courseware, installation, extensive testing and troubleshooting should take place to assure that the courseware are working without problems. Give yourself enough time that if some problems occur that you will have enough time to contact your supplier and work a solution. Do not put yourself in a position of stress with a tight deadline to open your learning center. Do not open your learning center if you still experience problems.

A2.3.26 Documentation of Courseware

All courseware, installation, and information on and their use must be available to trainers, a full description of the courseware along with objectives, strategies used and the workbook accompanying the courseware should also be available on time.

You must verify that you have the adequate number of workbooks accompanying the disc.

A limited set of information should be provided to the student in regards of the courseware objectives and how different topics are covered.

This includes as well all retrieval information available to trainers and assuring that all trainers be familiar with the documentation. Often the documentation of courseware is not complete, so it is important to take time to gather the required information and built the booklet.

A2.3.27 How a Courseware Work

This factor could be integrated with the documentation of courseware since it looks after how the courseware work. In this period of implementation, we have to make sure that the trainers know how the courseware work, that the courseware is easy to use and easy to access.

How the course work means understanding the different input device such as touch screen, mouse, key board or other types of input device which might be required with different courses. You have to inform the student what type of answer he is expected to give, how the different modules work. Dictionary, glossary, how to navigate in the course, quit the course for a break or how the end a training session.

Trainers must be very familiar because they will train the student and assist them.

A2.3.28 Operating System (On-line/Off-line) for Recording and Evaluating

Operating systems in this case refer to DOS, Windows and the network system, if any.

Since we are looking at individual workstation dedicated for IVI training, we are not referring to main frame. Operating systems usually come with the workstation, pre-load and tested. The network system, if any, is more of a concern and offer the possibility to retrieve information on student's performance from one station.

The evaluation and record keeping of the performance of a student are attached to a specific course and should be tested. Tested means having a small group of persons, trainers as an example, to use the course to ensure that the recording is accurate.

In the implementation period, this should be tested completely and systems ready to go.

A2.3.29 Administrative Functions: Planning, Organization, Direction, Control

Those administrative functions will be integrated in the creation of the grid in the next section.

A2.4 Human Resource Factors - for Teachers

TABLE A.4: FINAL HUMAN FACTORS - TEACHERS GRID

FACTORS	Old #	New #
Preparation Period		
Support from administration	1	1
Participation of the administration	2	2
Participation of the teachers	3	3
Adaptive planning process	9	4
Sufficient time allowed to learn the technology	4	5
Knowledge of the content to be taught on IVI	5	6
Teachers oriented People skills	6	7
Teachers to motivate students	7	8
Human support / Problem solving	8	9
Training package on site for teachers	10	10
Training package on site for administrators	11	11
On site service support personnel	12	12
Coordination (human support for orientation training)	13	13
Synchronization	14	14
Cooperation	15	15
Enrollment of students	16	16
Opportunity to be involved in new IVI development	17	17
Incentive to use system	18	18
New role of trainers and teachers		19
Implementation Period		

Personnel trained in their use to the satisfaction of the site managers	I-1	20
Well skilled service person on site	I-2	21

Preparation Period

A2.4.1 Support from Administration

Support from administration means the acceptance of the IVI project, which they allowed the required budget. But remember, this is not enough to guaranty a winning situation.

MEQ study proved that having the acceptance from the administration and the budget is not enough.

It needs the implication of the administration to promote the project and to see that the people involved will get enough time to be dedicated to the project. We have to ensure that all the necessary resources are available to launch such a project. The administration must to be interested in training and in new technology.

A2.4.2 Participation of the Administration

The participation means the involvment of administration by the creation of a steering comites that will help to understand the project, and the new technology. The administrators need to participate in identifying priorities, activities, to involve other staff members and trainers, etc.

Administrators need to be volunteer to learn the technology and new training tools in order to better understand trainers and other staff members. They must participate, encourage and motivate people involved in the team.

A2.4.3 Participation of the teachers

Teachers need to participate actively to the project. This means to be pro-active, ready to learn and take the time to learn the technology. Pro-active means to be active, not to sit and wait until the information comes to them.

Participation of teachers also means to get involve in the selection of the workstation, the courseware and to see how the new technology or new courseware may fit within the existing training program.

Teachers need to look at interactive video as a supportive technological tool for training which needs to be inserted within the existing training program. Moreover teachers must be part of committees with administrators and help to set up the learning center and other learning activities.

A2.4.4 Adaptive Planning Process

Understanding that some conditions must prevail to implement IVI projects, your planning process should be adaptive in a way that it will be flexible enough to insert additional courseware for different groups of students and for different topics.

The planning has to be flexible enough to take additional elements where it will be possible to insert additional data to expend the use of the technology.

The adaptive planning process is issued from the adaptive system model of Kast and Rosenzwieg, 1974.

A2.4.5 Sufficient Time Allowed to Learn the Technology

With the support and the participation of the administrators, teachers need to take the time to learn the technology. This includes to understand their implication and their new roles. Give the necessary time to learn the technology is a key to success. Re-arrangement of working schedule might be necessary. Devoted time period must be planned for teachers, as well additional efforts from teachers must be deployed.

A2.4.6 Knowledge of the Content to be Taught on IVI

The teachers need to learn the content on the videodisc to fit within the existing training program. This means to participate to the selection of the courseware related to the project and topic. The selection implies to evaluate the appropriateness of the content toward the training objectives but as well to learn the content and to see how it might fit in the training program. Teachers need to have a global view of the training program and not only by evaluating a specific courseware.

The learning process on the videodisc includes the understanding of the workbook with the videodisc and its relation with the text book supplied either by the school or training department. Teachers have to identify how the classroom delivery and content may change because of this new IVI tool. Unless teachers are well knowledgeable about the content of the videodisc, it will be almost impossible to insert this new technology in the training program.

A2.4.7 Teachers Oriented People Skills

Teachers must be oriented people skills to listen to people rather to concentrate on the expert content. It means as well that the role of the teachers will change and will be more oriented towards people. Integrating the content of the videodisc, expert-content, with real life situation within the training program. The teachers will assist people, manage training rather than deliver expertise. They need listening skills.

A2.4.8 Teachers to motivate students

Teachers must motivate students to use the new technology and to show the flexibility of the new tool and where it can assist them the most.

Motivating students can take place in showing how a course is used with its workbook and the reference book. Also, to show students that they are now in charge of their training and they can use the workstation and course at will.

A2.4.9 Human Support / Problem Solving

Human support and problem solving approach is a crucial element for the successful use of computer, technology or IVI. Interactive videodisc courseware is a self pace program where students develop their own approach toward different problems and find solutions, on the ground of the basic theoretical concept and the simulation where they put knowledge to practice.

In the implementation of this technology, it is important that the teacher has the necessary human support skills toward the technology as well as a problem solving approach rather than compounding problems and turn them to the administration.

The team approach should be favoured and problems should be worked through the team along with a steering committee involving the administrators.

A2.4.10 Training Package On Site for Teachers

Initially you can think about having all the teachers trained by a dedicated program. On site training package means organize information books and references that a person can use and read about this technology. It is a selfpace program with technical support when needed. Also, a workstation could be available in the teachers' hall where they could have access as many time as they want, to look furthermore at the technology, to use of courseware and to investigate other area where this technology could be used. The training package must be developed in the preparation period by different groups of teachers to assure that the level of accessibility is possible for all teachers.

A2.4.11 Training Package On Site for Administrators

To keep the interest of the administrators and to enlarge the interest of the management in general, it is important to have a training package or an awareness package for the administrators at an accessible level.

This will help them to get acquainted with the technology, to see the benefit of it, and to investigate its future possibilities in the organization. The administrators need an overall view of new training technologies. If administrators can get a clear understanding of the technology, its use, the benefit and the implication, they will become allied and in a position to endorse a project. Therefore, it is crucial that special training package be offered to the administrators. It does not need to be very detailed as the one for the teachers.

A2.4.12 On Site Service Support Personnel

On site support personnel is essential. This personnel does not need to come from a computer department but rather a person very familiar with the IVI technology. This person needs to be trained by the suppliers in order that they will able to troubleshoot the workstation and be supportive to teachers. It is important to have a minimum of knowledge about computers.

A2.4.13 Coordination, Human Support for Orientation Training

Trainers needed to be involved in the coordination of different topics in order to give an orientation to students. Coordination means to coordinate the different activities and learning strategies to complete the training program. This could involved many different topics. Coordination with classroom delivery and other teachers is very important.

This is the guiding of the student of what comes first, second and the prerequisite to take a courseware. From a clear understanding of the content of the videodisc, trainers will be able to coordinate a training program for a student. Trainers must define what topic to make available first to the student as a prerequisite or supportive courseware for more advanced training. In this description, we can find the coordination and the human support.

A2.4.14 Synchronization

Synchronization means to synchronize the use of the workstation or the learning center with other teachers either for the same or supportive topics.

We have to plan in advance the use of the learning center, who will have first right to use it, who will be next, and how we will organize the use of the different learning strategies following the use of this new technology.

A2.4.15 Cooperation

Cooperation means the common effort among teachers in the implementation and the use of the learning center. This means also not throwing the ball at somebody else or the administrators. Exchanges in meeting among teachers, mutual support and assistant is part of the cooperation.

A2.4.16 Enrollment of Student

Enrollment of students should be easy for teachers or trainers as well as for the retrieval of students' performances data. Knowledge about enrollment of students should take place at the beginning of the project and should be share among different teachers to avoid re-enrollment for different topics.

Enrollment means register student in a program or a course and give an access code to each student as well as recording information on student's profile. Transfer of data from and to main frame, or the use of diskettes should be possible especially to enroll large group of students.

A2.4.17 Opportunity to be Involved in New IVI Development

A generic package can be very acceptable to start the project but would need to be improved to enhance the training program with additional information.

Therefore it is important, at the beginning of the project, to plan the possibility for a teacher to see how he can adapt a courseware, a chapter or a module to a specific need.

As soon as teachers or trainers are knowledgeable enough with the technology, it is important to give them the opportunity to modify, add on, or develop new modules.

Special training on new tool is essential in that aspect and should be planned. This will help to keep their interest in the technology and as well to promote or insert additional topics using the IVI technology.

A2.4.18 Incentive to Use System

Incentive program might be appropriate to stimulate the use of a new technology especially when it demands additional effort from teachers or trainers. Incentive program does not mean to be very expensive. The objective is to recognize that people put additional efforts to implement the IVI technology. Incentive program could be defined as a possibility for teachers to develop new multimédia modules and/or having workstation available for them to use at will, with additional training and additional time allowed for those tasks.

Incentive could be a combination of means which motivate and encourage teachers and not only to use the technology. Bonus, increase of salaries is not the only way. Give them perspective of the future where their contribution will profit the organization.

A2.4.19 New Role of Trainers and Teachers

It is important that teachers and trainers understand their new role with this new IVI training technology. Teachers' new role will bring them to be manager of training where they will assist students in their learning process rather than to deliver the expertise.

This is probably the biggest change in trainer's role. Teachers will be able to devote their time to weak students or advanced students where both would need special attention and orientation. Classroom delivery environment does not permit such attention. Some teachers or trainers might see IVI as a threat but others might see it as a new opportunities where they will be able to relate the expertise to real life situation and to develop new content.

Also, teachers and trainers will need to relate the use of the new technology with the existing training program. This alone is quite a challenge. How to orchestrate the new technology in the existing program and how the training program will be affected by this new technology.

Implementation Period

A2.4.20 Personnel Trained in Their Use to the Satisfaction of the Site Managers

When we refer to personnel trained, we refer to teachers and trainers which should be well train to understand the IVI technology and its implication.

This includes where it should start, where it should end, and how to integrate this new technology in the existing training program.

The site managers could be seen as the administrator where he wants to see all parts of the puzzle coming together as a complete picture. If we want to guide the student, we need to have a complete picture of the training program (IVI and classroom delivery).

The site manager (director of the learning center) wants to have all teachers involved. Implementation is not only question of one teacher knowing about the IVI technology. At the implementation, the site manager, teachers or trainers need to work as a team.

A2.4.21 Well Skilled Service Person On Site

Well skilled service person on site means someone knowledgeable about computer science programming and above all knowing IVI technology where he can service each workstation. At this stage people involved in the project need to be fully trained on IVI.

To be more specific, the person must know how to load a courseware, the tracking system and troubleshoot the different peripheral.

At the beginning of a project, suppliers, especially a system integrator, can easily assist on hardware, courseware, installation and data retrieval. As your learning center will grow and you will get more workstations, it will become essential that a knowledgeable person in computers and especially about interactive video be on site.

His task would be to install courses, clean up hard disc from unnecessary data, response to the teacher's need and maintain the network, if any.

This training technology does not require from the teacher to be very knowledgeable about computer or technical details of interactive video but rather understanding the technology. This includes the management of student, retrieval of data and the overall implication of the IVI training technology.

A2.4.22 Administrative Functions: Planning, Organization, Direction, Control

Those administrative functions will be integrated in the creation of the grid in the next section.

A2.5 Human Resource Factors - for Students

TABLE A.5: FINAL HUMAN FACTORS - STUDENTS GRID

FACTORS	Old #	New #
Preparation Period		
Participation	1	1
Time to learn the technology	2	2
To be able to personalize the course	3	3
All students have access to the technology		4
Implementation Period		
Personnel trained in their use to the satisfaction of the site managers	I-1	5
Well skilled service person on site	I-2	6

Preparation Period

A2.5.1 Participation

It is important to seek the participation of student in the creation of a learning center. Their participation could consist on their feedback on the courses, the way we plan to use the technology along with the existing training program.

The needs analysis and the information from students about their difficulties to understand certain topics, will help you to plan and organize better the learning center and its activities, including the selection of the teaching material. Students need to participate in showing how they want to organize their training program which includes the IVI technology. They need to know how this role as a student will change. A committee with teachers to introduce the technology is essential including in the set up of the learning center.

A2.5.2 Time to Learn the Technology

For students, time to learn the technology is more a matter of two or three 3-hour seminar with a hands on session. Those seminars explain the effect of introducing IVI in the training program and how the student's program will be modified.

A2.5.3 To be Able to Personalize the Course

We have to admit that each student does not learn the same way, although we can find some general patterns. Therefore it is important that student be able to personalize in some way the way their strategie of learning with the use of generic courseware.

Some studies in using IVI demonstrated that some students would prefer to view the video first and get in the program after. Some other students will get hang to the content the way it is. It is important to pay attention about these references because it will help in motivating the student by their own input into the learning process and as well as in the courseware.

Being able to personalize the course, means to personalize the way a student will go through the IVI courseware. Except from what has been mentioned before, on a structured approach, a student can have access to the content at will. If results are not satisfactory, the student can redo the course as many times he needs.

A2.5.4 All Students Have Access to the Technology

It is important that within the same group of students in a training program that all students will have access to the new technology otherwise it can have a negative effect as it happens in the MEQ study. Those students learning the same electronics course who did not have access to the new technology was demotivated and had a feeling to be left aside.

Students should have access to the learning center at will. It is a self pace courseware and students should organize their own time or learning session.

Implementation Period

A2.5.5 Personnel Trained in Their Use to the Satisfaction of the Site Managers

It is important for the site manager that the students can feel that the teachers or trainers are well prepared and understanding the technology. Being able to coordinate and synchronize the IVI training with traditional classroom instruction. Also, students, as well, need to be well informed about the technology, its use, and its impact on their training program before starting the IVI training. They need to rely on well skill personnel on site. It is not to improve in front of students.

A2.5.6 Well Skilled Service Person On Site

Again, it is important that the students will get a well skills person to answer their questions either on the contents or on the hardware system. If problems occur, student needs support, otherwise they will feel to be put aside. The well skill person on site to assist students must be people oriented above all without neglecting the technical skills.